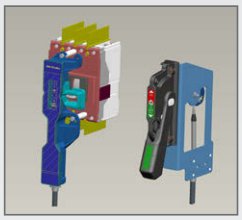
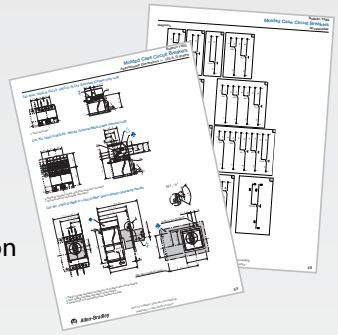
Selection and Application Tools

Circuit breakers from Rockwell Automation provide a range of tools to help you understand and apply these products in your application. You can access these tools online or through your local distributor.



CAD drawings in a range of formats



Selection guides and technical documentation

Local Distributor

Visit our website to find your local Distributor.

www.rockwellautomation.com/distributor



On-Line Product Directory

Our extensive product portfolio is designed to improve your processes through every stage of your manufacturing cycle.

http://ab.rockwellautomation.com/Circuit-and-Load-Protection/Circuit-Breakers



Product Selection Toolbox

Our powerful range of product selection and system configuration tools assist you in choosing and applying our products.

www.rockwellautomation.com/en/e-tools



Rockwell Automation, Inc. (NYSE:ROK), the world's largest company dedicated to industrial automation, makes its customers more productive and the world more sustainable. Throughout the world, our flagship Allen-Bradley® and Rockwell Software® product brands are recognized for innovation and excellence.

Connect with us.

Allen-Bradley, LISTEN. THINK. SOLVE. and Rockwell Software are trademarks of Rockwell Automation, Inc.
Trademarks not belonging to Rockwell Automation are property of their respective companies.

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 140G-TD100B-EN-P – May 2015
Supersedes Publication 140G-TD100A-EN-P – April 2014

Copyright © 2015 Rockwell Automation, Inc. All Rights Reserved. Printed in USA.

140G-I_

Installation instruction for 140G-I
Istruzioni di installazione
Installationsanleitung
Instructions pour l'installation
Instrucciones de instalación

Installation - Installazione - Instalación
Instalação - 取付け方法 - 安装

WARNING: To prevent electrical shock, disconnect from power source before installing or servicing. Install in suitable enclosure. Keep free from contaminants. (Follow NFPA70E requirements).

AVVERTENZA: Per prevenire infortuni, togliere tensione prima dell'installazione o manutenzione. Installare in custodia idonea. Tenere lontano da contaminanti. (Seguire i requisiti NFPA70E).

WARNUNG: Vor Installations- oder Servicearbeiten Stromversorgung zur Vermeidung von elektrischen Unfällen trennen. Die Geräte müssen in einem passenden Gehäuse eingebaut und gegen Verschmutzung geschützt werden. (Befolgen Sie die Anforderungen nach NFPA70E).

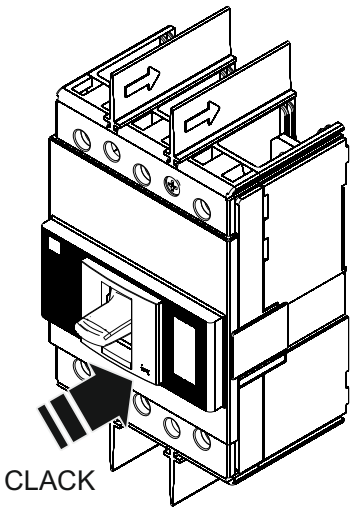
AVERTISSEMENT: Avant le montage et la mise en service, couper l'alimentation secteur pour éviter toute décharge. Prévoir une mise en coffret ou armoire appropriée. Protéger le produit contre les environnements agressifs. (Vous devez respecter la norme NFPA70E).

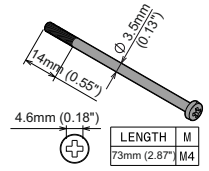
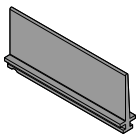
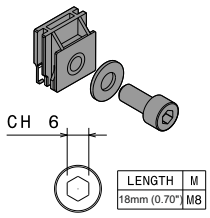
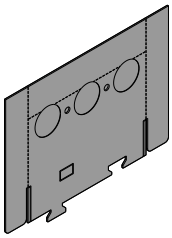
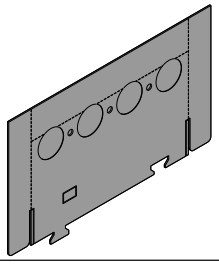
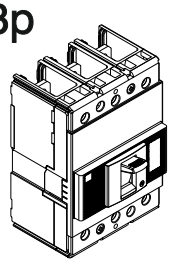
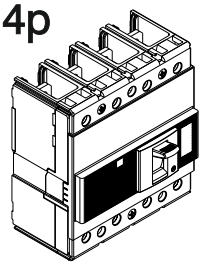
ADVERTENCIA: Desconéctese de la corriente eléctrica, antes de la instalación o del servicio, a fin de impedir sacudidas eléctricas. Instálelo en una caja apropiada. Manténgalo libre de contaminantes. (Cumpla con los requisitos NFPA70E).

ATENÇÃO: Para evitar choques, desconectar da corrente elétrica antes de fazer a instalação ou a manutenção. Instalar em caixa apropriada. Manter livre de contaminantes. (Cumpra as exigências da norma NFPA70E).

警告:感電事故防止のため、取付けまたは修理の際は電源から取り外してください。適切なケース内に取付けてください。また.汚染物質がないことを確認してください。(NFPA70Eの要件に従ってください)

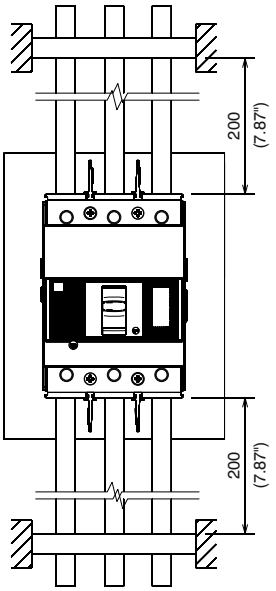
警告:为了防止触电，在安装或维修之前必须先切断电源。安装在合适的设备箱内。防止接触污染物。(符合NFPA70E要求)

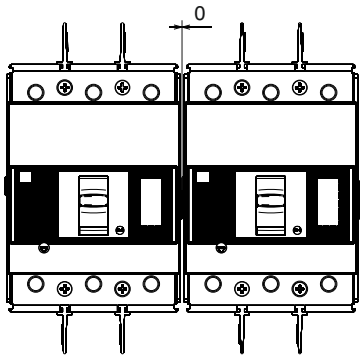


					
3p 	x2	x4	x6	x2	—
4p 	x3	x6	x8	—	x2

1

Maximum recommended support distance





2

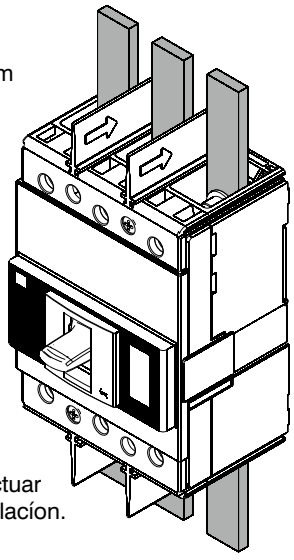
Use cable or insulated busbars/ or perform specific type test on the installation.

Usare cavi o barre isolate/ o eseguire prove di tipo specifiche sull' installazione.

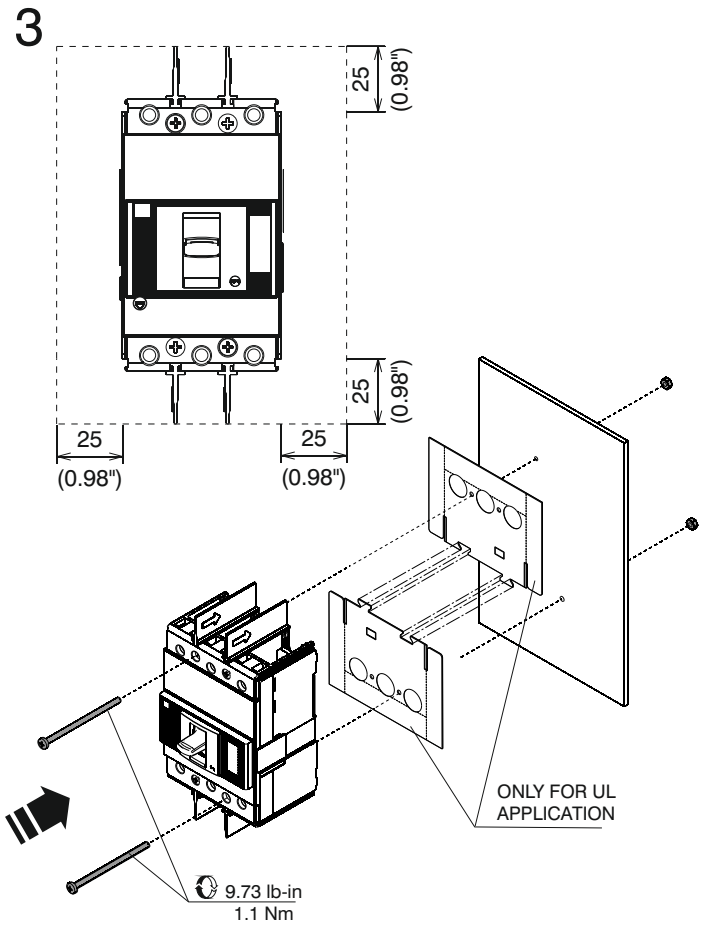
Kabel oder isolierte Sammelschienen verwenden / oder die spezifische Typprüfung auf derInstallation durchführen.

Utiliser un câble ou des barres isolées/ ou réaliser un test de type spécifique sur installation.

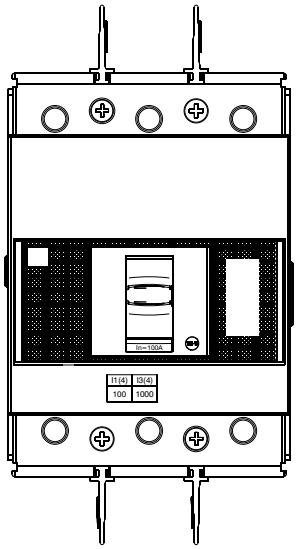
Utilizar un cable o barras aisladas / o efectuar una prueba de tipo específico sobre instalacíon.



3



4 140G-I THERMOMAGNETIC TRIP UNIT



Type	In	I1	I3
Fixed	60	60	600
Fixed	63	63	630
Fixed	70	70	700
Fixed	80	80	800
Fixed	90	90	900
Fixed	100	100	1000
Fixed	110	110	1100
Fixed	125	125	1250
Fixed	150	150	1500
Fixed	160	160	1600
Fixed	175	175	1750
Fixed	200	200	2000
Fixed	225	225	2250

5 140MG-I MAGNETIC ONLY TRIP UNIT

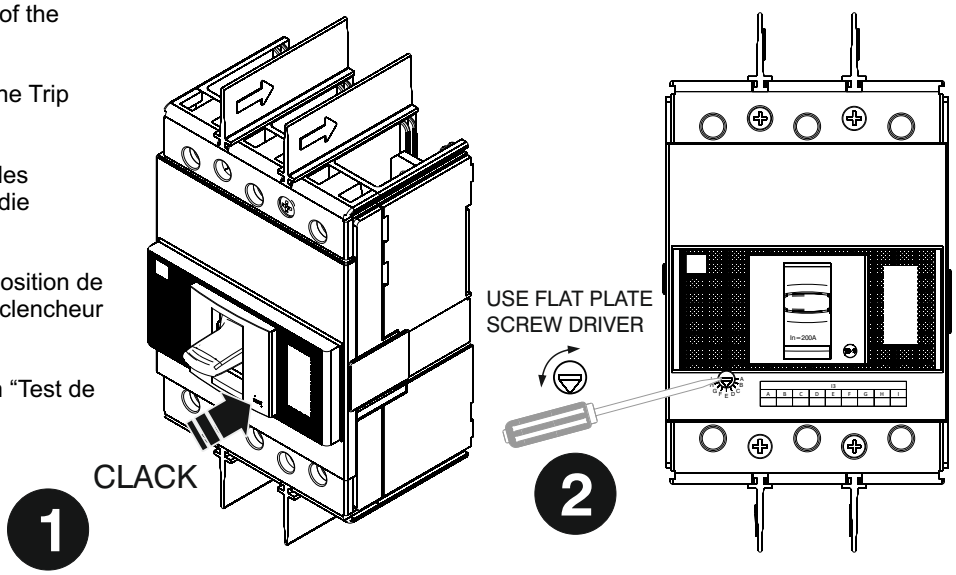
Manually trip the breaker prior to adjustment of the magnetic settings.

E'obbligatorio mettere l'interruttore in posizione Trip test prima di regolare il termomagnetico.

Der Leistungsschalter muss vor Einstellung des thermomagnetischen Auslösers zwingend in die Prüfstellung geschaltet werden.

Il est obligatoire de mettre le disjoncteur en position de Test de Déclenchement avant de régler le déclencheur magnétothermique.

Es obligatorio situar el interruptor en posición "Test de Disparo" antes de realizar el ajuste del relé termomagnético.



I3									
In	A	B	C	D	E	F	G	H	I
100	600	675	750	825	900	975	1050	1125	1200
110	660	743	825	908	990	1073	1150	1238	1320
125	750	844	938	1031	1125	1219	1313	1406	1500
150	900	1013	1125	1238	1350	1463	1575	1688	1800

Allen-Bradley, Rockwell Software, and Rockwell Automation are trademarks of Rockwell Automation, Inc.
Trademarks not belonging to Rockwell Automation are property of their respective companies.

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

DIR 1000720R0001 (L5141)

Publication **140G-IN095A-MU-P** - **April 2013**

Copyright © 2013 Rockwell Automation, Inc. All Rights Reserved.

Product: 140M-F8N-C32
Description: 140M MPCBs and MCPs



Representative Photo Only (actual product may vary based on configuration selections)

SYSTEM VOLTAGE DATA	
Supply Voltage	480Y/277 VAC 50/60HZ
CIRCUIT BREAKER	
Circuit Breaker Type	Motor Circuit Protector
Rated Operational Current (A)	32A
Application	Standard Magnetic Trip (Fixed at 13 x Ie)
Frame Size	Frame Size F
Magnetic Trip Current (A)	416A Fixed
Breaking Capacity	High Breaking Capacity
UL Listed Application Ratings	UL 508 - Manual Motor Controller
SHORT CIRCUIT COORDINATION	
Coordination Type	Type 1
OPTIONS	
Side Mount Shunt Trip and Undervoltage Release	None
Front Mount Auxiliary and Trip Contacts	None
Side Mount Auxiliary and Trip Contacts (TESTDESC)	None
CERTIFICATIONS AND APPROVALS	
UL508	and CSA 22.2, No. 14 Manual Motor Controller with Optional Approvals: Group Installation, Motor Disconnect, Tap Conductor Protection Manual, Self-Protected Combination Motor Controller
EN60947-2	Circuit Breaker
EN60947-4	Overload Protection
CE	Marking is self-certified
For UL Certifications Directory:	http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm

Product: 140U-D6D2-C30

Description: 140U-D Molded Case Circuit Breakers



Representative Photo Only (actual product may vary based on configuration selections)

System Data	
Supply Voltage	480V 60Hz
Circuit Breaker Data	
Current Limitation Required?	No
Pole Configuration	2 Pole
Rated Current (A)	30
Frame Size	D-Frame (up to 30A)
Interrupt Rating [kA]	65 kA

Current Range	12...30A
Max frame In	30A
Frame reference	D
Dimensions: (mm)	
H	102
W	45
D	85

Interrupting ratings

Rated Current I_n [A]	Breaking Capacity (50 Hz) [kA]								Interrupting Rating (60 Hz) [kA]			2 Pole Cat. No. ‡	3 Pole Cat. No. ‡
	230...240V		400...415V		525V		690V		240V	480Y/277V	600Y/347V		
	Icu	Ics	Icu	Ics	Icu	Ics	Icu	Ics					
12	100	100	65	50	65	50	10	6	65	65	35	140U-D6D2-C12	140U-D6D3-C12
15	100	100	65	50	65	50	10	6	65	65	35	140U-D6D2-C15	140U-D6D3-C15
20	100	100	65	50	65	50	10	6	65	65	35	140U-D6D2-C20	140U-D6D3-C20
25	100	100	65	50	65	25	10	6	65	65	35	140U-D6D2-C25	140U-D6D3-C25
30	100	100	65	50	65	25	10	6	65	65	35	140U-D6D2-C30	140U-D6D3-C30

Up to 15A suitable for continuous operation at 100% of rating only if used in a cubicle space of 250 x 175 x 150 mm (10 x 7 x 6 inch)
‡ Current Limiting - www.ab.com/catalogs

Protection Type	
Thermal Magnetic	FF
Electronic	-
Molded Case Switch	-
Internal accessories	
Alarm (Trip) Contact	✓
Auxiliary Contacts	✓
Auxiliary/Alarm Combination	✓
Shunt Trip	-
Undervoltage release	-
Field installable	✓
External Accessories	
Padlock option	✓
Terminal Cover	✓
Flex-Cable Op.Mech.	-
Rotary Op. Mech.	Standard
Standard & Approvals	
UL 489	✓
CSA C22.2 No.5	✓
IEC 60947-2	✓
CE Certified	✓

Product: 193-EEED

Description: 193, 193S E1 Plus Solid State Overload Relay



Representative Photo Only
(actual product may vary based on configuration selections)

CONTACTOR DATA

Phases	3 Phase

OVERLOAD RELAY DATA

Bulletin Number	Bulletin 193
Overload Relay Type	Trip Class 10, 15, 20, 30, Auto/Manual-Auto Reset Screw Type
Full Load Current Range (A)	5.4-27A (3 Phase)

Allen-Bradley

Bulletin 193 E1 PLUS Overload Relay Application and Installation
Application et installation du relais de surcharge Famille 193 E1 PLUS
Überlastrelais Bulletin 193 E1 PLUS, Anwendung und Installation
Aplicación e instalación del relé de sobrecarga, Boletín 193 E1 PLUS
Boletim 193 E1 PLUS Aplicação e Instalação do Relé de Sobrecarga
Applicazione ed installazione dei relè termici Bollettino 193 E1 PLUS
ブレティン193 E1 PLUS 過負荷継電器の応用と取付け
Bulletin 193 E1 PLUS 过载继电器的使用与安装

(Cat 193-ED1_ _ , 193*-EE_ _)

Installation
Instalación
Instalação
Installazione
取付け方法
安装

WARNING: To prevent electrical shock, disconnect from power source before installing or servicing. Install in suitable enclosure. Keep free from contaminants. (Follow NFPA70E requirements).

AVERTISSEMENT: Avant le montage et la mise en service, couper l'alimentation secteur pour éviter toute décharge. Prévoir une mise en coffret ou armoire appropriée. Protéger le produit contre les environnements agressifs. (Vous devez respecter la norme NFPA70E).

WARNUNG: Vor Installations- oder Servicearbeiten Stromversorgung zur Vermeidung von elektrischen Unfällen trennen. Die Geräte müssen in einem passenden Gehäuse eingebaut und gegen Verschmutzung geschützt werden. (Befolgen Sie die Anforderungen nach NFPA70E).

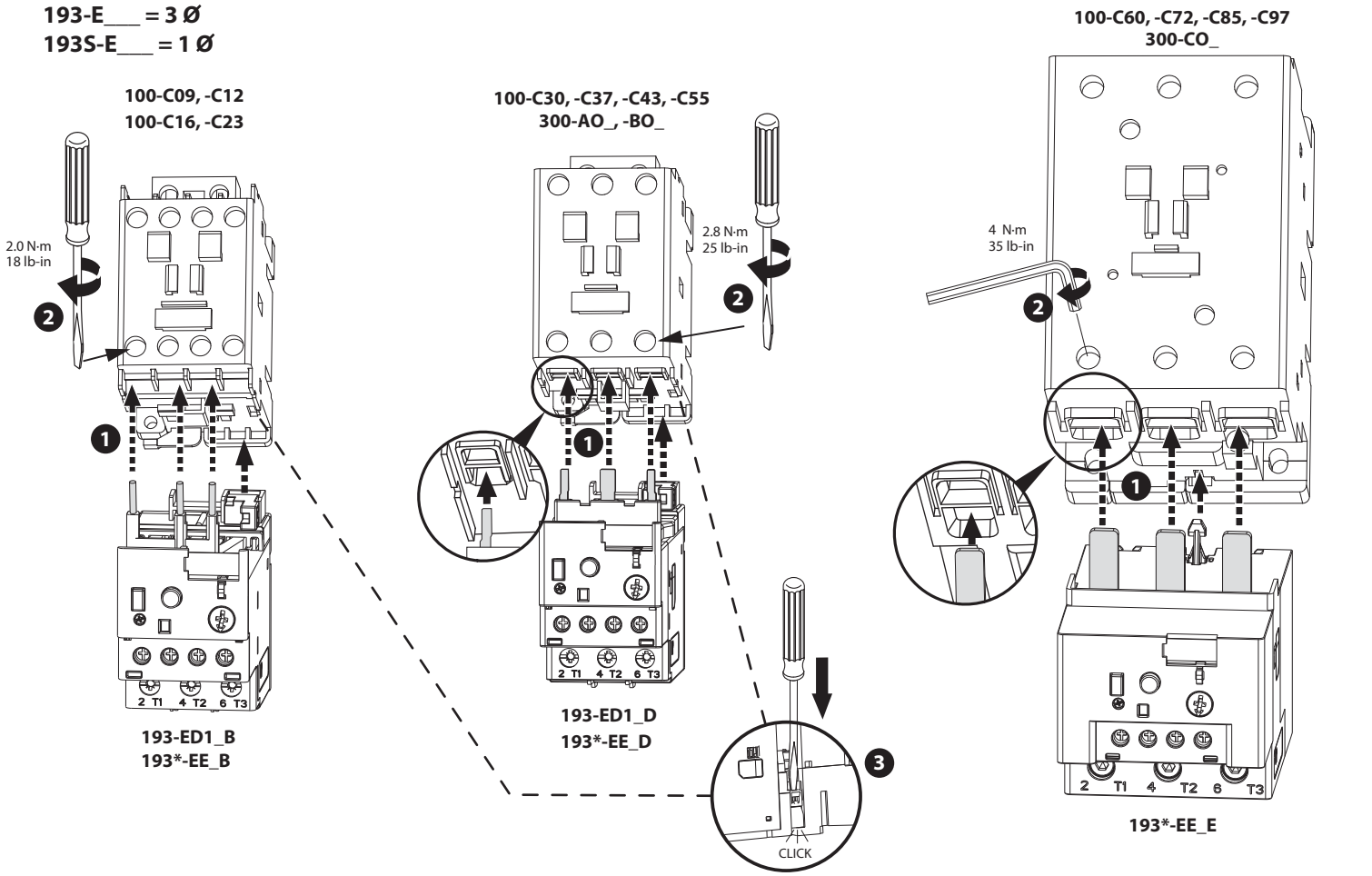
ADVERTENCIA: Desconéctese de la corriente eléctrica, antes de la instalación o del servicio, a fin de impedir sacudidas eléctricas. Instálelo en una caja apropiada. Manténgalo libre de contaminantes. (Cumpla con los requisitos NFPA70E).

AVISO: Para evitar choques, desconectar da corrente elétrica antes de fazer a instalação ou a manutenção. Instalar em caixa apropriada. Manter livre de contaminantes. (Cumpra as exigências da norma NFPA70E).

AVVERTENZA: Per prevenire infortuni, togliere tensione prima dell'installazione o manutenzione. Installare in custodia idonea. Tenere lontano da contaminanti. (Seguire i requisiti NFPA70E).

警告: 感電事故防止のため、取付けまたは修理の際は電源から取り外してください。適切なケース内に取付けてください。また、汚染物質がないことを確認してください。(NFPA70Eの要件に従ってください)

警告: 为了防止触电，在安装或维修之前必须先切断电源。安装在合适的设备箱内。防止接触污染物。(符合NFPA70E要求)



41053-358-01
DIR 41053-358 **(Version 13)**
Copyright © 2015 Rockwell Automation, Inc. All Rights Reserved. Printed in USA.

Allen-Bradley • Rockwell Software

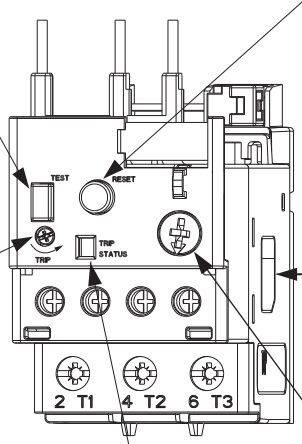
Rockwell Automation

E1 PLUS Features
Caractéristiques du E1 PLUS
Leistungsmerkmale des E1 PLUS
Características del E1 PLUS

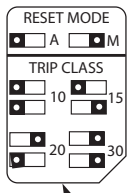
Características E1 PLUS
Funzioni dell'E1 PLUS
E1 PLUS の特長
E1 PLUS 继电器的特性

Push To Test
Enfoncer pour tester
Testschalter
Presione para probar
Pressione para testar
Spingere per provare
押してテストします。
按下键钮进行测试

Push to Reset
Enfoncer pour réinitialiser
Nullstellschalter
Presione para reiniciar
Pressione para religar
Premere per reimpostare
推进并重新设置
押してリセットします。



Rotate to Manually Trip
Faire pivoter pour déclencher manuellement
Für manuelle Auslösung drehen
Rotar para disparar manualmente
Gire para disparar manualmente
Ruotare per intervenire manualmente
旋转进行手动设置
回転すると手動トリップします。



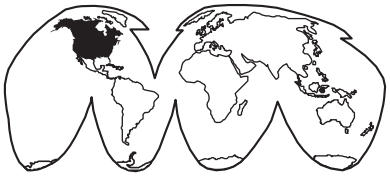
A = Automatic/Manual Reset Mode
A = Mode de réinitialisation automatique/manuel
A = Automatische/Manuelle Nullstellung
A = Modo de reinicio automático/manual
A = Modo de religação automático/manual
A = Modalità reimpostazione automatica/Manuale
自动和手动模式
A = 自動/手動リセットモード

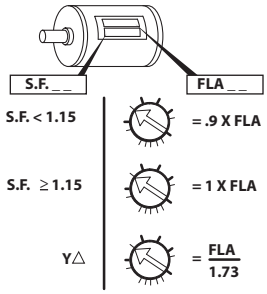
M = Manual Reset Mode
M = Mode de réinitialisation manuel
M = Manuelle Nullstellung
M = Modo de reinicio manual
M= Modo de religação manual
M = Modalità reimpostazione manuale
手动模式
M = 手動リセットモード

Selectable Trip Class
Classe de déclenchement sélectionnable
Wählbare Auslösestufen
Clase de disparo seleccionable
Seleção da classe de disparo
Classe di intervento selezionabile
選択可能なトリップ種類
可选用的跳闸等级

- **Trip Indicator Window**
  Yellow indicator not visible: Not Tripped.
  Yellow indicator visible: Tripped.
- **Fenêtre d'indicateur de déclenchement**
  Indicateur jaune non visible : pas de déclenchement
  Indicateur jaune visible : déclenchement
- **Auslösungsanzeigefenster**
  Gelbe Anzeige nicht sichtbar: keine Auslösung
  Gelbe Anzeige sichtbar: Auslösung
- **Ventana indicadora de disparo**
  Indicador amarillo no visible: No disparado
  Indicador amarillo visible: Disparado

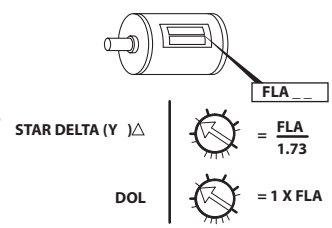
- **Visor de disparo**
  Se o indicador amarelo não estiver visível: não disparado
  Se o indicador amarelo estiver visível: disparado
- **Finestra indicatrice di intervento.**
  Indicatore giallo non visibile: non scattato.
  Indicatore giallo visibile: scattato.
- トリップ表示ウィンドウ
  黄色インジケータが表示されていない場合 :トリップなし
  黄色インジケータが表示されている場合 :トリップ済み
- 跳闸指示窗
  黄色标记未显示: 没有跳闸
  黄色标记显示: 已跳闸





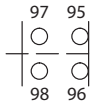
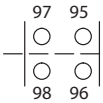
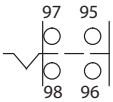
- **To adjust trip current, turn dial until the desired current is aligned with the ▲pointer. Trip rating is 120% of dial setting.**
- **Pour régler l'intensité de déclenchement, tournez le cadran jusqu'à ce que le pointeur ▲soit sur l'intensité voulue. La valeur nominale de déclenchement est de 120% du réglage cadran.**
- **Zur Einstellung des Auslösestroms drehen Sie den Schalter, bis der Zeiger ▲auf die gewünschte Stromstärke zeigt. Der zur Auslösung erforderliche Nennstrom beträgt 120% des eingestellten Wertes.**
- **Para ajustar la corriente del disparo, gire el dial hasta que la corriente deseada esté alineada con la marca▲. La capacidad nominal del disparo es el 120% del posicionamiento del dial.**
- **Para regular a corrente de disparo, gire o disco mostrador até que a corrente desejada esteja alinhada com o indicador ▲. A classe de disparo corresponde a 120% da marcação no mostrador.**
- **Per regolare la corrente di intervento, ruotare il regolatore fin quando la corrente desiderata non è allineata con il puntatore ▲. Il valore nominale di intervento corrisponde al 120% dell'impostazione del regolatore.**
- トリップ電流を調整するには、所定の電流の目盛りが▲印に来るまでダイヤルを回してください。トリップ定格は、ダイヤル設定値の**120%**です。
- 若欲调节跳闸电流设定，可转动刻度盘，使所需的设定值对准▲箭头。跳闸电流额定值是刻度盘显示值的**120%**。



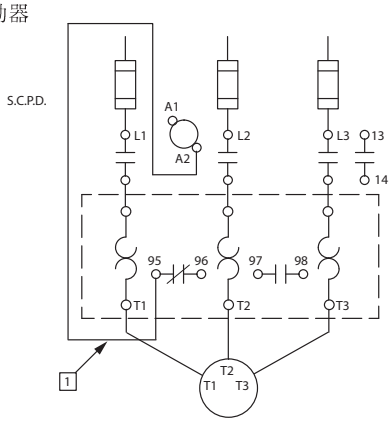


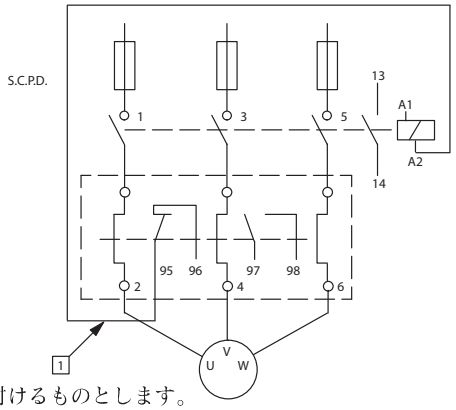
WARNING: Do not use automatic reset mode in applications where unexpected automatic restart of the motor can cause injury to persons or damage to equipment.
AVERTISSEMENT: N'utilisez pas le mode Remise à zéro automatique dans les applications où un redémarrage automatique inattendu du moteur pourrait provoquer des blessures personnelles ou des dégâts matériels.
WARNUNG: Der automatische Rücksetzmodus darf nicht in Anwendungen verwendet werden, in denen der unerwartete Neustart des Motors zuPersonen– oder Sachschäden führen kann.
ADVERTENCIA: No use el modo de reseteo automático en aplicaciones donde el rearranque repentino del motor pueda causar lesiones personales o dañoal equipo.
AVISO: Não utilize o modo de reajuste automático em aplicações nas quais o reinício automático e inesperado do motor possa causar ferimentosàs pessoas ou danos ao equipamento.
AVVERTENZA: Non usare la modalità di ripristino automatico in applicazioni dove il riavviamento automatico improvviso del motore può provocare infortuni o danni all'apparecchiatura.
警告：モーターの予期しない自動再スタートによって負傷や機器の破損をまねく恐れのあるような応用では、自動リセット・モードを使用しないでください。
警告: 在马达突然自动再起动可能导致人员伤害或设备损坏的地方，切勿采用自动复原模态。

Contact Status
Etat des contacts
Kontaktstatus
Estado del contacto
Situação de contato
Stato dei contatti
接触状態
接触状态

Normal		Test	Tripped
95 — 96	Closed	Open	Open
97 — 98	Open	Open	Closed
			

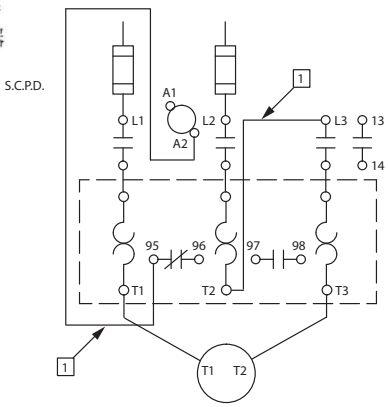
Wiring Diagram - 3 Phase Full Voltage DOL Starter
Schéma de câblage - Pleine tension triphasée Démarreur DOL (direct en ligne)
Verkabelungsschema - 3-phasiger Vollspannungs-DOL-Motoranlasser
Diagrama de cableado - Arrancador DOL (directo en línea) trifásico de voltaje pleno
Diagrama de circuito - Dispositivo de partida DOL, trifásico, de máxima tensão
Schema elettrico - Avviatore diretto trifase a tensione piena
配線図 - 3 相全電圧 DOL 始動器
配线图 — 三相全电压DOL起动器

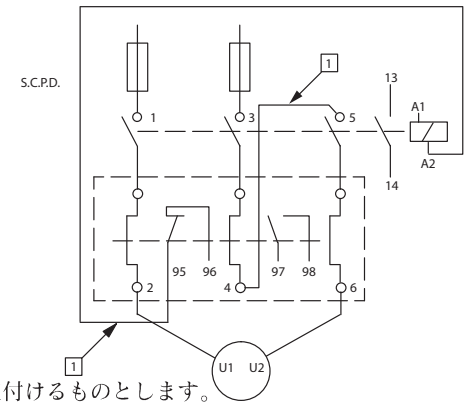




1 Connection must be fitted by user
1 Connexion à régler par l'utilisateur
1 Verbindung muß vom Benutzer hergestellt werden
1 La conexión debe ser realizada por el usuario
1 Conexão deve ser colocada pelo usuário
1 Il collegamento deve essere adattato dall'utente
1 接続部はユーザー側で取付けるものとします。
1 线路连接必须由用户完成

Wiring Diagram - 1 Phase Full Voltage DOL Starter (193S-____)
Schéma de câblage - Pleine tension monophasée Démarreur DOL (direct en ligne)
Verkabelungsschema - 1-phasiger Vollspannungs-DOL-Motoranlasser
Diagrama de cableado - Arrancador DOL (directo en línea) monofásico de voltaje pleno
Diagrama de circuito - Dispositivo de partida DOL, monofásico, de máxima tensão
Schema elettrico - Avviatore diretto monofase a tensione piena
配線図 - 1相全電圧 DOL 始動器
配线图 — 单相全压DOL起动器

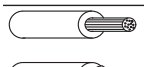
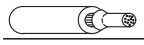
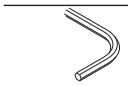




1 Connection must be fitted by user
1 Connexion à régler par l'utilisateur
1 Verbindung muß vom Benutzer hergestellt werden
1 La conexión debe ser realizada por el usuario
1 Conexão deve ser colocada pelo usuário
1 Il collegamento deve essere adattato dall'utente
1 接続部はユーザー側で取付けるものとします。
1 线路连接必须由用户完成

Main Connections
Raccordements Principale
Hauptanschlüsse
Collegamenti Principale
Conexões principais
Conexiones Principales
主体连接
主接続

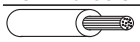
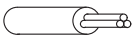
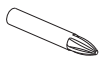
Rated Insulation Voltage (Ui): **690V AC**
Rated Operational Voltage (Ue) IEC/UL: **690V AC/600V AC**
Rated Operating Frequency: **50 / 60 Hz**

	193-ED1_B ✲ 193-EE_B ✲	**193-ED1_D ✲ 193-EE_D ✲**	**193-EEQD**	**193-EE_E**
Terminal Screw	M5	M5	M5	M8
	1x 2.5 … 16 mm² 2.0 Nm	1x 2.5 … 16 mm² 2.5 Nm	1x 2.5 … 16 mm² 2.5 Nm	1x 4 … 50 mm² 4.6 Nm
	2x 2.5 … 10 mm² 3.4 Nm	2x 2.5 … 10 mm² 3.4 Nm	2x 2.5 … 10 mm² 3.4 Nm	2x 4 … 25 mm² 4.6 Nm
	1x 2.5 … 25 mm² 2.0 Nm	1x 2.5 … 25 mm² 2.5 Nm	1x 2.5 … 25 mm² 2.5 Nm	1x 4 … 50 mm² 4.6 Nm
	2x 2.5 …16 mm² 3.4 Nm	2x 2.5 …16 mm² 3.4 Nm	2x 2.5 …16 mm² 3.4 Nm	2x 4 … 35 mm² 4.6 Nm
	1x 14… 6 AWG 18 lb-in	1x 14… 6 AWG 22 lb-in	1x 14 … 4 AWG 30 lb-in	1x 12 … 1/0 AWG 40 lb-in
	2x 12...6 AWG 30 lb-in	2x 12...6 AWG 32 lb-in	2x 12...6 AWG 30 lb-in	2x 8 … 2 AWG 40 lb-in
	#2	#2	#2	--
	1 x 6 mm	1 x 6 mm	1 x 6 mm	--
	--	--	--	4 mm

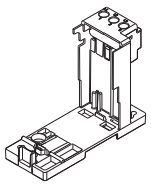
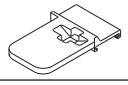
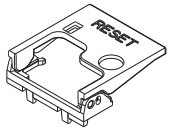
✲ **FOR MULTIPLE CONDUCTOR APPLICATIONS THE SAME SIZE AND STYLE WIRE MUST BE USED.**
POUR LES APPLICATIONS A CONDUCTEURS MULTIPLES, UTILISEZ UN CABLE DE MEME TAILLE ET DE MEME STYLE.
BEI VERWENDUNG MEHRERER LEITER MUSS DIESELBE DRAHTSTÄRKE UND DRAHTART VERWENDET WERDEN.
PER PIÙ CONDUTTORI È NECESSARIO UTILIZZARE LE STESSE DIMENSIONI E TIPI DI CAVO.
PARA CONDUTORES DIVERSOS, UTILIZE O MESMO TIPO E TAMANHO DE FIO.
EN APLICACIONES CON MÚLTIPLES CONDUCTORES DEBE UTILIZARSE CABLE DEL MISMO TAMAÑO Y ESTILO.
複 数 の導 体 を使用する場合は、同じサイズおよび型のワイヤを使用することが必要です。
对于多种导线应 用，必 须使用大小和样式都相同的 线缆。

Control Connections
Bornes de Commande
Steueranschlüsse
Morsetti di Commando
Conexões de controle
Conexiones de Control
控制连接
制御接続

Rated Insulation Voltage (Ui): **690V AC**
Rated Operational Voltage (Ue) IEC/UL: **690V AC/600V AC**
Rated Operating Current (Ie): **B600 N.O. / N.C.**

Terminal Screw	M3
	1x 0.5 … 2.5 mm² 0.55 Nm
	2x 0.2 … 0.75 mm² 0.55 Nm
	1x 0.5 … 4 mm² 0.55 Nm
	2x 0.2 … 1.5 mm² 0.55 Nm
	1x 24 … 10 AWG 5 lb-in
	2x 22 … 16 AWG 5 lb-in
	#1
	0.6 x 3.5 mm

Accessories
Accessoires
Zubehör
Accesorios
Acessórios
Accessori
付属品
附件

	For Use With	**Cat. No.**
DIN Rail/Panel Adapter 	193-ED1_B, 193*-EE_B	193-EPB
	193-ED1_D, 193*-EE_D	193-EPD
	193*-EE_E	193-EPE
Current Adjustment Shield 	193-ED1 (all) 193*-EE (all)	193-BC8
External Reset Adapter 	193-ED1 (all) 193*-EE (all)	193-ERA

Trip Curve
Courbe de déclenchement
Auslösekurve
Curva del disparo

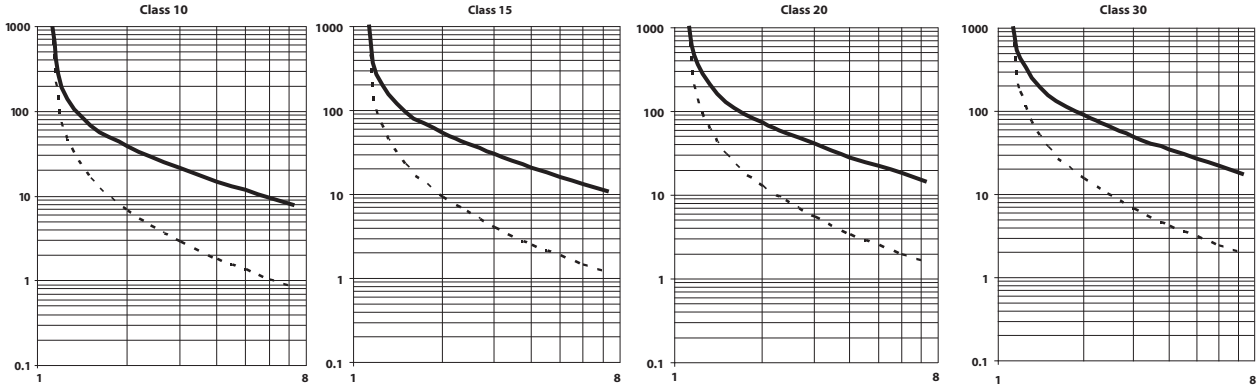
Curva de disparo
Curva di intervento
トリップ曲線
跳闸曲线

COLD START
DEMARRAGE A FROID
KALTSTART
ARRANQUE EN FRIO

PARTIDA À FRIO
AVVIAMENTO A FREDDO
冷始動
冷态起动

HOT START
DEMARRAGE A CHAUD
WARMSTART
ARRANQUE EN CALIENTE

PARTIDA À QUENTE
AVVIAMENTO A CALDO
熱始動
热态起动



Multiple of FLA
Intensités pleine charge multiples

Múltiplo de FLA
Vielfache des FLA-Wertes

Intensités pleine charge multiples
Multiplo di Max amp.

FLA 倍率
满载电流安培(FLA)的倍数

Short Circuit Ratings

Table 1 Standard Fault Short Circuit Ratings per UL508 and CSA 22.2 No. 14

E1 Plus Cat. No.		Max. available fault current (kA)	Max. voltage (V)	S.C.P.D.
193, 193S	ED1AB, ED1BB, EEAB, EEBB	1	600	Suitable for use with fuses only
	ED1CB, ED1DB, ED1EB, ED1ED, ED1FD EECB, EEDB, EEEB, EEED, EEFD, EEPB, EERB, EESB, EEQD, EETD	5		Not resticted to fusing only
	EEEE, EEFE, EEGE, EEUE, EEVE	10		

Table 3 Short Circuit Ratings per EN 60947-4-1

E1 Plus Cat. No.		Prospective S.C. current, Ir (kA)	Conditional S.C. current, Iq (kA)	Max. voltage (V)	S.C.P.D.
193,193S	ED1AB, ED1BB, EEAB, EEBB	1	100	690	Suitable for use with fuses only
	ED1CB, ED1DB, EECB, EEDB, EEPB, EERB	1			Not resticted to fusing only
	ED1EB, EEEB, ED1ED, ED1FD, EEED, EEFD, EEEE, EEFE, EESB, EEQD, EETD	3			
	EEGE, EEUE, EEVE	5			

Table 5 Overload relay only, High fault short circuit ratings per UL508 and CSA 22.2 No. 14

Cat. No.		Max. available fault. current (kA)	Max. voltage (V)	UL class RK1 fuse (A)
193, 193S	ED1CB, ED1DB, ED1EB, EECB, EEDB, EEEB, EEPB, EERB, EESB	100	600	60
	ED1ED, ED1FD, EEED, EEFD, EEQD, EETD			100
	EEEE, EEFE, EEGE, EEUE			200

Table 6 Type 2 Fuse Selection Table, Class gG and Class aM at Line Voltage of 400V, 50Hz

	Rated Operational Current I_e	Type gG Rated Current	Type aM Rated Current	Catalog Number	Catalog Number	Current Setting Range	Conditional S.C. Current Iq
[kW]	[A] 1)	[A]	[A]	2)	3)	[A]	[kA]
0.06	0.20	2	2	**100-C09…**	**193-EEAB**	0.1 - 0.5	50
0.09	0.30	2	2	**100-C09…**	**193-EEAB**	0.1 - 0.5	
0.12	0.44	2	2	**100-C09…**	**193-EEAB**	0.1 - 0.5	
0.18	0.60	2	2	**100-C09…**	**193-EEBB**	0.2 - 1.0	
0.25	0.85	4	2	**100-C09…**	**193-EEBB**	0.2 - 1.0	
0.37	1.1	4	2	**100-C09…**	**193-EECB**	1.0 - 5.0	
0.55	1.5	4	2	**100-C09…**	**193-EECB**	1.0 - 5.0	
0.75	1.9	6	4	**100-C09…**	**193-EECB**	1.0 - 5.0	
1.1	2.7	6	4	**100-C09…**	**193-EECB**	1.0 - 5.0	
1.5	3.6	6	4	**100-C09…**	**193-EECB**	1.0 - 5.0	
2.2	4.9	10	6	**100-C09…**	**193-EEDB**	3.2 - 16	
3	6.5	16	10	**100-C09…**	**193-EEDB**	3.2 - 16	
4	8.5	20	10	**100-C09…**	**193-EEDB**	3.2 - 16	
5.5	11.5	25	16	**100-C12…**	**193-EEDB**	3.2 - 16	
7.5	15.5	32	16	**100-C16…**	**193-EEDB**	3.2 - 16	
10	20	40	25	**100-C23…**	**193-EEEB**	5.4 - 27	
11	22	40	25	**100-C23…**	**193-EEEB**	5.4 - 27	
15	29	63	32	**100-C30…**	**193-EEFD**	9 - 45	
18.5	35	63	40	**100-C37…**	**193-EEFD**	9 - 45	
22	41	80	50	**100-C43…**	**193-EEFD**	9 - 45	
30	55	100	63	**100-C55…**	**193-EEQD**	11 - 55	
30	55	100	63	**100-C60…**	**193-EEGE**	18 - 90	
37	66	125	80	**100-C72…**	**193-EEGE**	18 - 90	
45	80	160	100	**100-C85…**	**193-EEGE**	18 - 90	
55	97	200	125	**100-C97…**	**193-EEVE**	60 - 120	

Recommended fuse sizes based on the following starting conditions:
≤ 3 kW Starting current max. 6 x Motor rated current, Starting time max. 5 s
> 3 kW Starting current max. 7 x Motor rated current, Starting time max. 5 s

Table 2 Type I and Type II Fuse Coordination with Bul. 100-C contactors per EN 60947-4-1

E1 Plus Cat. No.		Contactor Cat. No.	Max. starter FLC (A)	Prospective S.C. current, Ir (kA)	Conditional S.C. current, Iq (kA)	Max. voltage (V)	Type I Max. Class J or CC fuse (A)	Type II Max. Class J or CC fuse (A)
193, 193S	ED1AB, EEAB	100-C09	0.5	1	100	600	3	3
	ED1BB, EEBB		1				6	6
	ED1CB, ED1DB, EECB, EEDB, EEPB, EERB	100-C09	9	1			20	15
		100-C12	12				20	20
		100-C16	16				30	30
		100-C23	23				40	40
	ED1EB, EEEB, EESB	100-C09	9	3			20	15
		100-C12	12				20	20
		100-C16	16				30	30
		100-C23	23				40	40
	ED1ED, ED1FD, EEED, EEFD, EEQD, EETD	100-C30	30	3			50	50
		100-C37	37				50	50
		100-C43	43				70	70
		100-C55	55				80	80
	EEEE, EEFE	100-C60	60	3			80	80
		100-C72	72				100	100
		100-C85	85				150	150
	EEGE, EEUE	100-C60	60	5			80	80
		100-C72	72				100	100
		100-C85	85				150	150
	EEVE	100-C97	97				175	175

Table 4 High Fault Short Circuit Ratings, using Fusing, per UL508 and CSA 22.2 No. 14

E1 Plus Cat. No.		Contactor Cat. No.	Max. starter FLC (A)	Max.available fault current (kA)	Max. voltage (V)	Max. UL Class J or CC fuse, CSA HRCI-J (A)
193, 193S	ED1AB, EEAB	100-C09	0.5	100	600	3
	ED1BB, EEBB		1			6
	ED1CB, ED1DB, ED1EB, EECB, EEDB, EEEB, EEPB, EERB, EESB	100-C09	9			20
		100-C12	12			20
		100-C16	16			30
		100-C23	23			40
	ED1ED, ED1FD, EEED, EEFD, EEQD, EETD	100-C30	30			50
		100-C37	37			50
		100-C43	43			70
		100-C55	55			80
	EEEE, EEFE, EEGE, EEUE, EEVE	100-C60	60			80
		100-C72	72			100
		100-C85	85			150
		100-C97	97			175

193-EEED or 193-EEFD with 100-C30, 100-C37 or 100-C43 contactor: 480V/65kA; 600V/30kA when protected by Allen-Bradley 140U-H6C3 followed by suffixes CB rated 50A max.

1) Typical motor currents according IEC 60947-4-1 Table G.1
2) Incomplete catalog number, add coil and auxiliary contact codes
3) Overload relay 193-ED… with the same current setting range may also be used (up to 45A)

Table 7 High fault short circuit ratings, using Bul. 140MG, circuit protector, per UL508 and CSA 22.2 No.14

E1 Plus Cat. No.		Contactor Cat. No.	Max. starter FLC (A)	Max. available fault current (kA)		Circuit Protector Cat. No.	Max. Circuit Protector Current (A)	Minimum Enclosure Size (in.)
				At 480V	At 600V			
193	ED1ED, ED1FD, EEED, EEFD, EEQD	100-C30	30	65	25	140MG-H8P-C50	50	24x20x8 with two hinges and two multi-turn screw type latches
		100-C37	37	65	25	140MG-H8P-C50	50	
		100-C43	43	65	25	140MG-H8P-C50	50	
	EEEE, EEFE, EEGE, EEVE	100-C60	60	65	25	140MG-H8P-D12	125	
		100-C72	72	65	25	140MG-H8P-D12	125	
		100-C85	85	65	25	140MG-H8P-D12	125	
		100-C97	97	65	25	140MG-H8P-D12	125	

Table 8 High fault short circuit ratings, using Bul. 140G-H frame, circuit breakers, per UL508 and CSA 22.2 No.14

E1 Plus Cat. No.		Contactor Cat. No.	Max. starter FLC (A)	Max. available fault current (kA)		Circuit Breaker Cat. No.	Max. Circuit Breaker Current (A)
				At 480V	At 600V		
193	ED1ED, ED1FD, EEED, EEFD, EEQD	100-C30	30	50	25	140G-H6C3-C50	50
		100-C37	37	50	25	140G-H6C3-C50	50
		100-C43	43	50	25	140G-H6C3-C50	50
	EEEE, EEFE, EEGE, EEVE	100-C60	60	65	25	140G-H6F3-D11	110
		100-C72	72	65	25	140G-H6F3-D11	110
		100-C85	85	65	25	140G-H6F3-D11	110
		100-C97	97	65	25	140G-H6F3-D12	125

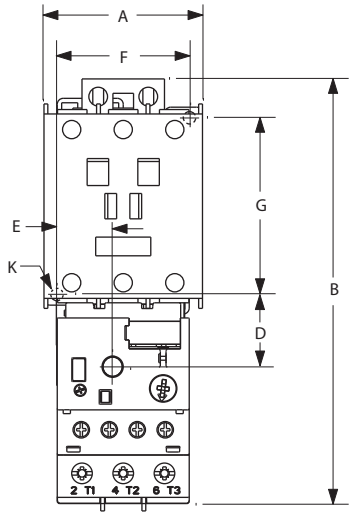
Table 9 Group installation short circuit ratings

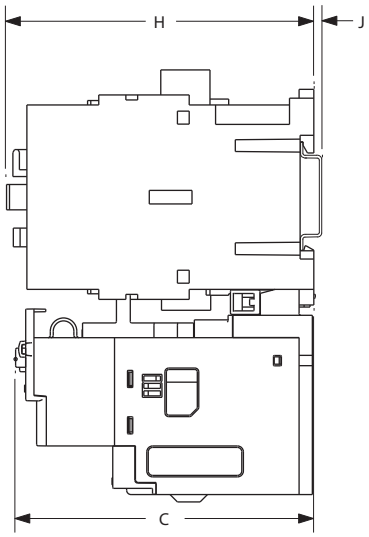
Catalog Nos. 193/592-EE and ED1 noted below have the following group installation short circuit ratings when used with the specified contactors and branch circuit protection.

Overload Relay		Contactor	Max. Available Fault Current	Max. Voltage	UL Fuse
193	-ED1AB, -ED1BB, -ED1CB, -ED1DB, -ED1EB. -EEAB, -EEBB, -EECB, -EEDB, -EEEB.	100-C09, 100-C12, 100-C16	5,000	480	Class RK5 60 Amp.
193	-ED1AB, -ED1BB, -ED1CB, -ED1DB, -ED1EB. -EEAB, -EEBB, -EECB, -EEDB, -EEEB.	100-C09, 100-C12, 100-C16	30,000	480	Class J 100 Amp

Table 10 Short circuit ratings, using 140U D Frame circuit breakers, per UL508 and CSA 22.2

Overload Relay		Contactor	Circuit Breaker Catalog Nos.	Short Circuit Rating
193	-ED1AB, -ED1BB, -ED1CB, -ED1DB, -ED1EB. -EEAB, -EEBB, -EECB, -EEDB, -EEEB.	100-C09, 100-C12, 100-C16 100-C23	140U-D6D3-A50, -B10, -B20, -B30, -B40, -B50, -B60 -B80, -C10, -C12, -C15, -C20, -C25, -C30	65,000 A. 480Y / 277 VAC
193	-ED1AB, -ED1BB, -ED1CB, -ED1DB, -ED1EB. -EEAB, -EEBB, -EECB, -EEDB, -EEEB.	100-C09, 100-C12, 100-C16 100-C23	140U-D6D3-A50, -B10, -B20, -B30, -B40, -B50, -B60 -B80, -C10, -C12, -C15, -C20, -C25, -C30	5,000 A. 600Y / 347 VAC
193	-ED1AB, -ED1BB, -ED1CB, -ED1DB, -ED1EB. -EEAB, -EEBB, -EECB, -EEDB, -EEEB.	100-C09, 100-C12, 100-C16 100-C23	140U-D6D3-A50, -B10, -B20, -B30, -B40, -B50, -B60 -B80, -C10, -C12, -C15, -C20, -C25, -C30	35,000 A. 600Y / 347 VAC





CONTACTOR CAT. NO.	E1 PLUS CAT. NO.		A	B	C	D	E	F	G	H	J	K
100-C09, -C12, -C16, -C23	193-ED1_B, 193*-EE_B	mm (in)	45 (1.76)	146.6 (5.77)	85.2 (3.35)	24.5 (.96)	13.9 (.55)	35 (1.38)	60 (2.36)	86.5 (3.40)	2 (.08)	4.5 (.17)
100-C30, -C37	193-ED1_D, 193*-EE_D	mm (in)	45 (1.76)	146.6 (5.77)	101.2 (3.98)	24.5 (.96)	13.9 (.55)	35 (1.38)	60 (2.36)	104 (4.09)	2 (.08)	4.5 (.17)
100-C43, -C55		mm (in)	54 (2.12)	146.6 (5.77)	101.2 (3.98)	24.5 (.96)	18.4 (.74)	45 (1.77)	60 (2.36)	104 (4.09)	2 (.08)	4.5 (.17)
100-C60, -C72, -C85, -C97	193*-EE_E	mm (in)	72 (2.83)	192 (7.57)	120.4 (4.74)	29 (1.14)	23.8 (.94)	55 (2.16)	100 (3.94)	126 (4.94)	2 (.08)	5.4 (.21)
300-AO_, -BO_	193-ED1_D, 193*-EE_D	mm (in)	45 (1.76)	146.6 (5.77)	101.2 (3.98)	24.5 (.96)	13.9 (.55)	35 (1.38)	60 (2.36)	104 (4.09)	2 (.08)	4.5 (.17)
300-CO_	193*-EE_E	mm (in)	72 (2.83)	192 (7.57)	120.4 (4.74)	29 (1.14)	23.8 (.94)	55 (2.16)	100 (3.94)	126 (4.94)	2 (.08)	5.4 (.21)

Copyright © 2015 Rockwell Automation, Inc. All Rights Reserved. Printed in USA.

Product: 800H-HR2

Description: 800H 2 Position Selector Switch

ASSEMBLY

Factory or User Assembled?	Factory Assembled

SELECTOR SWITCH DATA

Hazardous Location	No
Finger Safe Guards	No Guards
Knob Insert or Metal Wing Lever Color	White
Operator Function	Maintained
Contact Blocks	No Contacts

CERTIFICATIONS AND APPROVALS

UL	Listed E14840, E10314; Guide #NKCR, NOIV
CSA	LR1234, LR11924, 22.2 #14
CE	60947-5-1
For UL Certifications Directory:	http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm

Renewal Parts for 800H NEMA 4/4X Operators

Mounting Hardware for Bulletin 800H NEMA 4/4X Operators

Locking or Mounting Ring Thrust Washer Trim Washer Rubber Gasket





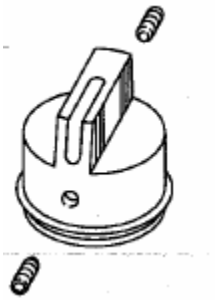

(Pictures are for illustration only. The exact size and dimensions will vary depending upon the catalog number)

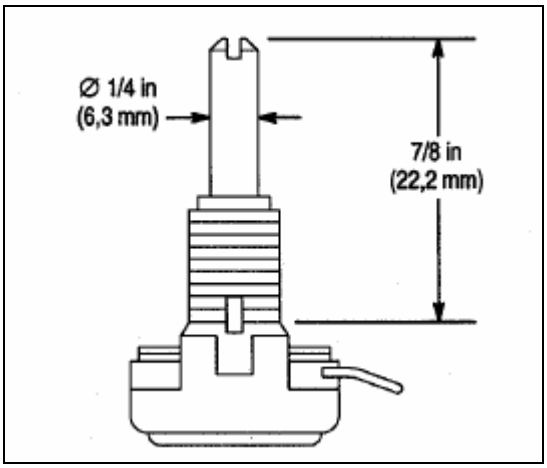
CATALOG NUMBER	DESCRIPTION	LOCKING RING ①	THRUST WASHER	TRIM WASHER	GASKET
800H-AR***	Flush Head Pushbutton	800H-N144	800H-N146	800H-N148	F-14963
800H-BR***	Extended Head Pushbutton	800H-N144	800H-N146	800H-N148	F-14963
800H-DR***	Mushroom Head Pushbutton	800H-N142	800H-N146	800H-N148	F-14963
800H-DR*J	Jumbo Plastic Mushroom Head	800H-N142	800H-N146	800H-N148	F-14963
800H-FRX****	Push Pull Devices – All	800H-N142	800H-N146	800H-N148	F-14963
800H-GR**	Guarded Pushbutton	800H-N143	800H-N146	800H-N148	F-14963
800H-H, -J, or -N	Selector Switch – Std Knob	800H-N145F	800H-N146	800H-N148	F-14963
800H-PR***	Pilot Light Transformer Unit	800H-N149	800H-N146	800H-N148	F-14963
800H-PRA**	Illum Pushbutton with Guard ②	800H-N152	800H-N146	800H-N148	F-14963
800H-PRB***	Illum Pushbutton w/o Guard	800H-N142	800H-N146	800H-N148	F-14963
800H-PRDT**	Dual Input Pilot Light	800H-N149	800H-N146	800H-N148	F-14963
800H-PRM**	Illum Mushroom Head Pushbutton	800H-N142	800H-N146	800H-N148	F-14963
800H-PRMJ**	Illum Jumbo Mushroom Head Pushbutton	800H-N142	800H-N146	800H-N148	F-14963
800H-PRT***	Push-to-Test Pilot Light	800H-N142	800H-N146	800H-N148	F-14963
800H-QR***	Pilot Light Full Voltage Unit	800H-N149	800H-N146	800H-N148	F-14963
800H-QRA**	Illum Pushbutton with Guard ②	800H-N152	800H-N146	800H-N148	F-14963
800H-QRB***	Illum Pushbutton w/o Guard	800H-N142	800H-N146	800H-N148	F-14963
800H-QRM**	Illum Mushroom Head Pushbutton	800H-N142	800H-N146	800H-N148	F-14963
800H-QRMJ**	Illum Jumbo Mushroom Head Pushbutton	800H-N142	800H-N146	800H-N148	F-14963
800H-QRT***	Push-to-Test Pilot Light	800H-N142	800H-N146	800H-N148	F-14963
800H-R**	Booted Pushbutton	Not Used	800H-N146	800H-N148	F-14963
800H-RR**	Neon Pilot Light	800H-N149	800H-N146	800H-N148	F-14963
800H-UR**	Potentiometer Units – All	800H-N143	800H-N146	800H-N148	F-14963
800H-WK**	Flip Lever Operator ③	40271-135-01	Not Used	Not Used	F-21013
800H-**HR**	Illum 2 Position Selector Switch	40209-065-01	800H-N146	800H-N148	F-14963
800H-**JR**	Illum 3 Position Selector Switch	40209-065-01	800H-N146	800H-N148	F-14963

① Locking Ring repair parts are for Series F units.
② The 800H-N152 kit includes the octagonal mounting ring and guard.
③ Additional hardware for flip lever units: Lockwasher with Teeth: 28309-523-26; 'C' Clamp Ring: B-31945.

Renewal Parts for 800H NEMA 4/4X Operators

Replacement Parts Bulletin 800H Nema 4/4X Potentiometer Units

	**Potentiometer Knob Assembly** (includes two set screws, o-ring). Order part number 40274-073-54.



Resistive Element (Potentiometer)

Catalog Number	Replacement Potentiometer Unit	Resistance Value	Type of Taper
800H-UR4	24752-221-03	150 ohm, 2.25 watts	Linear
800H-UR12	24752-221-05	500 ohm, 2.25 watts	Linear
800H-UR13	24752-221-06	1K ohm, 2.25 watts	Linear
800H-UR16	24752-221-07	1.5K ohm , 2.25 watts	Linear
800H-UR19	24752-221-08	2.5K ohm, 2.25 watts	Linear
800H-UR24	24752-221-10	5K ohm, 2.25 watts	Linear
800H-UR29	24752-221-12	10K ohm, 2.25 watts	Linear
800H-UR34	24752-221-13	15K ohm, 2.25 watts	Linear
800H-UR35	24752-221-14	20K ohm, 2.25 watts	Linear
800H-UR37	24752-221-15	25K ohm, 2.25 watts	Linear
800H-UR41	24752-221-17	50K ohm, 2.25 watts	Linear
800H-UR46	24752-221-19	75K ohm, 2.25 watts	Linear
800H-UR49	24752-221-21	100K ohm, 2.25 watts	Linear
800H-UR50	24752-221-22	150K ohm, 2.25 watts	Linear
800H-UR51	24752-221-23	200K ohm, 2.25 watts	Linear
800H-UR54	24752-221-25	400K ohm, 2.25 watts	Linear
800H-UR55	24752-221-26	500K ohm, 2.25 watts	Linear
800H-UR56	24752-221-27	800K ohm, 2.25 watts	Linear
800H-UR57	24752-221-28	1 Meg ohm,2.25 watts	Linear
800H-UR59	24752-221-29	2 Meg ohm, 2.25 watts	Linear
800H-UR62	24752-221-30	3 Meg ohm, 2.25 watts	Linear
800H-UR64	24752-221-31	4 Meg ohm, 2.25 watts	Linear
800H-UR90	24752-221-38	400K ohm, 2.25 watts	Linear
800H-UR91	24752-221-46	100K ohm, 2.25 watts	Modified Linear to 102 degrees, linear from 103 to 312 degrees

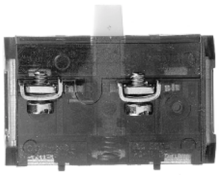
Modifications and Accessories

Contact Blocks

Packaged in kit form for field installation. All necessary mounting hardware is provided with each contact block kit. **Contact ratings are listed on page 10-59. Note**: It is not recommended to mount more than four contact blocks on any one Non-Illuminated operator, (maximum two blocks deep). Contact blocks cannot be stacked onto power modules, so illuminated operators are limited to two contact blocks. Sealed switch contact blocks are not stackable, and are limited to two blocks per operator. Time delay contacts are only available as one circuit per operator.



Shallow Block



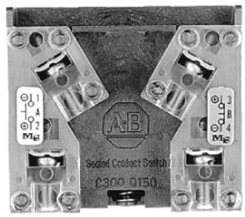
PenTUFF (Low Voltage) Contact Block



Logic Reed Block



Sealed Switch Block



Stackable Sealed Switch Block

Number of Contacts	Shallow Block ❶❷	Pen*TUFF* (Low Voltage) Block ❶❷	Logic Reed Block ❸	Sealed Switch Block ❸	Stackable Sealed Switch Block ❸
	Cat. No.	Cat. No.	Cat. No.	Cat. No.	Cat. No.
1 N.O.	800T-XD1	800T-XD1V	800T-XD1R	800T-XD1P	800T-XD1Y
1 N.C.	800T-XD2	800T-XD2V	800T-XD2R	800T-XD2P	800T-XD2Y
1 N.O. (Early Make)	800T-XD3	800T-XD3V	—	—	—
1 N.C. (Late Break)	800T-XD4	800T-XD4V	—	—	—
1 N.O. - 1 N.C.	800T-XA	800T-XAV	800T-XAR	800T-XAP	800T-XAY
2 N.O.	800T-XA2 ❹	—	800T-XA2R ❹	—	800T-XA2Y
2 N.C.	800T-XA4	—	800T-XA4R	—	800T-XA4Y
1 N.C. (Late Break) 1 N.O.	800T-XA1	—	—	—	—
1 N.C. (Late Break) 1 N.C.	800T-XA7	—	—	—	—



Mini Block



Time Delay Block

Number of Contacts	Mini Block ❶	Time Delay Block ❺
	Cat. No.	Cat. No.
1 N.O.	800T-XD5	800T-XT
1 N.C.	800T-XD6	800T-XS

❶ Contact blocks with normally closed contacts meet direct drive positive opening standard requirements when properly fused to IEC 269-1 and 269-2. Shallow/mini contacts: 10 A gl or N type cartridge fuse. Pen*TUFF* contacts: 6 A gl or N type cartridge fuse.
❷ Specify Bulletin 800TC for finger-safe contact blocks. Example: **800TC-XA**.
❸ 800T operator using sealed switch and logic reed contact blocks and installed in a suitable enclosure are UL Listed as suitable for use in Class I, Division 2/Zone 2 hazardous locations.
❹ Additional contacts cannot be stacked on XA2 and XA2R contact blocks.
❺ For contact ratings, see page 10-5.



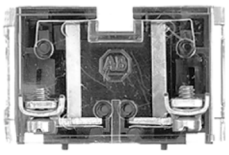
Shallow Contact Block Hardware

Description	Cat. No.
❻ Contact Block Mounting Screw	800T-N335
❼ Screw Retainer	800T-N336
❽ Actuator Extender	800T-N337

Modifications and Accessories, Continued

Power Modules

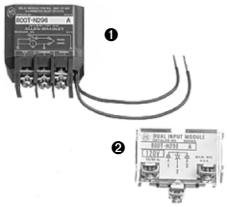
Packaged in kit form for field installation. Lamps are listed on page 10-47.



Full Voltage Power Module
Cat. No. 800T-N330



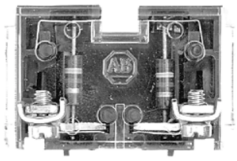
Transformer Power Module
Cat. No. 800T-N326



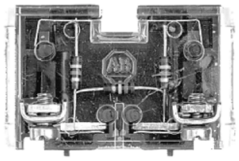
Dual Input Power Modules
Cat. No. 800T-N296 (Transformer)
800T-N290 (Diode)

Full Voltage		Transformer		Dual Input Kits (with Lamp)			
Voltage	**Cat. No.**	**Voltage**	**Cat. No.**	**Type**	**Lamp**	**Voltage**	**Cat. No.**
6 AC/DC	800T-N330	48 AC, 50/60 Hz	800T-N325	Transformer ❶	6V Incandescent	120 AC	800T-N296
12 AC/DC	800T-N330	120 AC, 50/60 Hz	800T-N326	Diode Type ❷	24V Incandescent	24 AC/DC	800T-N291
24 AC/DC	800T-N330	240 AC, 50/60 Hz	800T-N327	Diode Type ❷	90V Incandescent	120 AC/DC	800T-N290
120 AC/DC	800T-N330	480 AC, 50/60 Hz	800T-N328	Diode Type ❷	24V Red LED	24 AC/DC	800T-N343
240 AC/DC ❸	800T-N331	600 AC, 50/60 Hz	800T-N329	Diode Type ❷	24V Green LED	24 AC/DC	800T-N344
—	—	—	—	Diode Type ❷	24V Amber LED	24 AC/DC	800T-N345
—	—	—	—	Diode Type ❷	120V Red LED	120 AC	800T-N346
—	—	—	—	Diode Type ❷	120V Green LED	120 AC	800T-N347
—	—	—	—	Diode Type ❷	120V Amber LED	120 AC	800T-N348

❶ Transformer type dual input provides circuit isolation via a miniature type relay. This module is used in conjunction with a 120V transformer.
❷ Diode type dual input provides circuit isolation via opposing diodes. Not recommended for use with solid-state outputs and neon indicators.
❸ 240V full voltage module contains 50% dropping resistors for use with a 120V incandescent lamp



Resistor Power Module
Cat. No. 800T-N332



Neon Power Module
Cat. No. 800T-N333

Resistor (10% Drop)		Neon ❹	
Voltage	**Cat. No.**	**Voltage**	**Cat. No.**
120 AC/DC	800T-N332	120 AC/DC 240 AC/DC	800T-N333 800T-N334

❹ Neon modules contain resistors.

Modifications and Accessories, Continued

Replacement Color Caps

Color caps listed below are for field replacement on installed devices or for completion of devices ordered with color caps omitted.



Illuminated Extended Button



Standard Pilot Light



Push-to-Test Pilot Light

Illuminated Push Button Color Caps		Pilot Light Color Caps			
Color	Extended Button ❶	Color	Standard ❶	Color	Push-to-Test ❶
	Cat. No.		Cat. No.		Cat. No.
Red	800T-N40	Amber	800T-N26A	Red	800T-N40
Green	800T-N41	Blue	800T-N26B	Green	800T-N41
Amber	800T-N42	Clear	800T-N26C	Amber	800T-N42
Blue	800T-N43	Green	800T-N26G	Blue	800T-N43
White	800T-N44	Red	800T-N26R	White	800T-N44
Clear	800T-N45	White	800T-N26W	Clear	800T-N45

❶ Available in bulk quantities of 20. Add suffix (**-BP**) to the cat. no. and order in multiples of 20.



Non-Illuminated Plastic Mushroom



Non-Illuminated Plastic Jumbo Mushroom



Illuminated Mushroom



Illuminated Jumbo Mushroom

Push Button Color Caps, Non-Illuminated			Push Button Color Caps, Illuminated		
Color	Plastic Mushroom	Plastic Jumbo Mushroom	Color	Mushroom	Jumbo Mushroom
	Cat. No.	Cat. No.		Cat. No.	Cat. No.
Red	800H-N114A	800H-N115A	Red	800T-N304R	800T-N305R
Green	800H-N114B	800H-N115B	Green	800T-N304G	800T-N305G
Blue	800H-N114C	800H-N115C	Amber	800T-N304A	800T-N305A
Yellow	800H-N114E	800H-N115E	Blue	800T-N304B	800T-N305B
Orange	800H-N114F	800H-N115F	White	800T-N304W	800T-N305W
Gray	800H-N114G	800H-N115G	Clear	800T-N304C	800T-N305C
Black	800H-N114H	800H-N115H	—	—	—
White	800H-N114L	800H-N115L	—	—	—



Push-Pull



Push-Pull/Twist



Push-Pull Jumbo



Push-Pull/Twist Jumbo

Color	Push-Pull Color Caps, Non-Illuminated			
	Push-Pull	Push-Pull/Twist	Push-Pull Jumbo	Push-Pull/Twist Jumbo
	Cat. No.	Cat. No.	Cat. No.	Cat. No.
Red	800T-N160A	800T-N302A	800T-N208A	800T-N307A
Green	800T-N160B	800T-N302B	800T-N208B	800T-N307B
Blue	800T-N160C	800T-N302C	800T-N208C	800T-N307C
Yellow	800T-N160E	800T-N302E	800T-N208E	800T-N307E
Orange	800T-N160F	800T-N302F	800T-N208F	800T-N307F
Gray	800T-N160G	800T-N302G	800T-N208G	800T-N307G
Black	800T-N160H	800T-N302H	800T-N208H	800T-N307H
White	800T-N160L	800T-N302L	800T-N208L	800T-N307L

Bulletin 800H

30.5 mm Push Buttons

Type 4/4X/13, Corrosion-Resistant/Watertight/Oiltight

Modifications and Accessories, Continued

Replacement Color Caps, Continued

Color caps listed below are for field replacement on installed devices or for completion of devices ordered with color caps omitted.



Push-Pull



Push-Pull/Twist



Push-Pull Jumbo



Push-Pull/Twist Jumbo

Color	Push-Pull Color Caps, Illuminated			
	Push-Pull	Push-Pull/Twist	Push-Pull Jumbo	Push-Pull/Twist Jumbo
	Cat. No.	Cat. No.	Cat. No.	Cat. No.
Amber	800H-N112A	800T-N301A	800T-N209A	800T-N306A
Blue	800H-N112B	800T-N301B	800T-N209B	800T-N306B
Clear	800H-N112C	800T-N301C	800T-N209C	800T-N306C
Green	800H-N112G	800T-N301G	800T-N209G	800T-N306G
Red	800H-N112R	800T-N301R	800T-N209R	800T-N306R
White	800H-N112W	800T-N301W	800T-N209W	800T-N306W

Selector Switch Knobs, Illuminated



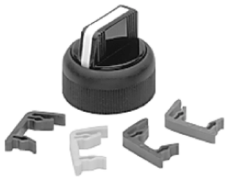
Standard Knob



Knob Lever

Color	Knob Type	
	Standard Knob	Knob Lever
	Cat. No.	Cat. No.
Amber	800H-N154A	800H-N155A
Blue	800H-N154B	800H-N155B
Clear	800H-N154C	800H-N155C
Green	800H-N154G	800H-N155G
Red	800H-N154R	800H-N155R
White	800H-N154W	800H-N155W

Booted Non-Illuminated Selector Switch Knobs



Booted Selector Switch Knob
Cat. No. 800H-NR5

Insert Material	Material			
	Hypalon	Silicone ●	Urethane ●●	Ethylene ● Propylene ●●
	Cat. No.	Cat. No.	Cat. No.	Cat. No.
Brass	800H-NR5 ❶	800H-NR101 ❶	800H-NR100 ❶	800H-NR103 ❶
Stainless Steel	800HS-NR5	800HS-NR101	800HS-NR100	800HS-NR103

❶ Color insert packet (Cat. No. 800T-N123) is included in each kit.

Modifications and Accessories, Continued

Protective Boots



Cat. No. 800H-N11



Cat. No. 800H-N12

Protective Boot for Illuminated Push Buttons		
Description	**Type**	**Cat. No.**
May be added to guarded units, units without guard or push-to-test devices. This protective silicone boot guards against the entrance of foreign materials reaching the opening between the button and locking ring.	Boot without Guard	800H-N11
	Boot with Guard	800H-N12

Boots supplied with control stations and components are made of a hypalon material with brass insert ring. To order boots with silicone, urethane or ethylene-propylene material, see table below.



Protective Boot for Push Button
Cat. No. 800H-N5A

Insert Material	Color	Material			
		Hypalon	Silicone ● ❶	Urethane ●● ❶	Ethylene ● Propylene ●● ❶
		Cat. No.	Cat. No.	Cat. No.	Cat. No.
Brass	Red	800H-N5A	800H-N101R	800H-N100R	800H-N103R
	Green	800H-N5B	800H-N101G	800H-N100G	800H-N103G
	Black	800H-N5H	800H-N101B	800H-N100B	800H-N103B
	Yellow	800H-N5E	800H-N101Y	800H-N100Y	—
	Blue	800H-N5C	800H-N101BL	800H-N100BL	—
Stainless Steel	Red	800HS-N5A	800HS-N101R	800HS-N100R	800HS-N103R
	Green	800HS-N5B	800HS-N101G	800HS-N100G	800HS-N103G
	Black	800HS-N5H	800HS-N101B	800HS-N100B	800HS-N103B
	Yellow	800HS-N5E	800HS-N101Y	800HS-N100Y	—
	Blue	800HS-N5C	800HS-N101BL	800HS-N100BL	—

❶ Dots printed on inside of boots identify type of boot material.

Protective Boot Application Information

- **Hypalon (synthetic rubber)**
  Very resistant to attack by oxidizing chemicals such as concentrated sulfuric acid and hypochlorite solutions. Also resistant to attack by oils and performs well in a wide range of other chemicals and solvents. Good flex and high impact resistance. This is the standard boot material supplied with 800H NEMA Type 4/4X push buttons unless otherwise specified.
- **Silicone**
  Superior high temperature resistance. Particularly suited for use where organic acids or vegetable oils may be present. Also superior resistance to the effects of outdoor use, such as oxygen, ozone, and weather.
- **Urethane**
  Excellent resistance to mechanical failure. Most durable boot material. Particularly suited for use where lubricating oils and automotive fuels may be present. Also well-suited for outdoor use.
- **Ethylene-propylene**
  Particularly suited for high temperature applications. Resistant to attack by many acids and alkalies, detergents, phosphate esters, ketones, alcohols, and glycols. Outstanding service in areas with hot water and steam wash-downs.

Modifications and Accessories, Continued

Miscellaneous



Closing Button
Cat. No. 800T-N1

Description	Color	Cat. No.
Closing Button Where an enclosure or flush plate with more than the required number of openings is used, this neat appearing button can be supplied to close the unused openings.	Gray	800T-N1
	Black	800T-N1B



Engraved E-Stop Jumbo Push-Pull Cap
Cat. No. 800T-N209RE1

Description	Cat. No.
Engraved Jumbo Push-Pull Cap For use on Bulletin 800T or 800H push-pull operators. Fits on illuminated and non-illuminated devices.	800T-N209RE1



Mounting Ring Wrench
Cat. No. 800T-N245

Description	Cat. No.
Mounting Ring Wrench This wrench will simplify tightening or loosening the octagonal mounting ring used on Bulletin 800H units. This wrench is double ended and can be used for 18 mm and 30 mm pilot light mounting rings.	800T-N245



Replacement Knobs and Mounting Rings

Description	Type	Cat. No.
Mounting Rings Illuminated push button or push-pull mounting ring	Type 1	800H-N142
Guarded push button mounting ring; also converts flush to guarded	Type 2	800H-N143
Mounting ring for flush and extended non-illuminated operators	Type 3	800H-N144
Selector switch knob and mounting ring	Type 4	800H-N145F



Color Insert Kits
Cat. No. 800T-N123

Description	Color	Cat. No.
Color Insert Kits Available on selector switches with removable color inserts. Standard knob and knob levers use the same insert. If color All is selected, a packet of color inserts will be furnished which includes one of each color except orange. Color insert kits can also be ordered with operators at no additional charge.	Red	800T-N124
	Green	800T-N125
	Blue	800T-N126
	Yellow	800T-N127
	White	800T-N128
	Orange	800T-N286
	All	800T-N123

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Rockwell Automation does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

Reproduction of the contents of this copyrighted publication, in whole or part, without written permission of Rockwell Automation, is prohibited.

Throughout this document we use notes to make you aware of safety considerations:

ATTENTION



Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

Use only replacement parts and devices recommended by Rockwell Automation to maintain the integrity of the equipment. It is the user's responsibility to ensure that the renewal part number selected is properly matched to the model, series and revision level of the equipment being serviced.

ATTENTION



Servicing energized Industrial Control Equipment can be hazardous. Severe injury or death can result from electrical shock, burn, or unintended actuation of controlled equipment. Recommended practice is to disconnect and lockout control equipment from power sources, and release stored energy, if present.

Refer to **National Fire Protection Association Standard No. NFPA70E, Part 2 and (as applicable) OSHA rules for Control of Hazardous Energy Sources (Lockout/Tagout) and OSHA Electrical Safety Related Work Practices** for safety related work practices, including procedural requirements for lockout/tagout, and appropriate work practices, personnel qualifications and training requirements where it is not feasible to de-energize and lockout or tagout electric circuits and equipment before working on or near exposed circuit parts.

ROCKWELL DISCLAIMS ALL WARRANTIES WHETHER EXPRESSED OR IMPLIED IN RESPECT TO THE INFORMATION (INCLUDING SOFTWARE) PROVIDED HEREBY, INCLUDING THE IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, AND NON-INFRINGEMENT. Note that certain jurisdictions do not countenance the exclusion of implied warranties; thus, this disclaimer may not apply to you.

Allen-Bradley is a trademark of Rockwell Automation

Product: 800H-JR2A

Description: 800H 3 Position Selector Switch

ASSEMBLY

Factory or User Assembled?	Factory Assembled

SELECTOR SWITCH DATA

Hazardous Location	No
Finger Safe Guards	No Guards
Knob Insert or Metal Wing Lever Color	White
Operator Function	Maintained
Target Table Selections	Cam and Contact Blocks

CERTIFICATIONS AND APPROVALS

UL	Listed E14840, E10314; Guide #NKCR, NOIV
CSA	LR1234, LR11924, 22.2 #14
CE	60947-5-1
For UL Certifications Directory:	http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm

Product: 800H-R2A

Description: 800H Momentary Contact, Non-Illuminated

ASSEMBLY

Factory or User Assembled?	Factory Assembled

PUSH BUTTON DATA

Hazardous Location	No
Finger Safe Guards	No Guards
Operator Type	Booted Head
Cap/Button Color	Black
Block Type	Standard
Contact Blocks	1 N.O. - 1 N.C.

CERTIFICATIONS AND APPROVALS

UL	Listed E14840, E10314; Guide #NKCR, NOIV
CSA	LR1234, LR11924, 22.2 #14
CE	60947-5-1
For UL Certifications Directory:	http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm

Product: 800H-R6A

Description: 800H Momentary Contact, Non-Illuminated

ASSEMBLY

Factory or User Assembled?	Factory Assembled

PUSH BUTTON DATA

Hazardous Location	No
Finger Safe Guards	No Guards
Operator Type	Booted Head
Cap/Button Color	Red
Block Type	Standard
Contact Blocks	1 N.O. - 1 N.C.

CERTIFICATIONS AND APPROVALS

UL	Listed E14840, E10314; Guide #NKCR, NOIV
CSA	LR1234, LR11924, 22.2 #14
CE	60947-5-1
For UL Certifications Directory:	http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm

Product: 800T-QH2A

Description: 800T Standard, Push-To-Test, Dual Input

ASSEMBLY

Factory or User Assembled?	Factory Assembled

PUSH BUTTON DATA

Hazardous Location	Yes
Finger Safe Guards	No Guards
Power Module Type	Full Voltage/ Universal
Lamp Test Options	No Test Option
Illumination Options	LED
Voltage	12-130V AC/DC
Lens Color	Amber
Contact Blocks	None

Product: 800T-TFXT6D2

Description: 800T Non-Illuminated Trigger Action E-Stops



Representative Photo Only
(actual product may vary based on configuration selections)

Selections

Finger Guards	No Guards on Terminals
Mushroom Head Size, Material	45mm Plastic Head
Cap Legend	No legend on cap
Contact Block Code (Trad)	1-NC Standard Contact

CERTIFICATIONS AND APPROVALS

UL	Listed E14840, E10314; Guide #NKCR, NOIV
CSA	LR1234, LR11924, 22.2 #14
CE	60947-5-1
For UL Certifications Directory:	http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm

Specifications

Electrical Ratings					
Poles					1, 2, 3
Tripping characteristics					C, D
Rated current (I_n)					0.5…63 A
Rated frequency [f]					50/60 Hz
Rated insulation voltage U_i acc. to IEC/EN 60664-1			Phase-to-ground		250V AC
			Phase-to-phase		440V AC
Overvoltage category					III
Pollution degree					3
Data acc. to UL/CSA					
Rated voltage	AC	1-pole	C Curve	0.5...40 A	277V AC
				50...63 A	240V AC
			D Curve	0.5...35 A	277V AC
				40...63 A	240V AC
		2-, 3-pole	C Curve	0.5...40 A	480Y/277V AC
				50...63 A	240V AC
			D Curve	0.5...35 A	480Y/277V AC
				40...63 A	240V AC
	DC	1-pole			48V DC
		2-pole			96V DC (2-pole in series)
Rated interrupting capacity acc. to UL 489					10 kA
Reference temperature for tripping characteristics					40 °C
Electrical endurance					6,000 operations (AC and DC); 1 cycle (1s - ON, 9s - OFF)
Data acc. to IEC/EN 60947-2					
Rated operational voltage (Ue)	1-pole				230V AC
	2-, 3-pole				400 V AC
Highest supply or utilization voltage (Umax)	AC	1-pole			253/440V AC
		2-, 3-pole			440V AC
	DC ★	1-pole			48V DC
		2-pole			96V DC
Min. operating voltage					12V AC, 12V DC
Rated ultimate short-circuit breaking capacity Icu					15 kA
Rated service short-circuit breaking capacity Ics					≤40 A: 11.25 kA >40 A: 7.5 kA
Rated impulse withstand voltage Uimp. (1.2/50µs)					4 kV (test voltage 6.2kV at sea level, 5kV at 2,000m)
Dielectric test voltage					2 kV (50/60Hz, 1 min.)
Reference temperature for tripping characteristics					30 °C
Electrical endurance 1 cycle (2s - ON, 13s - OFF, In ≤ 32A), 1 cycle (2s - ON, 28s - OFF, In > 32A)					In < 30A: 20,000 operations (AC), In ≥30A: 10,000 ops. (AC); 1,000 ops. (DC);

★ Self-declared IEC DC ratings.

Mechanical Data		
Housing		Insulation group II, RAL 7035
Indicator window		red ON/green OFF
Protection degree acc. to EN 60529		IP20, IP40 in enclosure with cover
Mechanical endurance		20,000 operations
Shock resistance acc. to IEC/EN 60068-2-27		25 g - 2 shocks - 13 ms
Vibration resistance acc. to IEC/EN 60068-2-6		5g - 20 cycles at 5…150…5 Hz with load 0.8 In
Environmental conditions (damp heat) acc. to IEC/EN 60068-2-30	°C/RH	28 cycles with 55°C/90-96% and 25°C/95-100%
Ambient temperature ★		-25…+55 °C
Storage temperature		-40…+70 °C
Installation		
Terminal		Dual terminal
Cross-section of conductors (top / bottom) solid, stranded ♣		35/35 mm^2
Flexible	mm^2	25/25 mm^2
	AWG	18 - 4 AWG
Cross-section of busbars (top / bottom)	mm^2	10/10 mm^2
	AWG	18 - 8 AWG
Tightening torque	N•m	2.8 N•m
	in•lb	AWG 18-16: 8.85 in•lb, AWG 14-10: 17.7 in•lb, AWG 8-4: 39.8 in•lb
Screwdriver		No. 2 Pozidrive
Mounting		DIN rail (EN 60715, 35mm) with fast clip
Mounting position		Any
Supply		Optional
Approximate Dimensions and Weight		
Pole dimensions (H x D x W)		111 x 69 x 17.5 mm (4.37 x 2.72 x .69")
Pole weight		125 g (4.4 oz.)
Combination with Auxiliary Elements		
Auxiliary contact		Yes
Signal contact		Yes
Shunt trip		Yes

♣ 35mm self-declared, not included in IEC/EN approval.

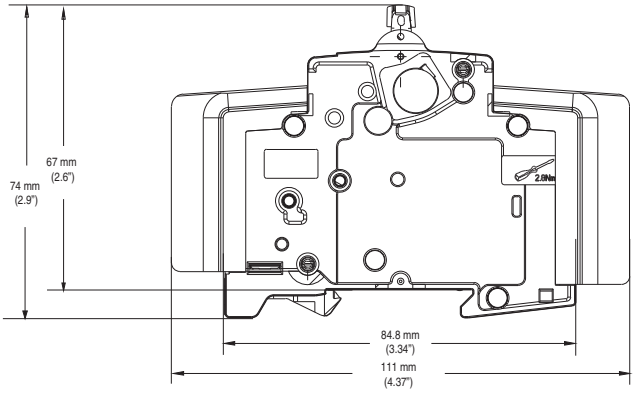
★ Refer to the Ambient Temperature Derating tables.

Power Loss Due to Current

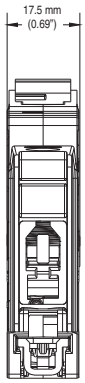
Rated Current [A]	Power Loss Per Pole [W]		Rated Current [A]	Power Loss Per Pole [W]
0.5	1.4		15	2.4
1	1.4		16	2.5
1.6	1.8		20	2.5
2	1.8		25	3.2
3	1.6		30	3.5
4	1.8		32	3.7
5	1.9		35	4.1
6	2.0		40	4.5
7	1.1		50	4.5
8	1.5		60	4.9
10	2.1		63	5.4
13	2.3		—	—

Approximate Dimensions

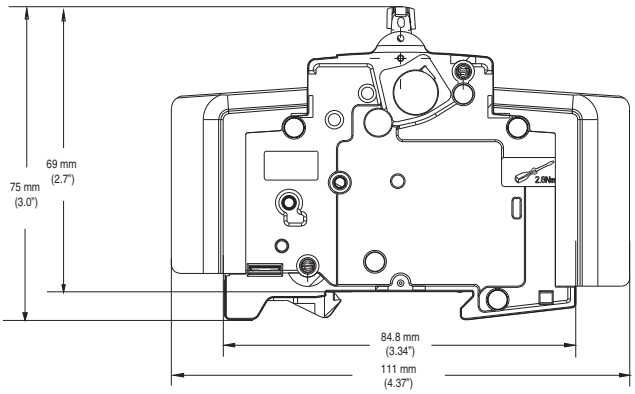
Note: Dimensions are shown in millimeters (inches). Dimensions are not intended for manufacturing purposes.



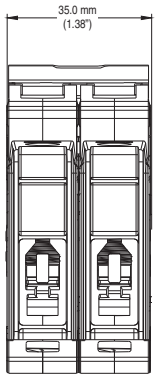
1-Pole



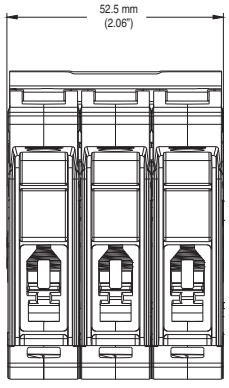
1-Pole



2-, 3-Pole



2-Pole



3-Pole

Application Information

Circuit Voltage

The Bulletin 1489-M circuit breakers are rated by voltage class. Applications should not exceed the listed voltage and current range.

Circuit Frequency

The Bulletin 1489-M circuit breakers may be applied to frequencies of 50 Hz and 60 Hz without derating. For applications above 60 Hz, contact Rockwell Automation with specific application information for the derating of the circuit breakers.

Available Short Circuit Current

The Bulletin 1489-M circuit breakers should only be applied in those applications in which the available short-circuit (or fault) current is less than or equal to 10 kA (US/Canada) and 15 kA (IEC).

Tripping Characteristics

The trip curve characteristics are shown on the following pages. The trip bands shown for each breaker represent current tripping limits for a circuit breaker and are within the limits established by UL.

The standard tripping characteristic for Bulletin 1489-M is Type C. Type C has a magnetic trip activated at 5-10 times the rated current of the circuit breaker. The reference temperature for the thermal tripping characteristics is 30 °C. The Type C characteristic will suit most applications.

In rare occurrences when the Type C characteristic does not fully meet the application, Type D magnetic trip characteristic is available, allowing for transients approximately twice as high as the standard Type C.

For a specific current at 30 °C, a circuit breaker will open ("clear the circuit") automatically at some total time that will be within the minimum and maximum time shown on the curves. For example, a one-pole, 15 A, Bulletin 1489-M circuit breaker trips in not less than 1 s and not more than 200 s on a 30 A current. Because the UL standard defines this time spread, users should not specify exact tripping time. The lower current portion of the curves (upper left) depicts the time to trip due to thermal action and reflect overload protection of the wire and connect load. The higher current portion of the curves (lower right) depicts the trip due to magnetic action of the circuit breaker and reflects protection due to short circuit level currents.

Application Considerations

The following is a discussion of application considerations related to North American applications. When applying product to IEC regional requirements, follow IEC practices and guidelines.

The selection of a specific ampere rating for a specific application is dependent on the type of load and duty cycle and is governed by the National Electric Code (Canadian Electric Code) and UL/CSA. In general, the codes require that overcurrent protection is at the current supply and at points where wire sizes are reduced. In addition, the codes state that conductors be protected according to their current carrying capacity. There are specific situations that require application consideration, such as motor circuit, and guidelines for the selection for transformer protection.

The Bulletin 1489-M circuit breakers are "non-100% rated" as defined by UL 489, para 7.1.4.2. As such, the circuit breaker's rating should be loaded to no more than 80% if used with continuous loads.

Line and load may be reversed. The Bulletin 1489-M circuit breaker may be bottom fed.

Branch Circuits

Bulletin 1489-M circuit breakers may be used to protect branch circuits. A branch circuit is the wiring portion of a system extending beyond the final overcurrent device protecting the circuit. Guidelines established in NEC, CEC, UL, and CSA should be used to determine the specific device. For example:

Motor Branch Circuit
Bulletin 1489-M circuit breakers are not horsepower rated because they are able to safely interrupt currents far in excess of the locked rotor value for a selected motor. This ability is recognized in the codes and standards and is also established by the UL and CSA tests described in UL 489 and CSA C22.2 No. 5 standards.

The size of a Bulletin 1489-M circuit breaker should be determined following the guidelines for an Inverse Time Circuit Breaker.

References: NEC 430.51 and UL 489. Also see CEC and appropriate Canadian Standards.

Transformer Protection
Bulletin 1489-M circuit breakers may be used for transformer protection following the guidelines established.

References: NEC 450 and UL 489. Also see CEC and appropriate Canadian Standards.

Heater Load, Lighting, and Other Load Protection
Bulletin 1489-M circuit breakers may be used for protection of heater loads, lighting loads, and other loads following the guidelines established.

References: NEC Article 31 and UL 508A. Also see CEC and appropriate Canadian Standards.

SWD Rating

The Bulletin 1489-M breakers (0.5 … 20 A) are rated as SWD (Switch Duty) and as such may be applied to switch fluorescent lighting loads up to their current and voltage maximum.

Coordinated Overcurrent Protection

Where an orderly shutdown is required to minimize the hazards to personnel and equipment, a system of coordination based upon the faulted or overloaded circuit is isolated by selective operation of only the overcurrent protective device closest to the overcurrent condition. The user should select devices that meet this requirement.
References: NEC 240.12. Also see CEC.

HACR Rating

Bulletin 1489-M Circuit Breakers are rated as Heating, Air Conditioning and Refrigeration circuit breakers as defined by UL 489, paragraph 6.7 and may used in this type of application.

Current Limiting

Bulletin 1489-M Circuit Breakers are rated as current limiting circuit breakers as defined by UL 489, paragraph 8.6.

The Bulletin 1489-M line features the ability to achieve short circuit interruptions far more effectively than conventional breakers. In conventional circuit breakers, the short circuit interruption time required is approximately one or two half cycles of an AC sine wave. When the contacts open, the resulting arc continues to burn until the current level passes through zero. The arc may re-ignite because of the insufficient width of the contact gap. The current that flows until the arc is extinguished produces a heating effect proportional to the I^2t value (let-through-energy) of the fault current.

The Bulletin 1489-M device is designed to substantially reduce the amount of let-through-current and the resulting let-through-energy that can damage protected components. The Bulletin 1489-M has the ability to interrupt short circuit current within the first half cycle of the fault. Limiting let-through current and energy will protect against the harmful effects of overcurrent and is focused primarily on avoiding excessive heat and mechanical damage.

Both of these factors are proportional to the square of the current. Thermal energy is proportional to the square of the RMS value and magnetic forces are proportional to the square of the peak value. The most effective way to provide protection is to substantially limit let-through-energy. This provides the following advantages:

- Far less damage at the location of the short circuit.
- Fast electric separation of a faulty unit from the system, especially power supplies connected in parallel that are switched off when the voltage of the power bus drops below a certain level.
- Far less wear on the miniature circuit breaker itself. This means more safe interruptions.
- Better protection of all components in the short circuit path.
- Far wider range of selective action when used with an upstream protective device. (No nuisance shut downs from feeder line interruptions, causing a blackout in all connected branches.)

Ambient Temperature Derating

The Bulletin 1489-M circuit breakers are rated in RMS amperes at a 40 °C (104 °F) ambient temperature per UL 489/CSA C22.2 No. 5. This temperature is used as the ambient temperature external to an industrial enclosure. If a circuit breaker is applied in a temperature that exceeds the 40 °C (104 °F) ambient, then the circuit breaker should be derated using the table below. For IEC 60947-2 standard, the products carry an ambient rating of 30 °C. Follow standard IEC application considerations for temperature rating in different ambient temperatures.

Note: Application below 0º C is for non-condensing atmosphere. Care should be taken for applications below 0 °C. These devices are not certified to operate correctly in the presence of ice.

Bulletin 1489-M

Temperature Derating, UL

Reference temperature = 40 °C

Current	Ambient temperature (°C)									
Rating [A]	-25	-20	-10	0	10	20	30	40	50	55
0.5	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5
1	1.2	1.2	1.2	1.1	1.1	1.1	1.0	1	1.0	0.9
1.6	2.0	2.0	1.9	1.8	1.8	1.7	1.7	1.6	1.5	1.5
2	2.5	2.4	2.4	2.3	2.2	2.1	2.1	2	1.9	1.9
3	3.7	3.7	3.6	3.4	3.3	3.2	3.1	3	2.9	2.8
4	5.0	4.9	4.7	4.6	4.4	4.3	4.1	4	3.9	3.8
5	6.2	6.1	5.9	5.7	5.6	5.4	5.2	5	4.8	4.7
6	7.4	7.3	7.1	6.9	6.7	6.4	6.2	6	5.8	5.7
7	8.7	8.6	8.3	8.0	7.8	7.5	7.3	7	6.7	6.6
8	9.9	9.8	9.5	9.2	8.9	8.6	8.3	8	7.7	7.6
10	12.4	12.2	11.9	11.5	11.1	10.7	10.4	10	9.6	9.4
13	16.1	15.9	15.4	14.9	14.4	14.0	13.5	13	12.5	12.3
15	18.6	18.3	17.8	17.2	16.7	16.1	15.6	15	14.4	14.2
16	19.8	19.6	19.0	18.4	17.8	17.2	16.6	16	15.4	15.1
20	24.8	24.4	23.7	23.0	22.2	21.5	20.7	20	19.3	18.9
25	31.0	30.6	29.6	28.7	27.8	26.9	25.9	25	24.1	23.6
30	37.2	36.7	35.6	34.4	33.3	32.2	31.1	30	28.9	28.3
32	39.7	39.1	37.9	36.7	35.6	34.4	33.2	32	30.8	30.2
35	43.4	42.8	41.5	40.2	38.9	37.6	36.3	35	33.7	33.1
40	49.6	48.9	47.4	45.9	44.4	43.0	41.5	40	38.5	37.8
50	62.0	61.1	59.3	57.4	55.6	53.7	51.9	50	48.2	47.2
60	74.4	73.3	71.1	68.9	66.7	64.4	62.2	60	57.8	56.7
63	78.2	77.0	74.7	72.3	70.0	67.7	65.3	63	60.7	59.5

Bulletin 1489-M

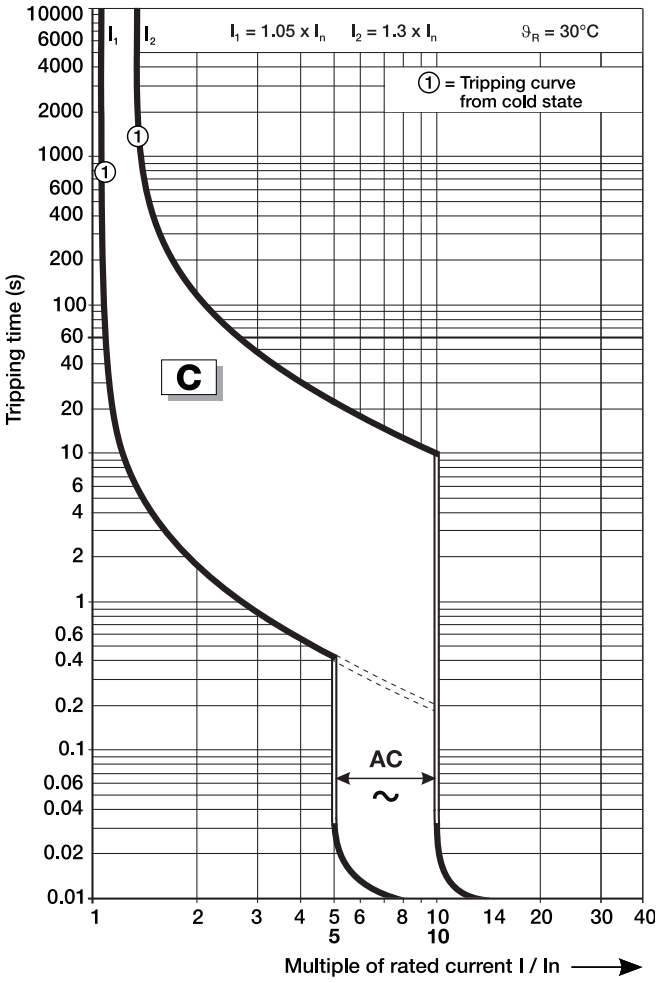
Temperature Derating, IEC

Reference temperature = 30 °C

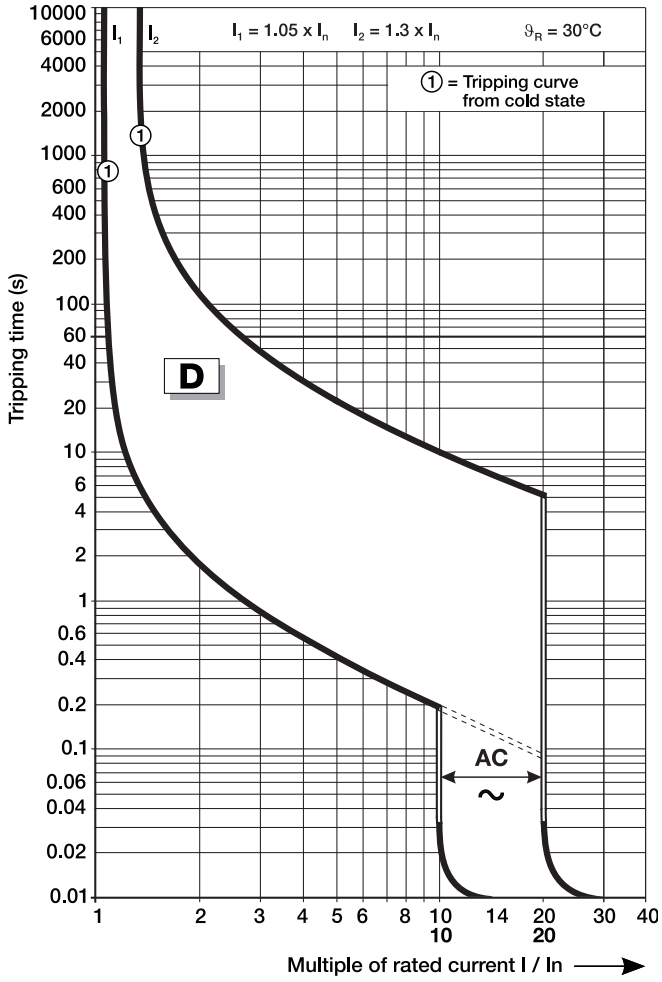
Current	Ambient temperature (°C)									
Rating [A]	-25	-20	-10	0	10	20	30	40	50	55
0.5	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5
1	1.2	1.2	1.1	1.1	1.1	1.0	1	1.0	0.9	0.9
1.6	1.9	1.8	1.8	1.7	1.7	1.6	1.6	1.6	1.5	1.5
2	2.3	2.3	2.2	2.2	2.1	2.1	2	1.9	1.9	1.9
3	3.5	3.5	3.4	3.3	3.2	3.1	3	2.9	2.8	2.8
4	4.7	4.6	4.5	4.4	4.2	4.1	4	3.9	3.8	3.7
5	5.8	5.8	5.6	5.5	5.3	5.2	5	4.9	4.7	4.6
6	7.0	6.9	6.7	6.5	6.4	6.2	6	5.8	5.6	5.6
7	8.2	8.1	7.8	7.6	7.4	7.2	7	6.8	6.6	6.5
8	9.3	9.2	9.0	8.7	8.5	8.2	8	7.8	7.5	7.4
10	11.7	11.5	11.2	10.9	10.6	10.3	10	9.7	9.4	9.3
13	15.1	15.0	14.6	14.2	13.8	13.4	13	12.6	12.2	12.0
15	17.5	17.3	16.8	16.4	15.9	15.5	15	14.6	14.1	13.9
16	18.6	18.4	17.9	17.4	17.0	16.5	16	15.5	15.0	14.8
20	23.3	23.0	22.4	21.8	21.2	20.6	20	19.4	18.8	18.5
25	29.1	28.8	28.0	27.3	26.5	25.8	25	24.3	23.5	23.1
30	35.0	34.5	33.6	32.7	31.8	30.9	30	29.1	28.2	27.8
32	37.3	36.8	35.8	34.9	33.9	33.0	32	31.0	30.1	29.6
35	40.8	40.3	39.2	38.2	37.1	36.1	35	34.0	32.9	32.4
40	46.6	46.0	44.8	43.6	42.4	41.2	40	38.8	37.6	37.0
50	58.3	57.5	56.0	54.5	53.0	51.5	50	48.5	47.0	46.3
60	69.9	69.0	67.2	65.4	63.6	61.8	60	58.2	56.4	55.5
63	73.4	72.5	70.6	68.7	66.8	64.9	63	61.1	59.2	58.3

Tripping Characteristics

C Curve



D Curve



Product: 1492-FB1J60-L
Description: 1492-FB Fuse Holders



Representative Photo Only (actual product may vary based on configuration selections)

FUSE HOLDER DATA

Electrical Standards	UL
Fuse Class	Class J Type Fuses
Number of Poles	1 pole
Maximum Current Rating	60A
Blown Fuse Indicator	LED Indicator

CERTIFICATIONS AND APPROVALS

UL	512, Guide No. IZLT, File No. E34648
CSA	22.2 No. 39
CE	Marked
For UL Certifications Directory:	http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm

Bulletin 1492-FB

Fuse Holders
UL Listed for Branch Circuit Protection

Allen-Bradley

Features and Benefits

- Silver-plated fuse clips
  - Improved fuse contact
- Available bus bars
  - 80 A and 100 A ampacity
  - UL, CSA, CE certified
- Ventilated housing
  - Allows good air flow and fuse ventilation
- Marker-ready feature
  - For circuit and wire identification
- Optional blown fuse indicator
  - Allow easy troubleshooting of electrical circuits
- Finger-safe design
  - Front-finger protection per IEC/ EN 60529 protects from accidental contact with energized circuits
- Compact size
  - Requires less panel space than open-style fuse holders
- No special tools required
  - Easy insertion/removal of fuses
- Versatile
  - Versions for 12V to 1000V
  - 1-, 2-, and 3-pole versions

Safe, compact and unique design, now amplified by the bus bar offering



Overview

The Allen-Bradley® Bulletin 1492-FB fuse holder line from Rockwell Automation has a distinctive, standalone design with many unique features. These fuse holders provide ease of use and installation (no special tools are needed), with a versatile, space saving and finger-safe design. This product line also stands out among the competition because of its distinct look, marker ready feature, and expanded ventilation. The fuse clips are silver-plated for improved fuse contact and there is a standardized LED indication feature for both AC and DC voltages.

The class CC and J holders are UL listed for branch circuit protection. Class CC and J fuses are ideal for wire protection, small motor loads, and for group protection of small motor loads. The midget holders are a UL recognized product where supplementary (1 1/2" x 13/32") fuses are applied. The midget fuse holder is also approved for 10 x 38 IEC midget fuses.

The 1492-FB fuse holder family is designed for use in many OEM applications such as power supplies, equipment protection, primary and secondary control transformers, solenoids, lighting and heater loads, and drives.

Product Selection

Fuse Holders

Description		For Class CC Fuse	For Class J Fuse		For Midget Fuse
		30 A*	30 A	60 A	30 A
		Cat. No.	Cat. No.	Cat. No.	Cat. No.
1-Pole	Fuse Holder	1492-FB1C30	1492-FB1J30	1492-FB1J60	1492-FB1M30
	Fuse Holder with Indication (110-600V)	1492-FB1C30-L	1492-FB1J30-L	1492-FB1J60-L	1492-FB1M30-L
	Fuse Holder with Indication, 12…72V	1492-FB1C30-D1	—	—	1492-FB1M30-D1
	Pieces per Carton	6			
2-Pole	Fuse Holder	1492-FB2C30	1492-FB2J30	1492-FB2J60	1492-FB2M30
	Fuse Holder with Indication	1492-FB2C30-L	1492-FB2J30-L	1492-FB2J60-L	149-FB2M30-L
	Pieces per Carton	3			
3-Pole	Fuse Holder	1492-FB3C30	1492-FB3J30	1492-FB3J60	1492-FB3M30
	Fuse Holder with Indication	1492-FB3C30-L	1492-FB3J30-L	1492-FB3J60-L	1492-FB3M60-L
	Pieces per Carton	2			

*All major fuse brands and current ranges have been evaluated for this fuse holder. Due to the heat they generate, the following fuses must be de-rated:
Ferraz Shamut ATQR 1.25 1 = 0.42 A max.
Ferraz Shamut ATQR 1.40 1 = 0.47 A max.

Specifications

Product Type (n = # of poles)		CC	M	J30	J60
		1492-FBnC30 "B" 1492-FB1C30-D1 "B" 1492-FBnC30-L "B"	1492-FBnM30 "B" 1492-FB1M30-D1 "B" 1492-FBnM30-L "B	1492-FBnJ30 "B" 1492-FBnJ30-L "B"	1492-FBnJ60 "B" 1492-FBnJ60-L "B"
For Fuse Type:		Class CC	Midget 13/32" X 1 1/2" 10 x 38 mm	Class J	
Approvals		UL, CSA, CE	UR, CSA, CE	UL, CSA, CE	
Maximum Voltage		600V Max	600V Max (690V AC max – IEC)	600V Max	
Maximum Current		30 A	30 A (32 A IEC)	30 A	60 A
Maximum Current Withstand (UL/CSA) (This is the rating of the fuse not the holder.)		200 kA sym	Fuse Dependent 50 kA max UL	200 kA sym	
Operating Temperature Range		-4 … 130 °F -20 … 55 °C			
Conductor Material		Cu, Stranded			
Conductor Strip Length		0.43 in (11 mm)		0.79 in (20 mm)	
Conductor Range	One wire per Terminal	#18 … 4 AWG (0.75 … 25 mm^2)		#18 … 1 AWG (0.75 … 50 mm^2)	#14 … 1 AWG (2.5 … 50 mm^2)
	Two wires per Terminal (both wires must be same size)	#18 … 8 AWG (0.75 … 10 mm^2)		#18 … 6 AWG (0.75 … 16 mm^2)	#14 … #6 AWG (2.5 … 16 mm^2)
Terminal Tightening Torque		# 18 … # 8 22 lb•in #6 … #4 26 lb•in (0.75 … 25 mm^2 2.5 nm)		35 lb•in (4 nm)	

Accessories

Bus Bars, Pin Style, When used with 1492-FB, type CC fuse holders, 600V AC

Cuttable, copper bus bar provided in 1 m length. UL 508 Listed, E56639, Category NMTR, cULus. CE to IEC 664
100 kA SCCR when used with Bus Protection, noted in table below.
Bus bars may also be used with 1492-FB - midget (10 x 38) fuse holders and 1492-SP Miniature Circuit Breaker/Supplementary Protector

Description	Devices per Meter	Package Quantity	Bus Protection Max. Fuse Type J	Ampacity	Cat. No.
1-Phase	57	(1) – 1 Meter Bus Bar	175 A	80 A	1492-A1B8
			200 A	100 A	1492-A1B1
2-Phase	29		175 A	80 A	1492-A2B8
			200 A	100 A	1492-A2B1
3-Phase	19		175 A	80 A	1492-A3B8
			200 A	100 A	1492-A3B1
End Cap for 1-Phase	—	10	—	—	1492-A1E
End Cap for 2-Phase & 3-Phase	—	10	—	—	1492-AME
Protective Shroud	—	10	—	—	1492-AAP
Terminal Lug	—	10	—	80 A/100 A	1492-AAT1

Allen-Bradley and Rockwell Software are trademarks of Rockwell Automation, Inc.
Trademarks not belonging to Rockwell Automation are property of their respective companies.

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 1492FB-PP001G-EN-P – April 2011
Supersedes Publication 1492FB-PP001F-EN-P – March 2010

Copyright © 2011 Rockwell Automation, Inc. All Rights Reserved. Printed in USA.

Product: 1492-PD3263
Description: 1492 Power Block



Representative Photo Only (actual product may vary based on configuration selections)

POWER BLOCK DATA

Base Block Type	Power Distribution Block
Number of Poles	3-Pole
Connector Material	Aluminum
Openings per Pole (Line Side)	2 Openings
Openings per Pole (Load Side)	6 Openings
Current Rating (per Pole)	350 Amps
Marking Strips	Single White Strip Provided

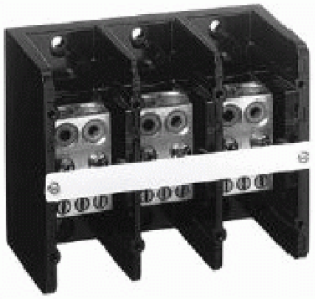
CERTIFICATIONS AND APPROVALS

CE	
UL	Component Recognized, Guide No. XCFR2, File No. E40735
CSA	Certified
For UL Certifications Directory:	http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.htm

LISTEN. THINK. SOLVE.®

Product Data Sheet

Power Distribution Terminal Blocks
Catalog Number: 1492-PD3263



Ratings:

350 Amps
600 Volts AC/DC
Panel Mount

Wire Range:

Line Side: (2) 2/0 - #14 AWG
Load Side: (6) #4 - #14 AWG

Agency Approvals:

- UL Recognized, UL 1059 Terminal Block Standard – File #XCFR2.E40735
- CSA Certified, CSA C22.2 No. 158 (Wire Class B & C only)
- CE Compliant to IEC 60947-7-1
- RoHS Compliant

Electrical Ratings:

- 350 Amp Copper Wire (Based on NEC Table 310-16, 75°C Column)
- 600 Volts AC/DC (UL 1059 Class C, User Group – General Industrial)
- Factory and Field Wiring

Mechanical Ratings:

Mounting Information:

- Panel Mount: #10 Fastener, Torque to 25-30 in-lbs
- Terminal Keys Needed:
  - Line Side 5/16", Load Side Slotted

Thermal Information*:

- Storage Temperature range:
  - -35°C to 125°C (-31°F to 257°F)
- Max. Insulator base temperature: 150°C (302°F) UL RTI
- Flammability rating of insulator base and base plate: UL 94 V-0

* Use outside these ratings needs to be judged in the end-use application.

Materials:

- Connector: High Conductivity Aluminum, Tin-Plated
- Insulator Base: Phenolic
- Terminal Set Screws: Aluminum, Tin-Plated and Steel, Nickel-Plated
- Connector Mounting Screw: Steel, Zinc-Plated

Accessories:

- Clear Protective Plastic Cover. Catalog Number: 1492-PBC2
- Marking Strip: White vinyl strip to mark circuits (Supplied with block)

LISTEN. THINK. SOLVE.®

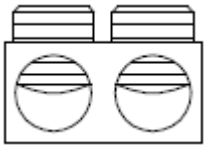
Product Data Sheet

Power Distribution Terminal Blocks
Catalog Number: 1492-PD3263

Short Circuit Current Ratings (Copper Wire Only): Default Rating 10kA if not listed in Table:

Wire Range (kcmil/AWG)		Max Fuse Protection Requirements Amp Rating / Class						SCCR RMS Amps (600V Max)
Line	Load	J	T	RK1	RK5	G	CC	
2/0 – 2	4 – 8	400	400	400	100	60	30	100,000
4 – 6	10 – 14	300	300	200	100	60	30	100,000

Wire Approvals:

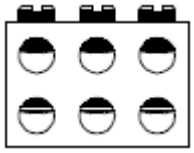


Line Side Wire Approvals:

- Wire Strip Length, Line Side Tap – 11/16”

Wire Size (kcmil/AWG)	Torque (In-lbs)	UL Copper Wire Stranding Classes - Number of Strands						
		Solid	Class B	Class C	Class G	Class H	Class I	Class K
2/0	120		19	37				
1/0	120		19	37				
1	120		19	37	133*	259*	210*	836*
2	120		7	19	49*	133*	161*	665*
4	120		7	19	49*	133*	105*	420*
6	120		7	19	49*	133*	63*	266*
8	40		7	19	49*	133*	41*	168*
10	35	1	7	19			27*	104*
12	35	1	7	19			19*	65*
14	35	1	7	19			19*	41*

Load Side Wire Approvals:



- Wire Strip Length, Load Side Tap: Top Holes – 7/16”, Bottom Holes – 3/4”

Wire Size (kcmil/AWG)	Torque (In-lbs)	UL Copper Wire Stranding Classes - Number of Strands						
		Solid	Class B	Class C	Class G	Class H	Class I	Class K
4	35		7	19				
6	35		7	19	49*	133*	63*	266*
8	35		7	19	49*	133*	41*	168*
10	35	1	(1-2) 7	(1-2) 19			(1-2) 27*	(1-2) 104*
12	35	1	(1-4) 7	(1-4) 19			(1-2) 19*	(1-2) 65*
14	35	1	(1-4) 7	(1-4) 19			(1-2) 19*	(1-2) 41*

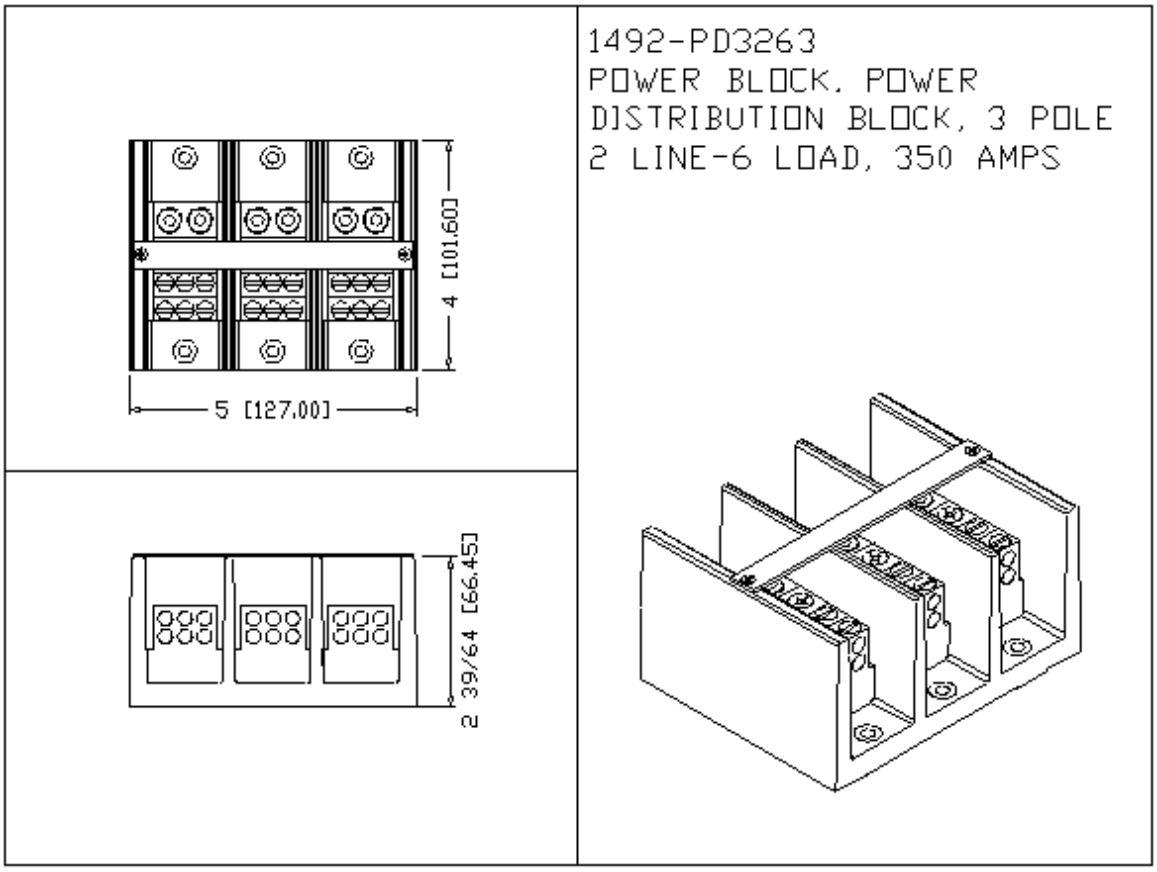
* Quantity of wire stands for classes G, H, I, K may vary by manufacturer

LISTEN.
THINK.
SOLVE.®

Product Data Sheet

Power Distribution Terminal Blocks
Catalog Number: 1492-PD3263

Product Dimensions / Drawings:



Product: 1492-REC20G
Description: 1492 DIN Rail Receptacle



Representative Photo Only
(actual product may vary based on configuration selections)

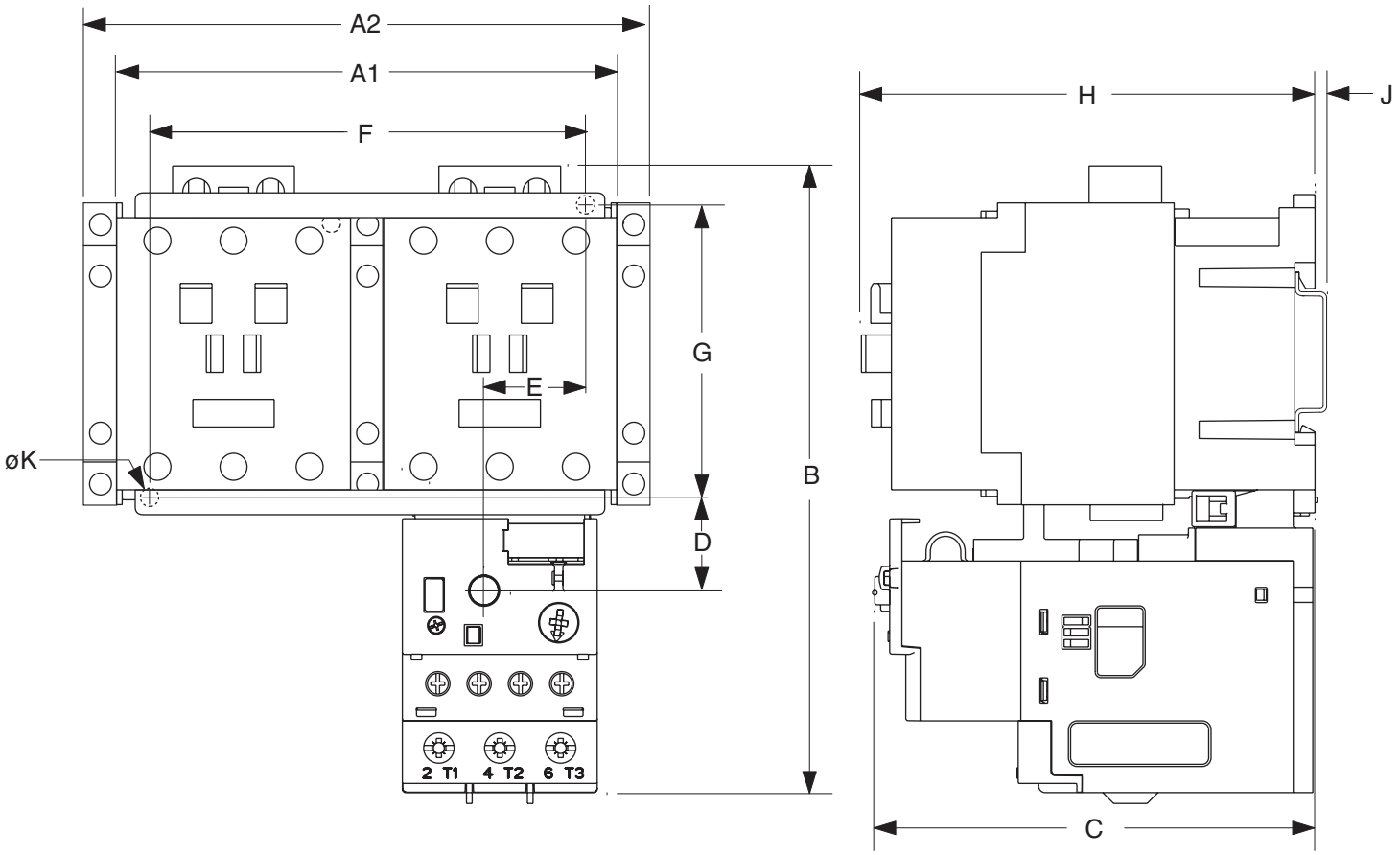
DIN Rail Receptacle

Current Rating	20 Amp
Options	Ground Fault Current Interrupt

Full Voltage Reversing Starter
NEMA Size 0, 1, 2

(Cat 305-AO_, -BO_, -CO_)

WARNING	To prevent electrical shock, disconnect from power source before installing or servicing. Install in suitable enclosure. Keep free from contaminants. (Follow NFPA70E requirements)
AVERTISSEMENT	Avant le montage et la mise en service, couper l'alimentation secteur pour éviter toute décharge. Prévoir une mise en coffret ou armoire appropriée. Protéger le produit contre les environnements agressifs. (Vous devez respecter la norme NFPA70E).
ADVERTENCIA	Desconéctese de la corriente eléctrica, antes de la instalación o del servicio, a fin de impedir sacudidas eléctricas. Instálelo en una caja apropiada. Manténgalo libre de contaminantes. (Cumpla con los requisitos NFPA70E).

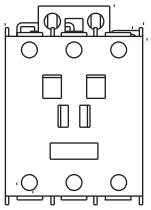


CAT. NO.		A1	A2	B	C	D	E	F	G	H	J	øK
305-AO_	(in)	3.90	- -	5.77	3.35	0.96	0.83	3.54	2.36	3.40	0.08	0.17
	mm	(99)		(147)	(85.2)	(24.5)	(21.1)	(90)	(60)	(86.5)	(2)	(4.5)
305-BO_	(in)	4.61	- -	5.77	3.98	0.96	0.83	3.54	2.36	4.09	0.08	0.17
	mm	(117)		(147)	(101)	(24.5)	(21.1)	(90)	(60)	(104)	(2)	(4.5)
305-CO_	(in)	- -	5.31	5.77	3.98	0.96	1.05	4.25	2.36	4.09	0.08	0.17
	mm		(135)	(147)	(101)	(24.5)	(26.6)	(108)	(60)	(104)	(2)	(4.5)

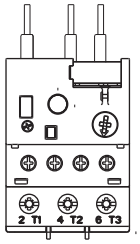
Electronically Controlled DC-Coil Only

NOTICE	(IEC / EN 60947-1) This product has been designed for environment A. Use of this product in environment B may cause unwanted electromagnetic disturbances in which case the user may be required to take adequate mitigation measures.
REMARQUE	(IEC / EN 60947-1) Ce produit on l'utilise dans l'environnement A. L'utilisation de ce produit dans l'environnement B peut créer des perturbations électromagnetiques. En ce cas, l'utilisateur doit prendredes mesures pour diminuer les perturbatione électromagnetiques.
AVISO	(IEC / EN 60947-1) Este producto se puede usar en el ambiente A. El uso en el ambiente B puede causar perturbaciones electromagnéticas. En ese caso de uso, el usuario debe tomar medidas de diminuir las perturbaciones electromagnéticas.

PN-33401
DIR 10000032276 **(Version 00)**
Printed in U.S.A.

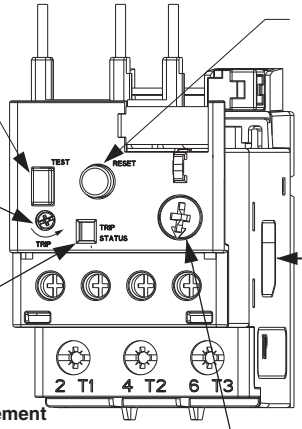


	Main Connections Raccordements Principale Collegamenti Principale		Control Connections Bornes de Commande Morsetti di Commando
	Size 0	Size 1	Size 0, 1 and 2
	#16 - 10 AWG 13 - 22 lb-in	#14 - 4 AWG 22 - 31 lb-in	#16 - 12 AWG 9 - 13 lb-in
	#2		#1
	1 x 6 mm		0.6 x 3.5 mm



	Main Connections Raccordements Principale Collegamenti Principale		Control Connections Bornes de Commande Morsetti di Commando	
	1x	#14 - 6 AWG 18 - 26 lb-in	1x	#24 - 10 AWG 4 - 6 lb-in
	2x	#14 - 6 AWG 24 - 36 lb-in	2x	#24 - 12 AWG 4 - 6 lb-in
	#2		#1	
	1 x 6 mm		0.6 x 3.5 mm	

E1 PLUS Features
Caractéristiques du E1 PLUS
Características del E1 PLUS



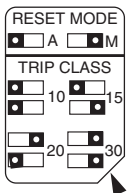
Push to Reset
Enfoncer pour réinitialiser
Presione para reiniciar

Push To Test
Enfoncer pour tester
Presione para probar

Rotate to Manually Trip
Faire pivoter pour déclencher manuellement
Rotar para disparar manualmente

- **Trip Indicator Window**
  Yellow indicator not visible: Not Tripped.
  Yellow indicator visible: Tripped.
- **Fenêtre d'indicateur de déclenchement**
  Indicateur jaune non visible : pas de déclenchement
  Indicateur jaune visible : déclenchement
- **Ventana indicadora de disparo**
  Indicador amarillo no visible: No disparado
  Indicador amarillo visible: Disparado

193*-EE

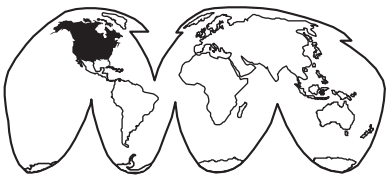


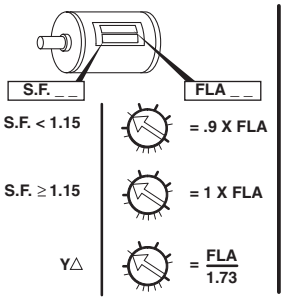
A = Automatic/Manual Reset Mode
A = Mode de réinitialisation automatique/manuel
A = Modo de reinicio automático/manual

M = Manual Reset Mode
M = Mode de réinitialisation manuel
M = Modo de reinicio manual

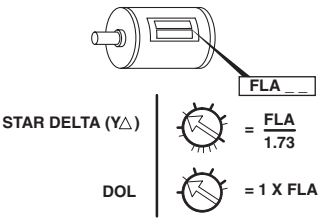
Selectable Trip Class
Classe de déclenchement sélectionnable
Clase de disparo seleccionable

- **To adjust trip current, turn dial until the desired current is aligned with the ▲ pointer. Trip rating is 120% of dial setting.**
- **Pour régler l'intensité de déclenchement, tournez le cadran jusqu'à ce que le pointeur ▲ soit sur l'intensité voulue. La valeur nominale de déclenchement est de 120% du réglage cadran.**
- **Para ajustar la corriente del disparo, gire el dial hasta que la corriente deseada esté alineada con la marca ▲. La capacidad nominal del disparo es el 120% del posicionamiento del dial.**





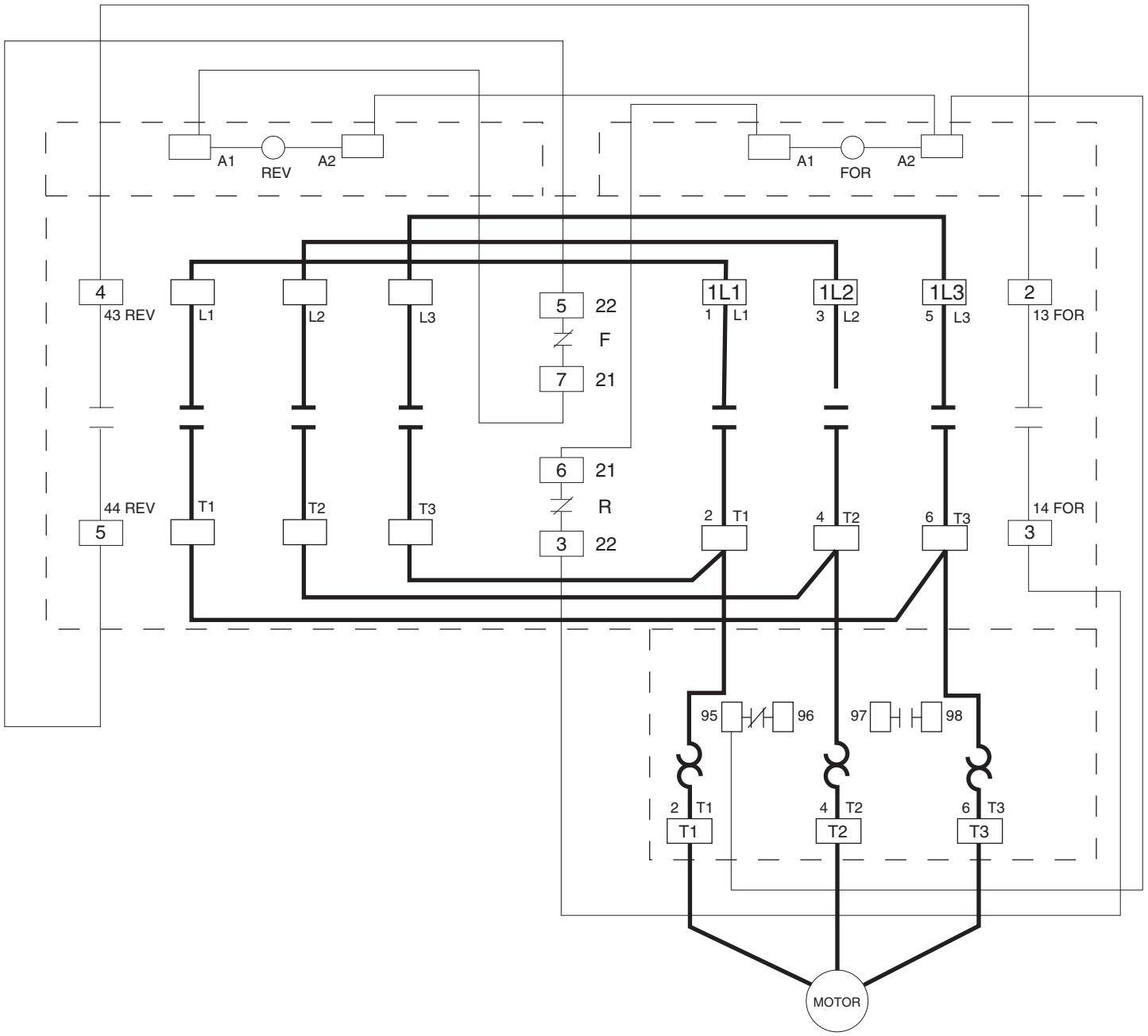




Starter Catalog Number	Standard Fault Ratings Short Circuit Rating	Fuse Rating Class K5 600V Max.	Circuit Breaker Rating	High Fault Ratings Short Circuit Rating	Fuse Rating Class J 600V Max.
305-AO*	5,000 A.	40 A.	40 A. 480 V max.	100,000 A.	40 A.
305-BO*	5,000 A.	100 A.	100 A. 600 V max.	100,000 A.	50 A.
305-CO*	5,000 A.	150 A.	125 A. 600 V max.	100,000 A.	70 A.

Starter Catalog Number	High Fault Ratings Short Circuit Rating	Circuit Breaker Rating 480 V Max.	Short Circuit Rating	Circuit Breaker Rating 600 V Max.
305-BO*	50,000 A.	50 A.	30,000 A.	50 A.
305-CO*	50,000 A.	50 A.	30,000 A.	50 A.

Wiring Diagram
Schéma de câblage
Diagrama de cableado



NOTICE	Additional control circuit overcurrent protection may be required. Refer to the National Electrical Code. The current rating of the control circuit conductors furnished with this device is 15 Amps. Use 75° C copper wire only. Maintain this equipment in accordance with guidelines of NFPA-70B, Electrical Equipment Maintenance. Select the motor branch circuit overcurrent protection in accordance with the National Electrical Code or the Canadian Electrical Code; except, use fuses only. The "REV" - "FOR" contactors are electrically and mechanically interlocked.

Renewal Parts

	AC Coil Voltage	Coil Part No. Size 0	Size 1	Size 2
Coils	24 V 50/ 60 HZ	TA855	TC855	TD855
	110 V / 50 HZ 120 V / 60 HZ	TA473	TC473	TD473
	220 V / 50 HZ 240 V / 60 HZ	TA474	TC474	TD474
	440 V / 50 HZ 480 V / 60 HZ	TA475	TC475	TD475
	550 V / 50 HZ 600 V / 60 HZ	TA476	TC476	TD476
	Current Range	**Catalog No. Size 0**	**Size 1**	**Size 2**
Overload Relays	1.0 - 5.0 Amps	193-EECB		
	5.4 - 27 Amps	193-EEEB		
	5.4 - 27 Amps		193-EEED	
	9 - 45 Amps			193-EEFD
Auxiliary Contact			100-SB10	100-SB10
Reversing Power Wire Kits		105-PW23	105-PW37	105-PW43
Mechanical Interlock		100-MCA02	100-MCA02	100-MCA02

PN-33401
DIR 10000032276 **(Version 00)**
Printed in U.S.A.

Rockwell Automation

CAROL® BRAND

Cord & Cordset Products

FOR INDUSTRIAL, COMMERCIAL AND SPECIALTY APPLICATIONS



General Cable

Cord & Cordset

This catalog contains in-depth information on the most comprehensive line of cord and cordset products. General Cable's flexible cord products are available today for commercial, industrial and specialty applications. Our contractor-grade extension cords, specialty cords, utility lights and accessories provide power for tools and equipment, and temporary lighting on residential, commercial and industrial job sites.

The product and technical sections have been developed with an easy-to-use "spec-on-a-page" format. They feature the latest information on Carol cord and cordset products, from applications and construction to detailed technical and specification data. There's also a user-friendly numerical catalog number index.

Our products are readily available through our network of authorized stocking distributors and distribution centers.

General Cable

All information in this catalog is presented solely as a guide to product selection and is believed to be reliable. All printing errors are subject to correction in subsequent releases of this catalog. Although General Cable has taken precautions to ensure the accuracy of the product specifications at the time of publication, the specifications of all products contained herein are subject to change without notice.

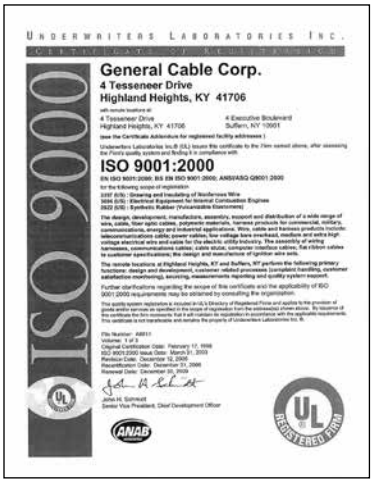
GENERAL CABLE, 17 FREE, CAROL BRAND, CAROLGRENE, CAROLPRENE, FROGHIDE, GENCLEAN, GEN*SPEED* BRAND, LIFETIME PLUS, NEXTGEN BRAND, PLUG-IT, POWR-CENTER, POWR-REEL, PROFLEX, SAFETY ORANGE, SHOCK SAFE, SUPER FLEX, SUPER VU-TRON, TRU-MARK and ULTRA FLEX are trademarks of General Cable Technologies Corporation.

© 2015. General Cable Technologies Corporation.
Highland Heights, KY 41076
All rights reserved. Printed in USA.

Delivering Solutions

THAT KEEP YOU CONNECTED

QUALITY


UNDERWRITERS LABORATORIES INC.
CERTIFICATE OF REGISTRATION

General Cable Corp.
4 Tesseneer Drive
Highland Heights, KY 41706

ISO 9001:2000

ISO 9000

ANAB

UL REGISTERED FIRM

General Cable is committed to developing, producing, and marketing products that exceed performance, quality, value and safety requirements of our customers. General Cable's goal and objectives reflect this commitment, whether it's through our focus on customer service, continuous improvement and manufacturing excellence demonstrated by our TL9000-registered business management system, the independent third-party certification of our products, or the development of new and innovative products. Our aim is to deliver superior performance from all of General Cable's processes and to strive for world-class quality throughout our operations.

INTERNATIONAL ISO 9002 CERTIFICATION

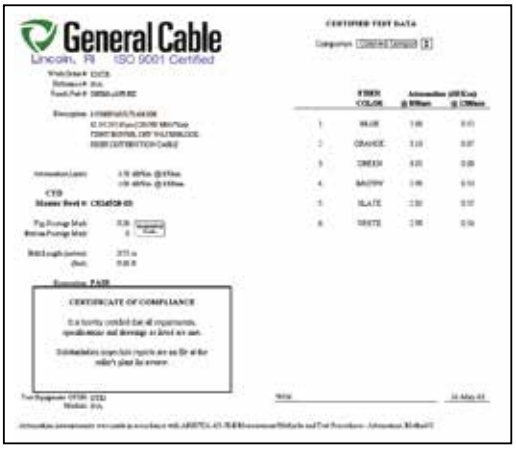
ETL LISTED Intertek

RUS Compliant

EIA TIA/EIA 568B

RoHS Compliant Directive 2002/95/EC

c UL us LISTED


General Cable
Lincoln, RI ISO 9001 Certified

CERTIFICATE OF COMPLIANCE

CUSTOMER SERVICE



General Cable is dedicated to customer service and satisfaction. Call our team of professionally trained sales associates at

800-243-8020

with any questions to meet your application needs.

GENERALCABLE.COM

What's New?

SAY YES TO CLEAN. NO TO GRIME.



General Cable offers its durable rubber cord products with GenClean™, its proprietary new cleanable jacket technology. Cables with the GenClean jacket permit organic remnants to be more readily removed in a wash cycle, which reduces the environmental conditions for microbial growth in industries such as food and beverage. Learn more about GenClean on page 9.

CHARGING FORWARD WITH PORTABLE POWER FOR HYBRID & ELECTRIC VEHICLES



General Cable's line of Carol® Brand CarolGrene™ Ultra Flex® EV Cables supplies charging power for all electric vehicles on the market today and is compatible with commercial and residential charging applications. The CarolGrene EV line, when terminated in accordance with electric vehicle industry standards, is the most comprehensive product offering, with three standard jacket types: CarolGrene EV All-Rubber Jacket, CarolGrene EVE Thermoplastic Elastomer (TPE) Jacket, and CarolGrene EVT Polyvinylchloride (PVC) Jacket. To find out more about these products, please see pages 47-48.

WITH 17 FREE®, LESS MEANS MORE



General Cable now offers Carol® Brand 17 FREE® types SOOW and SJOOW portable cord. The 17 FREE line is completely free of halogens, meaning it contains no chlorine, fluorine, bromine or iodine. The cables in this line are both economically viable and look and install like traditional cable constructions. They may also qualify for LEED credits under the U.S. Green Building Council's program. In addition to these two cord products, which appear on pages 14 and 16, General Cable also offers Gen*SPEED*® Brand Premise, NextGen® Brand Fiber Optic, Carol® Brand Coaxial Cable, and XHHW-2.

GENERAL CABLE IN STOCK AT YOUR SERVICE



General Cable is your ALL IN supplier with in-stock commercial, industrial and residential cables. With over 50 years of experience, General Cable is at your service with industry-leading Carol® Brand wire and cable products. Our people may come to work for us, but on the job, we work for you. Go ALL IN with us and win big with Carol Brand!



YES TO CLEAN. NO TO GRIME.

General Cable proudly brings you GenClean™, its proprietary new cleanable jacket technology developed for rubber portable cord used in the food and beverage industry.

Cables with a GenClean jacket permit organic remnants to be more readily removed in a wash cycle, which reduces the environmental conditions conducive to microbial growth. GenClean's cleanable rubber jacketing has been tested with many solvents and has proven itself in the toughest of environments! And its super tough jacket construction is built to withstand daily abuse, temperature extremes (-50°C to 105°C) and high-stress industrial environments. It is also abrasion-, cut-, heat-, flame-, sunlight- and chemical-resistant.

GenClean™ Jacket

Scan the QR code to learn more about Super Vu-Tron® Supreme featuring the GenClean™ jacket technology

Interested in GenClean?

Call us today at 800.243.8020 and tell us what size and conductor count you're looking for in your rubber cord and we'll produce a test sample for you.

General Cable

www.generalcable.com 1.800.243.8020

PRODUCT SELECTION LOCATOR

SECTION		PAGES
1	Portable Cord Specifications	1-7
2	Rubber Cord	8-22
3	Plastic Cord	23-33
4	Industrial Cord	34-46
5	Specialty Cord	47-55
6	Outdoor Extension Cords	56-61
7	Application-Specific Extension Cords	62-66
8	Plug-it® Extension Cord Accessories	67-69
9	Specialty Extension Cords and Lighting	70-73
10	General Information	74-91
11	Cord Technical Information	92-99
12	Cordset Technical Information	100-106
13	Catalog Number Index	107-109

One Company
Connecting The World



POWERFUL PRESENCE · PRODUCTS PERFORMANCE · PEOPLE

General Cable has been a wire and cable innovator for over 170 years, always dedicated to connecting and powering people's lives. Today, with approximately 14,000 employees and approaching $6 billion in revenues, we are one of the largest wire and cable manufacturers in the world.

Our company serves customers through a network of 38 manufacturing facilities in our core markets and has worldwide sales representation and distribution. We are dedicated to the production of high-quality aluminum, copper and fiber optic wire and cable and systems solutions for the energy, construction, industrial, specialty and communications sectors. With a vast portfolio of products to meet thousands of diverse application requirements, we continue to invest in research and development in order to maintain and extend our technology leadership by developing new materials, designing new products, and creating new solutions to meet tomorrow's market challenges.

In addition to our strong brand recognition and strengths in technology and manufacturing, General Cable is also competitive in such areas as distribution and logistics, marketing, sales and customer service. This combination enables us to better serve our customers globally and as they expand into new geographic markets.

General Cable offers our customers all the strengths and value of a large company, but our people give us the agility and responsiveness of a small one. We service you globally and locally.

General Cable | ONE COMPANY
CONNECTING THE WORLD

Visit our Website at
www.generalcable.com

General Cable

Corporate Social Responsibility

CREATING SHARED VALUE

General Cable believes corporate social responsibility (CSR) is about creating shared value. That means keeping a dual focus in our business decisions: what is good for us as a company and what contributes to the greater good of the communities in which we live and work.



SAFETY

Working safer by working together

General Cable has one worldwide safety vision and goal – ***ZERO & BEYOND***. We measure safety performance globally, share best practices and implement sound health and safety management systems. Many of our facilities worldwide are OHSAS 18001 (safety management system) certified. All North American facilities have implemented an equivalent health and safety management system. General Cable was a pioneer in obtaining the OHSAS 18001 Certificate for Occupational Health and Safety Management Systems in Europe and North Africa.



SUSTAINABILITY

Responsible practices in daily operations

As a global leader in the wire and cable industry, General Cable recognizes its role and responsibility in promoting sustainability. Our strongest business value is continuous improvement in all areas of our company. Across our many businesses, the quest to introduce new and better products through continuous improvement in environmental designs reflects our commitment to achieving industry-leading standards and responding proactively to global environmental issues. General Cable was the first cable manufacturer to obtain certification for its environmental management system, in accordance with the ISO 14001 and EMAS Standards.



CITIZENSHIP

A commitment to being good citizens

Being responsible citizens in our communities is of the utmost importance to us. Unequivocal honesty, integrity, forthrightness and fair dealing have long been part of General Cable's core values and are expected globally in all of our business relationships with our customers, employees, suppliers, neighbors and competitors. Our company leaders and employees strive to make a difference throughout a host of volunteer activities and financial support, improving the communities in which we live and work.



INNOVATION

Technologies that power and connect the world

General Cable is delivering innovation that matters. We are focusing on R&D expertise and investing in developing wire and cable solutions that meet the challenges confronting our customers and the world. In working together and using all the ingenuity and creativity we have, we will reach the goal of being the preeminent supplier of wire and cabling solutions in the industry, with both green constructions and designs for the ever-growing renewable energy market.

A commitment to achieving industry-leading standards
and responding proactively to environmental global issues.

+1.859.572.8000
info@generalcable.com

Visit www.GeneralCableCSR.com
to learn more.

Table of Contents

SECTION		PAGES
1	**Portable Cord Specifications**	**1-7**
	• How to Specify Portable Cord	1
	• Voltage Drop: Picking the Right Cable for the Long Run	2
	• Why Choose Rubber?	3-4
	• Ampacity: Choosing Cable When the Heat Is On	5
	• Index by Wire Type	6
	• Wire And Cable Abbreviations	7
2	**Rubber Cord**	**8-22**
	• Super Vu-Tron® Supreme Types SJOOW/SOOW with GenClean™	9
	• Super Vu-Tron® Supreme Types SJOOW/SOOW	10
	• Super Vu-Tron® III Types SJOOW/SOOW	11
	• Carolprene® Jacketed Types SOOW/SJOOW 90˚C	12
	• Carolprene® Jacketed Type SOOW 90˚C	13
	• Carolprene® with 17 FREE® Jacketed Type SOOW	14
	• Carolprene® Jacketed Type SJOOW	15
	• Carolprene® with 17 FREE® Jacketed Type SJOOW	16
	• Carolprene® Jacketed Type SOOW, Non-UL	17
	• Super Vu-Tron® Type SO	18
	• Type SJ	19
	• Carolprene® Type SVO	20
	• Super Vu-Tron® Multi-Conductor Type SOOW	21-22
3	**Plastic Cord**	**23-33**
	• Carol® Ultra Flex® Types SJEOOW/SEOOW	24-25
	• Types SJTOW and STOW	26
	• Type SVT	27
	• Type SJT 60˚C	28
	• Type SJT 105˚C	29
	• Bus Drop Cable	30
	• Thermostat Wire	31-32
	• Thermostat Wire, Unjacketed	33
4	**Industrial Cord**	**34-46**
	• Super Vu-Tron® Single Conductor Type W and Types RHH/RHW	35
	• Super Vu-Tron® Multi-Conductor Type W Round	36
	• Super Vu-Tron® Type G and Type G-GC Round	37
	• Super Vu-Tron® Canadian Type G-GC Round	38
	• Carol® Double Jacket Drill Cord	39
	• Carolprene® 105°C Welding Cable	40
	• Carolprene® 90°C Welding Cable	41
	• Super Vu-Tron® Welding Cable Types RHH/RHW	42
	• Super Vu-Tron® Entertainment Industry and Stage Lighting Cable	43
	• Super Vu-Tron® Single Conductor Type W Extra Flex	44
	• Diesel Locomotive Cable Types RHH/RHW-2	45
	• Super Vu-Tron® DLO	46
5	**Specialty Cord**	**47-55**
	• CarolGrene™ Ultra Flex® Jacketed Types EVJE, EVE, EVJT and EVT	48
	• CarolGrene™ Ultra Flex® Types EVJ and EV	49
	• Heater Cord Type HPN	50
	• Hook-Up Wire UL Types MTW, TFF, AWM and CSA TEW	51
	• Heavy Wall UL Types MTW, AWM, NEC Type THW and CSA TEW	52
	• Lamp Cord Type SPT	53
	• Low-Voltage Landscape Lighting Wire	54
	• Low-Voltage Sprinkler Wire	55

Table of Contents

SECTION		PAGES
6	**Outdoor Extension Cords**	**56-61**
• FrogHide® Ultra Flex® Extension Cords		57
• Lifetime Plus® Super Flex® Lighted Extension Cords		58
• Safety Orange® Extension Cords		59
• Outdoor Powr-Center® Extension Cords		60
• All Weather Extension Cords		61
• High Visibility All Weather Extension Cords		61
7	**Application-Specific Extension Cords**	**62-66**
• Pro Flex® Rubber Extension Cords		63
• Coiled Power Tool Extension Cords and Power Supply Cords		63
• Power Supply Replacement Cords		63-64, 66
• Range Cords		65
• Dryer Cords		65
• Air Conditioner Replacement Cords		65
• Major Appliance Cords		66
8	**Plug-it® Extension Cord Accessories**	**67-69**
• Plug-it® Fluorescent Utility Light		68
• Plug-it® Powr-Center® Adapter		68
• Powr-Reel™ with 3 Outlets		69
• Plug-it® Ground Fault Circuit Interrupter (GFCI) and Surge Protector Plug		69
9	**Specialty Extension Cords and Lighting**	**70-73**
• Shock Safe® Ground Fault Circuit Interrupter (GFCI) Powr-Center®		71
• Household Powr-Centers®		71
• Plastic Guard Utility Light		72
• Metal Guard Utility Light		72
• Brooder and Heat Lamp		73
• Clamp Light		73
10	**General Information**	**74-91**
• Glossary		75-89
• Unit Conversion Factors		90
• Temperature Conversion Chart		91
11	**Cord Technical Information**	**92-99**
• AWG to Metric Conversion Chart		93
• Common Wire Conductor Stranding		93
• Bend Radius Calculation per ICEA		93
• Class K Copper Stranding		94
• Class M Copper Stranding		95
• Installation — Training and Bending Limitations		96
• Cord Product Coding System		96
• Voltage Drop Calculations		97
• Insulation and Jacket Properties		98
• Government and Military Wire and Cable Specifications		99
12	**Cordset Technical Information**	**100-106**
• Extension Cord Facts		101
• Cordset Product Coding System		102
• Understanding Wire Gauge		103
• How to Select the Right Extension Cord		103
• Ground Fault Circuit Interrupters (GFCI)		104
• NEMA Receptacle and Plug Chart		105-106
13	**Catalog Number Index**	**107-109**

Portable Cord Specifications

1

When specifying and purchasing portable cord products, application details are important and often essential in determining the right product for the right job. Often, the same application can be served using one or more products.

Accurate understanding of the application and the environment where the cable is being used will often point to the product line providing the correct cord products. For those extreme application environments or very specific technical requirements, General Cable's engineering and customer service **Wire Wizards** are eager to assist you. We will help you find the right cable for your needs.

This easy-to-use checklist outlines the key questions you will need to ask to determine the right cable for a particular application:

1. What is the application? (identifies where cable is being used)
   a. Environmental Conditions
   b. Temperature/Humidity (minimum/maximum ranges)
   c. Moisture (will the cable be submerged or exposed to weather, rain, etc.?)
   d. Dirt/Dust
   e. Chemical Exposure (gases, oils, alkalis, acids, cleaning materials)
   f. Critical Service/ Reliability Needs
2. What is the voltage? See **page 2** for additional information regarding **Voltage Drop.**
3. What is the amperage? See **page 3** for additional information regarding **Ampacity.**
4. What is the gauge size?
5. How many conductors are required for the application?
6. What is the stranding? (some applications require higher count stranding for better flexibility)
7. What is the overall length needed? (important in calculating voltage drop)
8. Is any special color-coding of conductors needed?
9. Does this cable need agency approvals (UL, CSA, MSHA, RoHS, etc.)?

Answers to these questions will help you determine the right product for the application. While this information is sufficient for most application requirements, good engineering practices are still essential.

General Cable's customer service and engineering **Wire Wizards** are ready to help you in finding the right cord product for all of your application needs. Our **Wire Wizards** have the skill and knowledge to select and even custom-engineer cord products for your most demanding and challenging applications.

Voltage Drop: Picking the Right Cable for the Long Run

BY SAM FRIEDMAN, DIRECTOR, TECHNICAL SERVICES — CAROL® BRAND CORD PRODUCTS — GENERAL CABLE

Reliability may not be a tangible item that's installed alongside a new furnace or wired into a dock-side crane, but nonetheless, it is an essential "accessory" that can mean the difference between overtime and lost time; in-stock and out-of-stock; perfect fits and refits. Being labeled as "unreliable" can mean ruin for a business, regardless of what you're making, installing or servicing. That's why it is vital to understand simple yet often overlooked problems, like voltage drop, in product applications.

Voltage drop is the reduction in voltage in an electrical circuit between the source and load. For equipment to operate properly, it must be supplied with the right amount of power, which is measured in watts: current (amps) times voltage (volts). Motors, generators, tools — anything that runs on electricity is rated for power, as in a 100-watt light bulb. The correct amount of power enables equipment to meet its designed power rating and operate efficiently. Incorrect or insufficient power amounts can result in inefficient operation, wasteful power usage, and even equipment damage. That is why understanding voltage drop calculations and selecting the correct cable for each application is so important.

The National Electrical Code (NEC) catalogs the requirements for safe electrical installations and represents the primary document for guidance in the United States. Providing direction for both trained professionals and end users, these codes set the foundation for the design and inspection of electrical installations. So how does the Code treat voltage drop issues? For branch circuits, look to NEC (NFPA 70) Section 215.2(A)(3) footnote 2 and Section 210.19(A)(1) footnote 4. Both advise that conductors for feeders to dwelling units should be sized to prevent voltage drop exceeding 3% and maximum total voltage drop on both feeders and branch circuits should not exceed 5% for "reasonable efficiency of operation."

In addition, look to NEC (NFPA 70) Section 647.4 (D) when dealing with sensitive electronic equipment. It states that voltage drop on any branch circuit shall not exceed 1.5% and the combined voltage drop on branch-circuit and feeder conductors shall not exceed 2.5%. It is important to note that much of the equipment manufactured today contains sensitive electronics.

Ampacity, a cable's electric current-carrying capacity, is also connected to voltage drop. The Code stresses the importance of accounting for voltage drop when considering a cable's ampacity rating and the need to satisfy both requirements. NEC Section 310.15 (A)(1) states that ampacity tables do not take voltage drop into consideration.

For DC current, voltage drop is proportional to amount of current flow and wire resistance. In AC circuits, total impedance and power factor (power loss ratio) also need to be considered. Since wire resistance is a factor of wire size, material and length of run, it is important to choose the proper wire size for length of run to keep voltage drop at the desired level.

To simplify your voltage drop calculations, turn to the *Carol Brand Cord & Cordset Catalog* and/or our online resources. Use either the "Voltage Drop Calculations" table on page 84 in the catalog or download a PDF of the catalog by visiting:

www.generalcable.com/GeneralCable/en-US/Products/CordandCordsetProducts/Catalog/

Wherever you find it — in print or online — this table makes calculating project voltage drop straightforward and easy. For example, let's say your project involves a 100-foot run of 12/3 SOOW wire, 12 amps line current for equipment, line circuit of 120 volts AC, 3 phase, 100% power factor. According to the calculation table, the factor is 3190. Next, multiply current times distance (feet) times factor: 12 x 100 x 3190 = 3,828,000. Finally, place a decimal in front of the last six figures, and the result is the volts lost — voltage drop = 3.8 volts (3.2% of overall voltage).

So, to ensure the reliability of your products/installations/service calls, be sure to account for voltage drop when making your cable selections. While it is mainly a nuisance issue, voltage drop can affect equipment efficiency, power consumption and potential damage to sensitive electronics and other systems. Fortunately, these issues are easily avoided, especially when you rely upon the NEC codes and standards that relate to voltage drop — each of which provides useful guidance in ensuring the success of your application.

By selecting a cable with the correct voltage drop characteristics, you will optimize the operation of your connected equipment, increase your efficiencies and prevent equipment damage. And that's a pretty good payoff, in the short term or the long run.

Still need help? Carol's Wire Wizards are ready with first-class customer support, printed catalog materials and detailed product specifications. Please give us a call at 1.800.243.8020, send us an e-mail at info@generalcable.com or visit www.generalcable.com.

General Cable Wire Wizard℠

CAROL® BRAND

General Cable

Portable Power Cords:
Why Choose Rubber?



ADVANTAGES

Thermoset rubber delivers superior performance. Thermoset compounds have been vulcanized by heat and will not soften or distort from their formed shape when exposed to excessive heat or open flame. On the contrary, thermoplastics will deform under high temperatures, resulting in degradation of their physical attributes. Rubber not only exhibits excellent heat-resistant characteristics; it offers other advantages as well.

- Flexibility
- Durability
- Tear Resistance
- Abrasion Resistance
- Melt Resistance
- Oil, Water and Chemical Resistance
- Impact Resistance

APPLICATIONS

Since rubber was first introduced, it has been the product of choice for portable power applications. It is more durable in the harsh conditions encountered in the following environments:

- Mining and Submersible Pumps
- Control Circuits
- Motors and Associated Machinery
- Temporary and Portable Power
- Construction Equipment
- Portable Tools and Equipment
- Portable Appliances

PRODUCT OFFERING

Cable Types: SOOW, SJOOW, SO and SJ
Voltage: 600V and 300V
Gauges: 2 AWG to 18 AWG
Conductors: 1 to 50
Jacket Color: Black (standard) and Yellow
Compliances: UL, CSA, MSHA

Carolprene® **Super Vu-Tron®**

GenClean™ Jacket

CAROL® BRAND

General Cable

Rubber Portable Power Cords

General Cable's Carol® Brand rubber portable cords, which are manufactured in the U.S.A., are an obvious choice for portable power applications. Rubber surpasses plastic compounds in flexibility, high temperature performance, durability and more. This quick reference guide summarizes the key performance differences among the various portable cord compounds available in today's market.

Properties	Thermoplastic PVC	Thermoplastic Elastomer	Thermoset Rubber	Benefits of Thermoset Rubber Products
GenClean™ Jacketing			✓	Permits organic remnants to be more easily removed from a rubber jacket in a wash cycle, which reduces the environmental conditions conducive to microbial growth
Hot Oil Resistance			✓	Thermoset rubber will maintain mechanical integrity in high temperature oil
High Temperature Performance			✓	Thermoset rubber is heat-cured, so it will not melt at high temperatures
Flexibility at Room Temperature		✓	✓	Thermoset rubber and thermoplastic elastomer are more flexible at room temperature than PVC
Flexibility at Low Temperatures			✓	Thermoset rubber will stay more flexible while approaching low temperatures
Industrial Abrasion Resistance			✓	Thermoset rubber products are preferred in industrial applications
Wear Resistance			✓	Field experience has proven thermoset rubber cords to be the most durable products on the market
Electrical Resistance			✓	Thermoset rubber insulation compounds have lower dielectric constants, providing greater dielectric strength than thermoplastic products
Tear Resistance			✓	Thermoset rubber jackets have better tear resistance than thermoplastic jackets
Water Resistance	✓	✓	✓	All three products are designed to meet UL & CSA water resistance requirements for outdoor cords
Sunlight Resistance	✓	✓	✓	All three products are formulated to have UV stability
UL Listing (Indoor & Outdoor) and CSA	✓	✓	✓	Only rubber compounds can be used on SOOW products
MSHA Approval	✓	✓	✓	Thermoset rubber will not deform after exposure to open flame

General Cable

General Cable Wire Wizard℠

CAROL® BRAND

Carol Cord ★ Made in USA

General Cable

Ampacity: Choosing Cable When the Heat Is On

BY SAM FRIEDMAN, DIRECTOR, TECHNICAL SERVICES — CAROL® BRAND CORD PRODUCTS — GENERAL CABLE

Thanks to the dedication and ingenuity of cable engineers around the world, there are cables available for an almost infinite number of applications. Welding cable, extension cords, stage lighting cable, landscape lighting wire, diesel locomotive cable, major appliance cord — you name the energy transmission need, and I'll name the applicable product. Whether your project faces environmental extremes, necessitates considerable flexibility, or simply requires unfailing reliability and longevity, it's essential that your quest for the optimal cable begin with identifying its optimal ampacity.

Ampacity is the maximum current an insulated conductor can safely carry without exceeding its insulation and jacket temperature limitations — or in plain terms, it's a cable's electric current-carrying capacity. Most power cable is sized according to its ampacity, a fact that underscores the importance of first considering amperage needs when selecting portable power cable. By doing so, you'll avoid serious safety hazards, equipment damage and production downtime caused by overcurrent — i.e., too much current flowing through a conductor — which is a significant threat to under-amped cable. Excessive current can cause overheating, insulation damage and fire/shock hazards that, in turn, can harm equipment through heat buildup and produce cable faults that lead to lost productivity. Therefore, it is essential to start every project with the correct cable and then have every installation reviewed and carried out by a trained electrical professional.

There are several systems of codes and standards that can help identify the correct ampacity for your power cable needs. Developed to provide direction for both trained professionals and end users, these codes set the foundation for the design and inspection of electrical installations. First, there is the National Electric Code (NEC or NFPA 70), which catalogs the requirements for safe electrical installations and represents the primary document for guidance in the United States. There are also regulations set forth by the Insulated Cable Engineers Association (ICEA) and the Institute of Electrical and Electronics Engineers (IEEE) — both of which address ampacity standards for power cables. Because there are so many diverse electrical specialties, be sure to select a professional who has expertise in your particular application and its specific code requirements.

For the purpose of this discussion, let's focus on the standards established by the National Electric Code. It's amazing how many sections of the NEC deal with wire, depending on the user's particular application. It is essential for project safety that you study the portion of the code that concentrates on your intended environment and use.

As I mentioned earlier, temperature plays an important role in determining cable ampacity. For purposes of design rating, the ambient temperature is set at the maximum expected ambient temperature. In the NEC, the values in the ampacity tables are based on 30°C ambient. In order to determine ampacities at ambient temperatures other than 30°C, the code has included correction factors for these other temperatures in the ampacity tables in Article 310.

Cable ampacity of a single conductor is calculated based on the size of the electrified conductor, the established ambient temperature and the temperature rating of the insulation and jacket compounds. An increase in temperature rating of the compounds and/or an increase in conductor size will increase cable ampacity. Conversely, an increase in ambient temperature will decrease ampacity.

However, the number of current-carrying conductors found in a cable also affects ampacity. When a group of cables are bunched closely together, the NEC requires a derating of the ampacity for each individual cable. This is because tightly gathered cables can create a significant buildup of heat, which could rise above the rated temperature of the compounds used. This bunching effect also hinders heat dissipation, further increasing the risk of heat-related cable damage. Refer to NEC Table 310.15(B)(2)(a) for specifics about ampacity derating based on number of cables used in cable, conduit or raceway.

It is important to remember that heat degrades most ordinary insulating materials, and this decay directly affects cable ampacity — yet another reason to take current-carrying capacity into account when selecting a cable. By doing so, you confirm that the conductor's insulating material and jacket can handle the heat load caused by electrical current flow and eliminate the possibility of exposing cables to temperatures higher than they are designed to manage.

The NEC also permits ampacities to be calculated. However, this should only be attempted under engineering supervision and when the parameters of the cable and installation are known. Article 310.15(C) provides the method for doing this calculation.

There are some specific cabling applications for which the NEC does not set ampacity guidelines, including mining cable and utility cable. For example, most ampacity ratings for mining cable come from ICEA standard tables, which assume an ambient temperature of 40°C vs. 30°C. Because of its many specialized applications, the ampacity ratings for most power generation and energy transmission/distribution utility cables are specified by use — such as direct-buried cable, suspended cable (e.g., transmission lines) and in-duct cable. These particular installations also require specific engineering calculations that incorporate factors like temperature, wind speeds and sunlight exposure. Understandably, such highly specialized setups require not only unique ampacity guidelines but also engineering supervision and the seasoned judgment of a trained electrical professional.

So, the next time you're in the market for a cable solution, start your search by first establishing the project's ampacity requirements. By doing so, you can avoid dangerous heat buildup, prevent equipment damage and ensure the long-term safety of your cable selection. But don't worry, you don't have to go it alone! The codes and standards established for your particular application can provide invaluable guidance throughout your product search and final installation. If your project falls into one of the specialized setups addressed in a unique code section, please consider having your cable installation carried out under engineering supervision.

Put simply, safety depends on selecting the right cable. By paying attention to the current-carrying capacity of your chosen cable, you'll help maximize the life of your cable and contribute to the well-being of anyone who comes into contact — be it directly or indirectly — with your installation. Now that's a hot idea!

Still need help? Carol's Wire Wizards are ready with first-class customer support, printed catalog materials and detailed product specifications. Please give us a call at 1.800.243.8020, send us an e-mail at info@generalcable.com or visit www.generalcable.com.

General Cable Wire Wizard℠

General Cable

CAROL® BRAND

Index By Wire Type

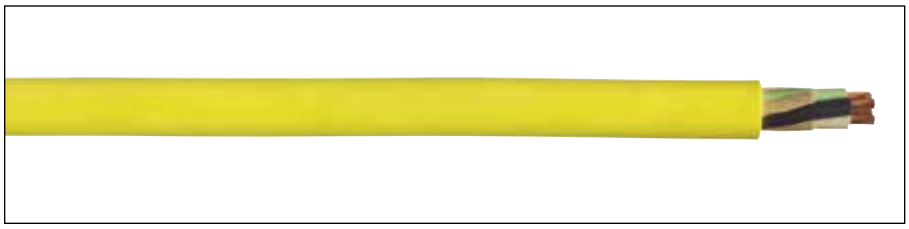
Wire Type	Page
AWM	20, 51-52
BUS DROP CABLE	30
CAROLPRENE®	12-17, 20, 40-41
CL2	31
DLO	46
ENTERTAINMENT CABLE	43
EXTENSION CORDS	57-61, 63-66, 71
G	37
G-GC	37-38
HEATER CORD	50
HOOK-UP WIRE	51
HPN	50
LAMP CORD	53
LOCOMOTIVE CABLE	45-46
LOW VOLTAGE WIRE	54-55
LVT	32
MTW	51-52
PPC	43
REPLACEMENT CORDS	63-66
RHH	35, 42, 45
RHW	35, 42, 45
SC	43
SJ	19, 63-64
SJEOOW	24, 60-61
SJO	69
SJOW	57, 64
SJOOW	9-12, 15-16, 64
SJT	28-29, 63-64, 71-72
SJTOW	26
SJTW	58-60, 71, 73
SO	18
SOOW	9-14, 17, 21-22
SPT	53
SPT-1	53, 66
SPT-2	53, 73
SPT-3	65-66, 71
SRDT	65
ST	64
STAGE LIGHTING CABLE	43
STOW	26
STW	60
SUPER VU-TRON®	9-11, 18, 21-22, 35-38, 42-44, 46
SVO	20
SVT	27
TEW	51-52
TFF	51
THERMOSTAT WIRE	31-33
THW	52
TYPE G	37
TYPE G-GC	37-38
TYPE W	35-36, 44
WELDING CABLE	40-42

Wire and Cable Abbreviations

E	Thermoplastic Elastomer (TPE)
J	Junior (300 V)
O	Oil-Resistant
P	Parallel
S	Service (600 V)
T	Thermoplastic/Vinyl
W	Weather Approved (water-, moisture-, damp-, sunlight-resistant)

EPDM	Ethylene-propylene-diene monomer rubber.
HPN	Two-conductor, neoprene-insulated heater cord. Parallel construction. For use in high temperature locations.
S	Extra-hard-usage, rubber-insulated portable cord. Stranded copper conductors with separator and individual rubber insulation. Two or more color-coded conductors cabled with filler, wrapped with separator and rubber jacketed overall. 600 V.
SJ	Hard-usage, rubber-insulated pendant or portable cord. Same construction as Type S, but 300 V. Jacket thickness different.
SJEOW	Hard-usage thermoplastic or rubber-insulated conductors and oil-resistant thermoplastic outer jacket. All-elastomer construction. 300 V, 90˚C to 105˚C. Weather-resistant. Meets UL specifications.
SJEW	Hard-usage thermoplastic or rubber-insulated conductors and overall thermoplastic jacket. All elastomer construction. 300 V, 90˚C to 105˚C. Weather-resistant. Meets UL specifications.
SJO	Same as SJ, but Carolprene®, oil-resistant compound outer jacket. Can also be made water-resistant. 300 V, 60˚C.
SJOO	Same as SJO but inner conductor insulation as well as the outer jacket is oil-resistant.
SJOOW	Same as SJOO but also water- and weather-resistant.
SJT	Hard-usage thermoplastic or rubber-insulated conductors with overall thermoplastic jacket. 300 V, 60˚C to 105˚C.
SJTO	Same as SJT, but oil-resistant thermoplastic outer jacket. 60˚C.
SJTW	Extra-hard-usage thermoplastic conductors and overall thermoplastic jacket. 300 V, 60˚C to 105˚C. Weather-resistant for outdoor use.
SO	Extra-hard-usage cord, same construction as Type S, except oil-resistant Carolprene® jacket. 600 V, 60˚C to 90˚C.
SOO	Same as SO, but inner conductor insulation as well as the outer jacket is oil-resistant.
SOOW	Same as SOO, but also weather-, water- and sunlight-(UV) resistant.
SP-1	All-rubber, parallel-jacketed, two-conductor light-duty cord for pendant or portable use in damp locations. 300 V.
SP-2	Same as SP-1, but heavier construction, with or without third conductor for grounding purposes. 300 V.
SPT-1	Same as SP-1, except all-thermoplastic. 300 V. With or without third conductor for grounding.
SPT-2	Same as SP-2, except all-thermoplastic. 300 V. With or without third conductor for grounding.
SPT-3	Same as SP-3, except all-thermoplastic. 300 V. With or without third conductor for grounding.
SRD	Portable range or dryer cable. Three or four rubber-insulated conductors with rubber or neoprene jacket, flat or round construction. 300 V, 60°C rated.
SRDT	Same as SRD, except all-thermoplastic with a maximum temperature of 90˚C.
ST	Extra-hard-usage cord, jacketed, same as Type S except all-plastic construction. 600 V, 60˚C to 105˚C.
STO	Same as ST, but with oil-resistant thermoplastic outer jacket. 600 V, 60˚C.
STW	Extra-hard-usage cord, jacketed. 600 V, 60˚C to 105˚C. Weather- and water-resistant for outdoor use.
SV	Vacuum cleaner cord, two- or three-conductor, rubber insulated. Overall rubber jacket. For light-duty in damp locations. 300 V, 60˚C.
SVO	Same as SV, except oil-resistant Carolprene® jacket. 300 V, 60˚C.
SVT	Same as SV, except all-plastic construction. With or without third conductor for grounding purposes only. 300 V, 60˚C to 90˚C.
XLPE	Crosslinked polyethylene.

Rubber Cord 2



Thermoset rubber cord products have evolved over the last 50 years from simple and unsophisticated to a product line where specialized, technologically advanced products are in demand for exacting commercial and industrial applications.

No longer are rubber cord products used only in applications where flexibility is needed; today typical applications require cord to perform well in environments of extreme heat and cold and on job sites and factory floors where resistance to oil, chemicals and abrasion is mandatory.

General Cable's role, as the producer of the premiere Carol® Brand rubber cord products, is to ensure that new product development, product innovation and quality not only keep pace with industry requirements but also set the trends.

Our rubber cord products carry a full range of listings and certifications with Underwriters Laboratories, Inc. and the Canadian Standard Association. In addition, many products meet or exceed the requirements of OSHA, MSHA and other relevant industry standards.

Carol Brand is simply the most accepted in the industry, having proven itself on the job time after time. Our rubber cord line is the most comprehensive in the industry, ensuring that the proper Carol product can always be specified.

Index **Page**

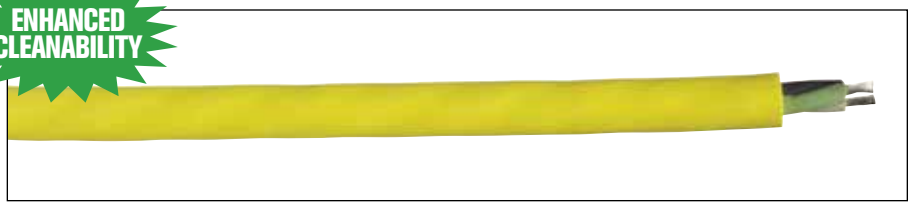
Super Vu-Tron® Supreme Types SJOOW/SOOW with GenClean™	9
Super Vu-Tron® Supreme Types SJOOW/SOOW	10
Super Vu-Tron® III Types SJOOW/SOOW	11
Carolprene® Jacketed Types SOOW/SJOOW	12
Carolprene® Jacketed Type SOOW	13
Carolprene® with 17 FREE® Jacketed Type SOOW	14
Carolprene® Jacketed Type SJOOW	15
Carolprene® with 17 FREE® Jacketed Type SJOOW	16
Carolprene® Jacketed Type SOOW, Non-UL	17
Super Vu-Tron® Type SO	18
Type SJ	19
Carolprene® Type SVO	20
Super Vu-Tron® Multi-Conductor Type SOOW	21-22

Super Vu-Tron® Supreme Types SJOOW/SOOW with GenClean™

105°C, 300 and 600 Volt, UL/CSA Portable Cord

Featuring GenClean™ Jacket

ENHANCED CLEANABILITY



Product Construction:

Conductors:
- 18 through 10 AWG fully annealed stranded tinned copper

Insulation:
- Premium-grade, color-coded, oil-resistant 105°C EPDM
- Color code: See chart below

Jacket:
- Super Vu-Tron® Supreme, yellow, with GenClean™ technology
- Temperature range: –50°C to +105°C UL/CSA
- Voltage rating: 300 volts Type SJOOW 600 volts Type SOOW

Jacket Marking:
- SUPER VU-TRON® SUPREME SJOOW - CAROL SUPER VU-TRON® SUPREME FEATURING GENCLEAN™ JACKET (SIZE) (mm^2) 105°C (UL) WATER RESISTANT SJOOW CSA (-50°C) FT1 --- P-07-KA120015-MSHA 300 VOLT ROHS MADE IN USA
- SUPER VU-TRON® SUPREME SOOW - CAROL SUPER VU-TRON® SUPREME FEATURING GENCLEAN™ JACKET (SIZE) (mm^2) 105°C (UL) WATER RESISTANT SOOW CSA (-50°C) FT1 --- P-07-KA120015-MSHA 600 VOLT ROHS MADE IN USA

Target Applications/Markets:
- Food/beverage manufacturing
- Marine manufacturing
- Manufactured structures
- Severe environments
- Dockside power
- Health care

Features:
- Cleanable rubber jacket
- Excellent flexibility in cold temperatures
- Lasts longer in flex applications (extra-flexible Class M stranding)
- Integral Flexfill®
- Enhanced cleanability
- Reduced scuffing
- Ozone-, sunlight (UV)- and weather-resistant
- UL Listed and CSA Certified for indoor and outdoor use
- Water-resistant*
- Safety-colored, with high-visibility yellow jacket
- High heat and flame resistance
- Resistant to sunlight, oils, acids and chemicals
- Excellent abrasion and cut resistance
- Tinned copper conductors — corrosion/oxidation-resistant

Industry Approvals:
- UL Flexible Cord - UL 62
- CSA Flexible Cord - C22.2-49
- MSHA Approved
- OSHA Acceptable
- RoHS Compliant

Packaging:
- 250' (76.2 m), 500' (152.4 m), 1000' (304.8 m)
- Other put-ups available on special order

*Suitable for immersion in water if properly sealed and terminated.

TYPE SJOOW – 300 VOLT – UL/CSA

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	STRAND O.D.	NOM. INS. THICKNESS		JACKET NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M'(S)	COPPER WT. LBS/M'	STD. CTN.
					INCHES	mm	INCHES	mm				
GC601	2	18	41/34	.048"	0.030	0.76	0.310	7.87	10	56	10	1000'
GC602	3	18	41/34	.048"	0.030	0.76	0.320	8.13	10	66	15	1000'
GC603	4	18	41/34	.048"	0.030	0.76	0.345	8.76	7	79	21	250'
GC604	2	16	65/34	.057"	0.030	0.76	0.315	8.00	13	62	16	1000'
GC605	3	16	65/34	.057"	0.030	0.76	0.335	8.51	13	77	24	250'
GC606	4	16	65/34	.057"	0.030	0.76	0.370	9.40	10	98	32	250'
GC607	2	14	105/34	.077"	0.030	0.76	0.370	9.40	18	75	24	250'
GC608	3	14	105/34	.077"	0.030	0.76	0.375	9.53	18	99	36	250'
GC609	4	14	105/34	.077"	0.030	0.76	0.405	10.29	15	122	48	250'

TYPE SOOW – 600 VOLT – UL/CSA

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOM. INS. THICKNESS		JACKET NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M'(S)	COPPER WT. LBS/M'	STD. CTN.
				INCHES	mm	INCHES	mm				
GC631*	2	18	41/34	0.030	0.76	0.365	9.27	10	75	10	250'
GC632	3	18	41/34	0.030	0.76	0.375	9.53	10	84	15	250'
GC633*	4	18	41/34	0.030	0.76	0.400	10.16	7	110	21	250'
GC634	2	16	65/34	0.030	0.76	0.370	9.40	13	80	16	250'
GC635	3	16	65/34	0.030	0.76	0.395	10.03	13	96	24	250'
GC636	4	16	65/34	0.030	0.76	0.425	10.80	10	118	32	250'
GC621	5	16	65/34	0.030	0.76	0.515	13.08	8	166	40	250'
GC637*	2	14	105/34	0.045	1.14	0.510	12.95	18	153	24	250'
GC638	3	14	105/34	0.045	1.14	0.525	13.34	18	164	36	250'
GC639	4	14	105/34	0.045	1.14	0.575	14.61	15	204	48	250'
GC622*	5	14	105/34	0.045	1.14	0.675	17.15	12	279	60	250'
GC641*	2	12	168/34	0.045	1.14	0.590	14.99	25	198	38	250'
GC642	3	12	168/34	0.045	1.14	0.600	15.24	25	224	57	250'
GC643	4	12	168/34	0.045	1.14	0.650	16.51	20	270	76	250'
GC623*	5	12	168/34	0.045	1.14	0.730	18.54	16	308	96	250'
GC645	3	10	259/34	0.045	1.14	0.660	16.76	30	295	99	250'
GC646	4	10	259/34	0.045	1.14	0.710	18.03	25	365	132	250'
GC624*	5	10	259/34	0.045	1.14	0.770	19.56	20	422	168	250'

* Non-stock item; minimum quantity purchase required.
† Green conductor for grounding only. Ampacities based on NEC Table 400.5(A)(1).
(S)Actual shipping weight may vary.

TOP PERFORMANCE IN THE TOUGHEST ENVIRONMENTS

Volume change (%) of SUPER VU-TRON® SUPREME after 28 days at room temperature in the following materials			
ACETIC ACID (30%)	+19.00	LINSEED OIL	+1.04
AMMONIA HYDROXIDE	+3.12	LUBE OIL	-1.82
ASTM 3 OIL	+0.26	MILK	+4.16
BEER	+4.42	NITRIC ACID (10%)	+7.29
BLEACH WATER	+2.60	SAE 30 OIL	-1.30
BUTYL ALCOHOL	-1.82	SKYDROL 500	+17.10
CORN OIL	0.00	SODIUM HYDROXIDE	+10.90
FORMALDEHYDE	+3.38	SULFURIC ACID (10%)	+2.34
GLYCOL (ANTI-FREEZE)	-2.60	TOLUENE	+30.20
HYDROCHLORIC ACID (20%)	+10.60	UNLEADED GAS	+22.10
JP-4	+10.90	WATER	+2.86
KEROSENE	+10.60		

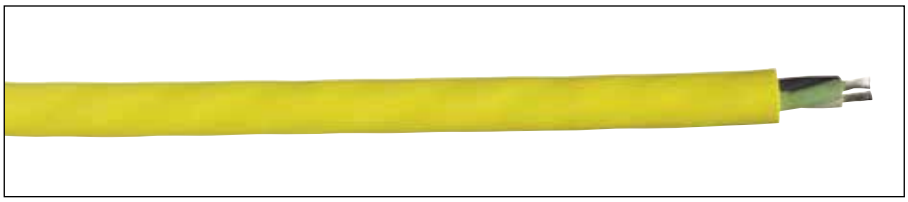
COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
2	Black, White
3	Black, White, Green/Yellow
4	Black, White, Red, Green/Yellow
5	Black, White, Red, Green/Yellow, Orange

General Cable · Made in U.S.A. · RoHS Compliant Directive 2011/65/EU · MSHA Mine Safety and Health Administration · OSHA Acceptable Occupational Safety and Health Administration · CSA Certified Canadian Standard Association · UL LISTED · CAROL BRAND

Super Vu-Tron® Supreme Types SJOOW/SOOW

105°C, 300 and 600 Volt, UL/CSA Portable Cord



TYPE SJOOW – 300 VOLT – UL/CSA

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	STRAND O.D.	NOM. INS. THICKNESS		JACKET NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M'(S)	COPPER WT. LBS/M'	STD. CTN.
					INCHES	mm	INCHES	mm				
02601	2	18	41/34	.048"	0.030	0.76	0.310	7.87	10	56	10	1000'
02602	3	18	41/34	.048"	0.030	0.76	0.320	8.13	10	66	15	1000'
02603	4	18	41/34	.048"	0.030	0.76	0.345	8.76	7	79	20	250'
02604	2	16	65/34	.057"	0.030	0.76	0.315	8.00	13	62	16	1000'
02605	3	16	65/34	.057"	0.030	0.76	0.335	8.51	13	77	24	250'
02606	4	16	65/34	.057"	0.030	0.76	0.370	9.40	10	98	32	250'
02607	2	14	105/34	.077"	0.030	0.76	0.370	9.40	18	75	24	250'
02608	3	14	105/34	.077"	0.030	0.76	0.375	9.53	18	99	36	250'
02609	4	14	105/34	.077"	0.030	0.76	0.405	10.29	15	122	48	250'

TYPE SOOW – 600 VOLT – UL/CSA

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOM. INS. THICKNESS		JACKET NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M'(S)	COPPER WT. LBS/M'	STD. CTN.
				INCHES	mm	INCHES	mm				
02631*	2	18	41/34	0.030	0.76	0.365	9.27	10	75	10	250'
02632	3	18	41/34	0.030	0.76	0.375	9.53	10	84	15	250'
02633*	4	18	41/34	0.030	0.76	0.400	10.16	7	110	21	250'
02634	2	16	65/34	0.030	0.76	0.370	9.40	13	80	16	250'
02635	3	16	65/34	0.030	0.76	0.395	10.03	13	96	24	250'
02636	4	16	65/34	0.030	0.76	0.425	10.80	10	118	32	250'
02621	5	16	65/34	0.030	0.76	0.515	13.08	8	166	40	250'
02637*	2	14	105/34	0.045	1.14	0.510	12.95	18	153	24	250'
02638	3	14	105/34	0.045	1.14	0.525	13.34	18	164	36	250'
02639	4	14	105/34	0.045	1.14	0.575	14.61	15	204	48	250'
02622*	5	14	105/34	0.045	1.14	0.675	17.15	12	279	60	250'
02641*	2	12	168/34	0.045	1.14	0.590	14.99	25	198	38	250'
02642	3	12	168/34	0.045	1.14	0.600	15.24	25	224	57	250'
02643	4	12	168/34	0.045	1.14	0.650	16.51	20	270	76	250'
02623*	5	12	168/34	0.045	1.14	0.730	18.54	16	308	96	250'
02645	3	10	259/34	0.045	1.14	0.660	16.76	30	295	99	250'
02646	4	10	259/34	0.045	1.14	0.710	18.03	25	365	132	250'
02624*	5	10	259/34	0.045	1.14	0.770	19.56	20	422	168	250'

* Non-stock item; minimum quantity purchase required.
† Green conductor for grounding only. Ampacities based on NEC Table 400.5(A)(1).
(S)Actual shipping weight may vary.

TOP PERFORMANCE IN THE TOUGHEST ENVIRONMENTS

Volume change (%) of SUPER VU-TRON® SUPREME after 28 days at room temperature in the following materials			
ACETIC ACID (30%)	+19.00	LINSEED OIL	+1.04
AMMONIA HYDROXIDE	+3.12	LUBE OIL	-1.82
ASTM 3 OIL	+0.26	MILK	+4.16
BEER	+4.42	NITRIC ACID (10%)	+7.29
BLEACH WATER	+2.60	SAE 30 OIL	-1.30
BUTYL ALCOHOL	-1.82	SKYDROL 500	+17.10
CORN OIL	0.00	SODIUM HYDROXIDE	+10.90
FORMALDEHYDE	+3.38	SULFURIC ACID (10%)	+2.34
GLYCOL (ANTI-FREEZE)	-2.60	TOLUENE	+30.20
HYDROCHLORIC ACID (20%)	+10.60	UNLEADED GAS	+22.10
JP-4	+10.90	WATER	+2.86
KEROSENE	+10.60		

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
2	Black, White
3	Black, White, Green/Yellow
4	Black, White, Red, Green/Yellow
5	Black, White, Red, Green/Yellow, Orange

Product Construction:

Conductors:
- 18 through 10 AWG fully annealed stranded tinned copper

Insulation:
- Premium-grade, color-coded, oil-resistant 105°C EPDM
- Color code: See chart below

Jacket:
- Super Vu-Tron® Supreme, yellow
- Temperature range: –50°C to +105°C UL/CSA
- Voltage rating: 300 volts Type SJOOW 600 volts Type SOOW

Jacket Marking:
- SUPER VU-TRON® SUPREME SJOOW - CAROL SUPER VU-TRON® SUPREME (SIZE) (mm^2) 105°C (UL) WATER RESISTANT SJOOW CSA (-50°C) FT1 --- P-07-KA120015-MSHA 300 VOLT ROHS MADE IN USA (TRU-MARK SEQUENTIAL FOOTAGE)
- SUPER VU-TRON® SUPREME SOOW - CAROL SUPER VU-TRON® SUPREME (SIZE) (mm^2) 105°C (UL) WATER RESISTANT SOOW CSA (-50°C) FT1 --- P-07-KA120015-MSHA 600 VOLT ROHS MADE IN USA (TRU-MARK SEQUENTIAL FOOTAGE)

Applications:
- Machine tools
- Power tools
- Dockside power applications
- Motor leads
- Portable machinery
- Cranes
- Submersible pumps
- Where water immersion is required
- Severe environment OEM/MRO applications

Features:
- Excellent flexibility in cold temperatures
- Lasts longer in flex applications (extra-flexible Class M stranding)
- Integral Flexfill®
- Ozone-, sunlight (UV)- and weather-resistant
- UL Listed and CSA Certified for indoor and outdoor use
- Water-resistant*
- Safety-colored, with high-visibility yellow jacket
- High heat and flame resistance
- Resistant to sunlight, oils, acids and chemicals
- Excellent abrasion and cut resistance
- TRU-Mark® sequential footage marking
- Tinned copper conductors — corrosion/oxidation-resistant

Industry Approvals:
- UL Flexible Cord - UL 62
- CSA Flexible Cord - C22.2-49
- MSHA Approved
- OSHA Acceptable
- RoHS Compliant

Packaging:
- 250' (76.2 m), 500' (152.4 m), 1000' (304.8 m)
- Other put-ups available on special order

*Suitable for immersion in water if properly sealed and terminated.

CAROL BRAND · UL LISTED · CSA Certified Canadian Standard Association · OSHA Acceptable Occupational Safety and Health Administration · MSHA Mine Safety and Health Administration · RoHS Compliant Directive 2011/65/EU · Made in U.S.A. · General Cable

Super Vu-Tron® III Types SJOOW/SOOW

105°C, 300 and 600 Volt, UL/CSA Portable Cord

Product Construction:

Conductors:
- 18 through 10 AWG fully annealed stranded bare copper

Insulation:
- Premium-grade, color-coded, oil-resistant 105°C EPDM
- Color code: See chart below

Jacket:
- Super Vu-Tron® III, yellow
- Temperature range: –50°C to +105°C UL/CSA
- Voltage rating: 300 volts Type SJOOW 600 volts Type SOOW

Jacket Marking:
- SUPER VU-TRON® III SJOOW - CAROL SUPER VU-TRON® III (SIZE) (mm^2) 105°C (UL) WATER RESISTANT SJOOW CSA (-50°C) FT1 --- P-07-KA120015-MSHA 300 VOLT ROHS MADE IN USA (TRU-MARK SEQUENTIAL FOOTAGE)
- SUPER VU-TRON® III SOOW - CAROL SUPER VU-TRON® III (SIZE) (mm^2) 105°C (UL) WATER RESISTANT SOOW CSA (-50°C) FT1 --- P-07-KA120015-MSHA 600 VOLT ROHS MADE IN USA (TRU-MARK SEQUENTIAL FOOTAGE)

Applications:
- Machine tools
- Power tools
- Dockside power applications
- Motor leads
- Portable machinery
- Cranes
- Submersible pumps

Features:
- Excellent flexibility in cold temperatures
- Last longer in flex applications
- Integral Flexfill®
- Ozone-, sunlight (UV)- and weather-resistant
- UL Listed and CSA Certified for indoor and outdoor use
- Water-resistant*
- Safety-colored
- High heat and flame resistance
- Resistant to oils, acids and chemicals
- Excellent abrasion and cut resistance
- TRU-Mark® sequential footage marking

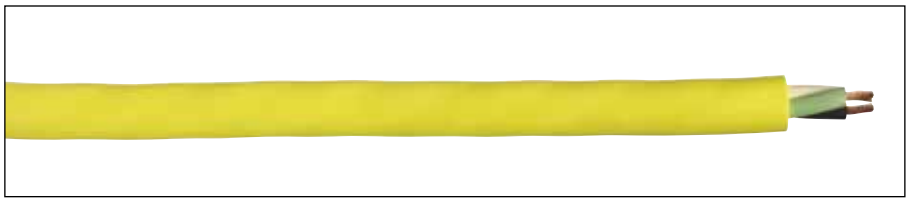
Industry Approvals:
- UL Flexible Cord - UL 62
- CSA Flexible Cord - C22.2-49
- MSHA Approved
- RoHS Compliant

Packaging:
- 250' (76.2 m), 500' (152.4 m), 1000' (304.8 m)
- Other put-ups available on special order

*Suitable for immersion in water if properly sealed and terminated.

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
2	Black, White
3	Black, White, Green
4	Black, White, Red, Green
5	Black, White, Red, Green, Orange



TYPE SJOOW – 300 VOLT – UL/CSA

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M1(S)	STD. CTN.
				INCHES	mm	INCHES	mm			
02001*	2	18	41/34	0.030	0.76	0.310	8.00	10	56	1000'
02002*	3	18	41/34	0.030	0.76	0.320	8.12	10	65	1000'
02003*	4	18	41/34	0.030	0.76	0.345	8.76	7	80	250'
02004*	2	16	65/34	0.030	0.76	0.315	8.00	13	68	1000'
02005*	3	16	65/34	0.030	0.76	0.335	8.51	13	80	250'
02006*	4	16	65/34	0.030	0.76	0.370	9.40	10	95	250'
02007*	2	14	41/30	0.030	0.76	0.370	9.40	18	90	250'
02008*	3	14	41/30	0.030	0.76	0.375	9.52	18	110	250'
02009*	4	14	41/30	0.030	0.76	0.405	10.29	15	130	250'

TYPE SOOW – 600 VOLT – UL/CSA

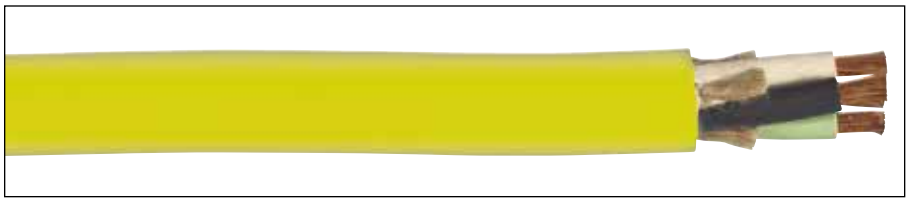
CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M1(S)	STD. CTN.
				INCHES	mm	INCHES	mm			
02031*	2	18	41/34	0.030	0.76	0.365	9.27	10	75	250'
02032*	3	18	41/34	0.030	0.76	0.375	9.53	10	80	250'
02033*	4	18	41/34	0.030	0.76	0.400	10.16	7	110	250'
02034*	2	16	65/34	0.030	0.76	0.370	9.40	13	75	250'
02035*	3	16	65/34	0.030	0.76	0.395	10.80	13	100	250'
02036*	4	16	65/34	0.030	0.76	0.425	10.80	10	120	250'
02021*	5	16	65/34	0.030	0.76	0.515	13.08	8	150	250'
02037*	2	14	41/30	0.045	1.14	0.510	12.95	18	155	250'
02038*	3	14	41/30	0.045	1.14	0.525	13.34	18	165	250'
02039*	4	14	41/30	0.045	1.14	0.575	14.61	15	215	250'
02022*	5	14	41/30	0.045	1.14	0.675	17.15	12	285	250'
02041*	2	12	65/30	0.045	1.14	0.590	14.99	25	200	250'
02042*	3	12	65/30	0.045	1.14	0.600	15.24	25	250	250'
02043*	4	12	65/30	0.045	1.14	0.650	16.51	20	280	250'
02023*	5	12	65/30	0.045	1.14	0.730	18.54	16	315	250'
02045*	3	10	104/30	0.045	1.14	0.660	16.76	30	320	250'
02046*	4	10	104/30	0.045	1.14	0.710	18.03	25	375	250'
02024*	5	10	104/30	0.045	1.14	0.770	19.56	20	432	250'

* Non-stock item available by special order; minimum quantity purchase required.
† Green conductor for grounding only. Ampacities based on NEC Table 400.5(A)(1).
(S)Actual shipping weight may vary.

General Cable Made in U.S.A. RoHS Compliant Directive 2011/65/EU MSHA Mine Safety and Health Administration OSHA Acceptable Occupational Safety and Health Administration Certified Canadian Standard Association UL LISTED CAROL BRAND

Carolprene® Jacketed Types SOOW/SJOOW

90°C, 300 and 600 Volt, UL/CSA Portable Cord



YELLOW HIGH-VISIBILITY – TYPE SJOOW – 300 VOLT – 90°C – UL/CSA

CATALOG NUMBER	NO. OF COND	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M'(S)	STD. CTN.
				INCHES	mm	INCHES	mm			
01411	3	18	16/30	0.030	0.76	0.305	7.75	10	63	1000'
01444	4	18	16/30	0.030	0.76	0.330	8.38	7	76	250'
01442	3	16	26/30	0.030	0.76	0.330	8.38	13	76	250'
01443	4	16	26/30	0.030	0.76	0.365	9.27	10	95	250'
01460	3	14	41/30	0.030	0.76	0.370	9.40	18	106	250'
01464	4	14	41/30	0.030	0.76	0.410	10.41	15	121	250'
01480	3	12	65/30	0.030	0.76	0.430	10.92	25	146	250'
01481	4	12	65/30	0.030	0.76	0.475	12.07	20	185	250'
01483	3	10	104/30	0.045	1.14	0.580	14.73	30	242	250'
01484	4	10	104/30	0.045	1.14	0.655	16.64	25	304	250'

YELLOW HIGH-VISIBILITY – TYPE SOOW – 600 VOLT – 90°C – UL/CSA

CATALOG NUMBER	NO. OF COND	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M'(S)	STD. CTN.
				INCHES	mm	INCHES	mm			
02469	3	18	16/30	0.030	0.76	0.365	9.27	10	84	250'
02470	4	18	16/30	0.030	0.76	0.390	9.91	7	101	250'
02465	3	16	26/30	0.030	0.76	0.390	9.91	13	103	250'
02466	4	16	26/30	0.030	0.76	0.420	10.67	10	119	250'
02462	3	14	41/30	0.045	1.14	0.535	13.59	18	172	250'
02468	4	14	41/30	0.045	1.14	0.575	14.61	15	208	250'
02425	3	12	65/30	0.045	1.14	0.595	15.11	25	229	250'
02426	4	12	65/30	0.045	1.14	0.650	16.51	20	280	250'
02428	3	10	104/30	0.045	1.14	0.660	16.76	30	295	250'
02427	4	10	104/30	0.045	1.14	0.715	18.16	25	353	250'

Cord furnished with UL and CSA labels.
† Green conductor for grounding only. Ampacities based on NEC Table 400.5(A)(1).
(S)Actual shipping weight may vary.

Product Construction:

Conductors:
- 18 through 10 AWG fully annealed stranded bare copper

Insulation:
- Premium-grade, color-coded 90°C EPDM
- Color code: See chart below

Jacket:
- Yellow Carolprene®
- Temperature range: -40°C to +90°C

Jacket Marking:
- CAROL (SIZE) (mm^2) 90°C (UL) WATER RESISTANT SJOOW CSA (-40°C) FT2 P-7K-123033 MSHA 300 VOLT ROHS MADE IN USA (TRU-MARK SEQUENTIAL FOOTAGE)
- CAROL (SIZE) (mm^2) 90°C (UL) WATER RESISTANT SOOW CSA (-40°C) FT2 P-7K-123033 MSHA 600 VOLT ROHS MADE IN USA (TRU-MARK SEQUENTIAL FOOTAGE)

Applications:
- Portable tools and equipment
- Portable appliances
- Small motors and associated machinery
- Food processing plants and equipment
- Marinas/docks
- Shipyards
- OEM/MRO
- OSHA VPP safety
- Construction site power
- Industrial plants
- Mining

Features:
- Excellent resistance to oil and moisture
- Good tensile strength, elongation and aging characteristics
- High flexibility
- Excellent abrasion resistance
- Water-resistant*
- UL Listed and CSA Certified for indoor and outdoor use
- Ozone-, sunlight (UV)- and weather-resistant
- TRU-Mark® sequential footage marking

Industry Approvals:
- UL Flexible Cord - UL 62
- CSA Flexible Cord - C22.2-49
- MSHA Approved
- RoHS Compliant

Packaging:
- 250' (76.2 m), 1000' (304.8 m)
- Other put-ups available on special order

* Suitable for immersion in water if properly sealed and terminated.

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
3	Black, White, Green
4	Black, White, Red, Green

Carolprene® Jacketed Type SOOW

90ºC, 600 Volt, UL/CSA Portable Cord

Product Construction:

Conductors:
- 18 through 2 AWG fully annealed stranded bare copper

Insulation:
- Premium-grade, color-coded 90ºC EPDM
- Color code: See chart below

Jacket:
- Carolprene®, black
- Temperature range: -40ºC to +90ºC

Jacket Marking:
- CAROL (SIZE) (mm²) 90°C (UL) WATER RESISTANT SOOW CSA (-40°C) FT2 P-7K-123033 MSHA 600 VOLT ROHS MADE IN USA (TRU-MARK SEQUENTIAL FOOTAGE)

Applications:
- Portable tools and equipment
- Portable appliances
- Small motors and associated machinery

Features:
- Excellent resistance to oil and moisture
- Good tensile strength, elongation and aging characteristics
- High flexibility
- Excellent abrasion resistance
- Water-resistant*
- UL Listed and CSA Certified for indoor and outdoor use
- Ozone-, sunlight (UV)- and weather-resistant
- TRU-Mark® sequential footage marking

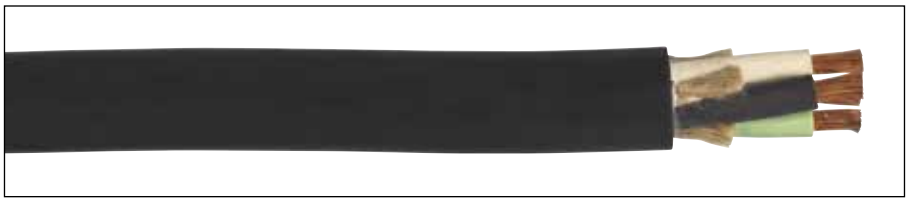
Industry Approvals:
- UL Flexible Cord - UL 62
- CSA Flexible Cord - C22.2-49
- MSHA Approved
- RoHS Compliant

Packaging:
- 250' (76.2 m), 500' (152.4 m), 1000' (304.8 m)
- Other put-ups available on special order

*Suitable for immersion in water if properly sealed and terminated.

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
2	Black, White
3	Black, White, Green
4	Black, White, Red, Green
5	Black, White, Red, Green, Orange



TYPE SOOW – 600 VOLT – UL/CSA

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M'(S)	STD. CTN.
				INCHES	mm	INCHES	mm			
02763	2	18	16/30	0.030	0.76	0.345	8.76	10	65	250'
02769	3	18	16/30	0.030	0.76	0.365	9.27	10	80	250'
02770	4	18	16/30	0.030	0.76	0.390	9.91	7	94	250'
02722	2	16	26/30	0.030	0.76	0.370	9.40	13	77	250'
02765	3	16	26/30	0.030	0.76	0.390	9.91	13	94	250'
02766	4	16	26/30	0.030	0.76	0.420	10.67	10	114	250'
02723	2	14	41/30	0.045	1.14	0.510	12.95	18	154	250'
02762	3	14	41/30	0.045	1.14	0.535	13.59	18	171	250'
02768	4	14	41/30	0.045	1.14	0.575	14.61	15	209	250'
02724	2	12	65/30	0.045	1.14	0.570	14.48	25	168	250'
02725	3	12	65/30	0.045	1.14	0.595	15.11	25	223	250'
02726	4	12	65/30	0.045	1.14	0.650	16.51	20	276	250'
02767	2	10	104/30	0.045	1.14	0.620	15.75	30	230	250'
02728	3	10	104/30	0.045	1.14	0.660	16.76	30	289	250'
02727	4	10	104/30	0.045	1.14	0.715	18.16	25	351	250'
16063	3	8	133/29	0.060	1.52	0.840	21.33	40	450	250'
16064	4	8	133/29	0.060	1.52	0.945	24.00	35	580	250'
16065	5	8	133/29	0.060	1.52	1.030	26.16	28	700	250'
16073	3	6	133/27	0.060	1.52	0.980	24.89	55	637	250'
16074	4	6	133/27	0.060	1.52	1.080	27.43	45	830	250'
16075	5	6	133/27	0.060	1.52	1.200	30.48	36	1015	250'
16083	3	4	133/25	0.060	1.52	1.140	28.96	70	926	250'
16084	4	4	133/25	0.060	1.52	1.260	32.00	60	1145	250'
16085	5	4	133/25	0.060	1.52	1.365	34.67	48	1419	250'
16093	3	2	133/23	0.060	1.52	1.330	33.78	95	1367	250'
16094	4	2	133/23	0.060	1.52	1.460	37.08	80	1699	250'
16095*	5	2	133/23	0.060	1.52	1.580	40.13	64	2066	250'

Cord furnished with UL and CSA labels.
* Non-stock item; minimum quantity purchase required.
† Green conductor for grounding only. Ampacities based on NEC Table 400.5(A)(1).
(S)Actual shipping weight may vary.

General Cable

Made in U.S.A.

RoHS Compliant Directive 2011/65/EU

MSHA Mine Safety and Health Administration

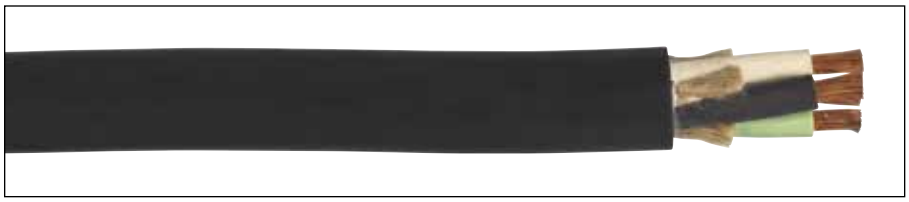
Certified Canadian Standard Association

UL LISTED

CAROL BRAND

Carolprene® with 17 FREE® Jacketed Type SOOW

105°C, 600 Volt, UL/c(UL) Portable Cord



TYPE SOOW – 600 VOLT – UL/c(UL)

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M'(S)	STD. CTN.
				INCHES	mm	INCHES	mm			
HF763*	2	18	16/30	0.030	0.76	0.345	8.76	10	61	250'
HF769*	3	18	16/30	0.030	0.76	0.365	9.27	10	76	250'
HF770*	4	18	16/30	0.030	0.76	0.390	9.91	7	89	250'
HF722*	2	16	26/30	0.030	0.76	0.370	9.40	13	73	250'
HF765*	3	16	26/30	0.030	0.76	0.390	9.91	13	89	250'
HF766*	4	16	26/30	0.030	0.76	0.420	10.67	10	109	250'
HF723*	2	14	41/30	0.045	1.14	0.510	12.95	18	146	250'
HF762*	3	14	41/30	0.045	1.14	0.535	13.59	18	163	250'
HF768*	4	14	41/30	0.045	1.14	0.575	14.61	15	200	250'
HF724*	2	12	65/30	0.045	1.14	0.570	14.48	25	158	250'
HF725*	3	12	65/30	0.045	1.14	0.595	15.11	25	213	250'
HF726*	4	12	65/30	0.045	1.14	0.650	16.51	20	265	250'
HF767*	2	10	104/30	0.045	1.14	0.620	15.75	30	218	250'
HF728*	3	10	104/30	0.045	1.14	0.660	16.76	30	277	250'
HF727*	4	10	104/30	0.045	1.14	0.715	18.16	25	338	250'
HF063*	3	8	133/29	0.060	1.52	0.840	21.34	40	432	250'
HF064*	4	8	133/29	0.060	1.52	0.945	24.00	35	557	250'
HF065*	5	8	133/29	0.060	1.52	1.030	26.16	28	675	250'
HF073*	3	6	133/27	0.060	1.52	0.980	24.89	55	613	250'
HF074*	4	6	133/27	0.060	1.52	1.080	27.43	45	800	250'
HF075*	5	6	133/27	0.060	1.52	1.200	30.48	36	979	250'
HF083*	3	4	133/25	0.060	1.52	1.140	28.96	70	893	250'
HF084*	4	4	133/25	0.060	1.52	1.260	32.00	60	1106	250'
HF085*	5	4	133/25	0.060	1.52	1.365	34.67	48	1375	250'
HF093*	3	2	133/23	0.060	1.52	1.330	33.78	95	1322	250'
HF094*	4	2	133/23	0.060	1.52	1.460	37.08	80	1649	250'
HF095*	5	2	133/23	0.060	1.52	1.580	40.13	64	2010	250'

Cord furnished with UL and c(UL) labels.
* Non-stock item; minimum quantity purchase required.
† Green conductor for grounding only. Ampacities based on NEC Table 400.5(A)(1).
(S)Actual shipping weight may vary.

Product Construction:

Conductors:
- 18 through 2 AWG fully annealed stranded bare copper

Insulation:
- Premium-grade, color-coded 105°C 17 FREE® EPDM
- Color code: See chart below

Jacket:
- Carolprene®, black, 17 FREE®
- Temperature range: -40°C to +105°C

Jacket Marking:
- CAROL (SIZE) (mm²) 105°C (UL) WATER RESISTANT SOOW WITH 17 FREE (-40°C) FT2 c(UL) 600 VOLT ROHS MADE IN USA (TRU-MARK SEQUENTIAL FOOTAGE)

Applications
- Portable tools and equipment
- Portable appliances
- Small motors and associated machinery

Features
- No halogens
- More environmentally friendly
- Oil-resistant
- Good tensile strength, elongation and aging characteristics
- High flexibility
- Excellent abrasion resistance
- Water-resistant*
- UL Listed for indoor and outdoor use
- Ozone-, sunlight (UV)- and weather-resistant
- TRU-Mark® sequential footage marking

Industry Approvals
- UL/c(UL) Flexible Cord - UL 62/CSA 22.2 No. 49
- RoHS Compliant

Packaging:
- 250' (76.2 m), 500' (152.4 m), 1000' (304.8 m)
- Other put-ups available on special order

* Suitable for immersion in water if properly sealed and terminated.

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
2	Black, White
3	Black, White, Green
4	Black, White, Red, Green
5	Black, White, Red, Green, Orange

Going Green with General Cable
General Cable has accelerated its environmental commitment, addressing its green alternative approach by identifying greener opportunities and promoting green cabling solutions wherever feasible. This includes promoting our existing green products, partnering with key customers in their green endeavors, identifying and providing for green product gaps, and participating as a member of the United States Green Building Council (USGBC) and collaborative ventures such as the Green Suppliers Network (GSN).

CAROL BRAND UL LISTED c UL LISTED RoHS Compliant Directive 2011/65/EU Made in U.S.A. General Cable

Carolprene® Jacketed Type SJOOW

90ºC, 300 Volt, UL/CSA Portable Cord

NOW WITH TRU-Mark® Footage Marking System PRECISION

Product Construction:

Conductors:
- 18 through 10 AWG fully annealed stranded bare copper

Insulation:
- Premium-grade, color-coded 90°C EPDM
- Color code: See chart below

Jacket:
- Carolprene®, black
- Temperature range: -40°C to +90°C

Jacket Marking:
- CAROL (SIZE) (mm²) 90°C (UL) WATER RESISTANT SJOOW CSA (-40°C) FT2 P-7K-123033 MSHA 300 VOLT ROHS MADE IN USA (TRU-MARK SEQUENTIAL FOOTAGE)

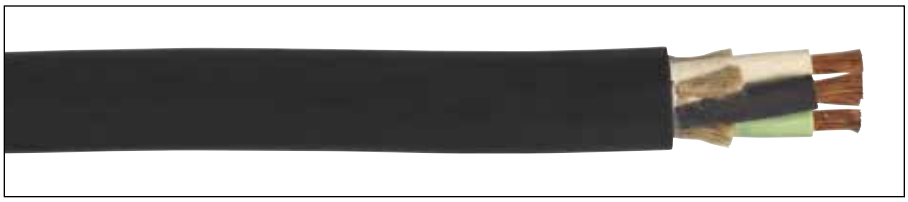
Applications:
- Portable tools and equipment
- Portable appliances
- Small motors and associated machinery

Features:
- Excellent resistance to oil and moisture
- Good tensile strength, elongation and aging characteristics
- High flexibility
- Excellent abrasion resistance
- Water-resistant*
- UL Listed and CSA Certified for indoor and outdoor use
- Ozone-, sunlight (UV)- and weather-resistant
- TRU-Mark® sequential footage marking

Industry Approvals:
- UL Flexible Cord - UL 62
- CSA Flexible Cord - C22.2-49
- MSHA Approved
- RoHS Compliant

Packaging:
- 250' (76.2 m), 500' (152.4 m), 1000' (304.8 m)
- Other put-ups available on special order

*Suitable for immersion in water if properly sealed and terminated.



TYPE SJOOW – 300 VOLT – UL/CSA

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M'(S)	STD. CTN.
				INCHES	mm	INCHES	mm			
01310	2	18	16/30	0.030	0.76	0.285	7.24	10	46	1000'
01311	3	18	16/30	0.030	0.76	0.305	7.75	10	60	1000'
01344	4	18	16/30	0.030	0.76	0.330	8.38	7	72	250'
01312	2	16	26/30	0.030	0.76	0.310	7.87	13	56	1000'
01342	3	16	26/30	0.030	0.76	0.330	8.38	13	72	250'
01343	4	16	26/30	0.030	0.76	0.365	9.27	10	89	250'
01358	2	14	41/30	0.030	0.76	0.340	8.64	18	75	250'
01360	3	14	41/30	0.030	0.76	0.370	9.40	18	100	250'
01364	4	14	41/30	0.030	0.76	0.410	10.41	15	128	250'
01379	2	12	65/30	0.030	0.76	0.410	10.41	25	108	250'
01380	3	12	65/30	0.030	0.76	0.430	10.92	25	136	250'
01381	4	12	65/30	0.030	0.76	0.475	12.07	20	177	250'
01382*	2	10	104/30	0.045	1.14	0.560	14.22	30	190	250'
01383	3	10	104/30	0.045	1.14	0.580	14.73	30	236	250'
01384	4	10	104/30	0.045	1.14	0.655	16.64	25	296	250'

Cord furnished with UL and CSA labels.
* Non-stock item; minimum quantity purchase required.
† Green conductor for grounding only. Ampacities based on NEC Table 400.5(A)(1).
(S)Actual shipping weight may vary.

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
2	Black, White
3	Black, White, Green
4	Black, White, Red, Green

General Cable

Made in U.S.A.

RoHS Compliant Directive 2011/65/EU

MSHA Mine Safety and Health Administration

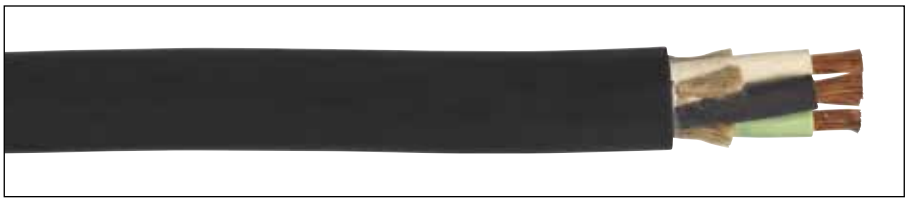
Certified Canadian Standard Association

UL LISTED

CAROL BRAND

Carolprene® with 17 FREE® Jacketed Type SJOOW

105°C, 300 Volt, UL/c(UL) Portable Cord



TYPE SJOOW – 300 VOLT – UL/c(UL)

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M'(S)	STD. CTN.
				INCHES	mm	INCHES	mm			
HF310*	2	18	16/30	0.030	0.76	0.285	7.24	10	44	1000'
HF311*	3	18	16/30	0.030	0.76	0.305	7.75	10	58	1000'
HF344*	4	18	16/30	0.030	0.76	0.330	8.38	7	70	250'
HF312*	2	16	26/30	0.030	0.76	0.310	7.87	13	54	250'
HF342*	3	16	26/30	0.030	0.76	0.330	8.38	13	70	250'
HF343*	4	16	26/30	0.030	0.76	0.365	9.27	10	87	250'
HF358*	2	14	41/30	0.030	0.76	0.340	8.64	18	73	250'
HF360*	3	14	41/30	0.030	0.76	0.370	9.40	18	97	250'
HF364*	4	14	41/30	0.030	0.76	0.410	10.41	15	125	250'
HF379*	2	12	65/30	0.030	0.76	0.410	10.41	25	104	250'
HF380*	3	12	65/30	0.030	0.76	0.430	10.92	25	132	250'
HF381*	4	12	65/30	0.030	0.76	0.475	12.07	20	172	250'
HF382*	2	10	104/30	0.045	1.14	0.560	14.22	30	183	250'
HF383*	3	10	104/30	0.045	1.14	0.580	14.73	30	229	250'
HF384*	4	10	104/30	0.045	1.14	0.655	16.64	25	288	250'

Cord furnished with UL and c(UL) labels.
* Non-stock item; minimum quantity purchase required.
† Green conductor for grounding only. Ampacities based on NEC Table 400.5(A)(1).
(S)Actual shipping weight may vary.

Product Construction:

Conductors:
- 18 through 10 AWG fully annealed stranded bare copper

Insulation:
- Premium-grade, color-coded 105°C 17 FREE® EPDM
- Color code: See chart below

Jacket:
- Carolprene®, black, 17 FREE®
- Temperature range: -40°C to +105°C

Jacket Marking:
- CAROL (SIZE) (mm²) 105°C (UL) WATER RESISTANT SJOOW WITH 17 FREE (-40°C) FT2 c(UL) 300 VOLT ROHS MADE IN USA (TRU-MARK SEQUENTIAL FOOTAGE)

Applications:
- Portable tools and equipment
- Portable appliances
- Small motors and associated machinery

Features:
- No halogens
- More environmentally friendly
- Oil-resistant
- Good tensile strength, elongation and aging characteristics
- High flexibility
- Excellent abrasion resistance
- Water-resistant*
- UL Listed for indoor and outdoor use
- Ozone-, sunlight (UV)- and weather-resistant
- TRU-Mark® sequential footage marking

Industry Approvals:
- UL/c(UL) Flexible Cord - UL 62/CSA 22.2 No. 49
- RoHS Compliant

Packaging:
- 250' (76.2 m), 500' (152.4 m), 1000' (304.8 m)
- Other put-ups available on special order

* Suitable for immersion in water if properly sealed and terminated.

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
2	Black, White
3	Black, White, Green
4	Black, White, Red, Green

Going Green with General Cable
General Cable has accelerated its environmental commitment, addressing its green alternative approach by identifying greener opportunities and promoting green cabling solutions wherever feasible. This includes promoting our existing green products, partnering with key customers in their green endeavors, identifying and providing for green product gaps, and participating as a member of the United States Green Building Council (USGBC) and collaborative ventures such as the Green Suppliers Network (GSN).

Carolprene® Jacketed Type SOOW

90ºC, 600 Volt, Non-UL Portable Cord

Product Construction:

Conductors:
- 8 through 2 AWG fully annealed stranded bare copper

Insulation:
- Premium-grade, color-coded 90°C EPDM
- Color code: See chart below

Jacket:
- Carolprene®, black
- Temperature range: -40°C to +90°C

Jacket Marking:
- CAROL (SIZE) TYPE SOOW 90°C P-7K-123033 MSHA 600 VOLT ROHS MADE IN USA

Applications:
- Portable tools and equipment
- Temporary and portable power
- Motors and associated machinery

Features:
- Excellent resistance to oil and moisture
- Good tensile strength, elongation and aging characteristics
- High flexibility
- Excellent abrasion resistance
- Ozone-, sunlight (UV)- and weather-resistant
- Water-resistant*

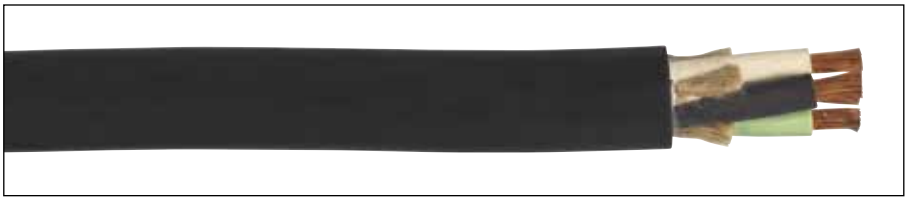
Industry Approvals:
- MSHA Approved
- RoHS Compliant

Packaging:
- 250' (76.2 m), 500' (152.4 m), 1000' (304.8 m)
- Other put-ups available on special order

*Suitable for immersion in water if properly sealed and terminated.

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
2	Black, White
3	Black, White, Green
4	Black, White, Red, Green
5	Black, White, Red, Green, Orange



TYPE SOOW, NON-UL – 600 VOLT

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M'(S)	STD. CTN.
				INCHES	mm	INCHES	mm			
01811*	2	8	65/26	0.050	1.27	0.660	16.76	40	278	250'
01812	3	8	65/26	0.050	1.27	0.695	17.65	40	343	250'
01827	4	8	65/26	0.050	1.27	0.760	19.30	35	442	250'
98267	5	8	65/26	0.050	1.27	0.840	21.34	28	542	250'
01825	3	6	101/26	0.050	1.27	0.790	20.07	55	482	250'
01824	4	6	101/26	0.050	1.27	0.865	21.97	45	599	250'
98270	5	6	101/26	0.050	1.27	0.945	24.00	36	750	250'
01823*	2	4	119/25	0.050	1.27	0.870	22.09	70	515	250'
01822	3	4	119/25	0.050	1.27	0.925	23.49	70	683	250'
01821	4	4	119/25	0.050	1.27	1.015	25.78	60	851	250'
98463	5	4	119/25	0.050	1.27	1.115	28.32	48	1039	250'
01819	3	2	133/.0211	0.055	1.40	1.085	27.56	95	1003	250'
01818	4	2	133/.0211	0.055	1.40	1.170	29.72	80	1248	250'
98187	5	2	133/.0211	0.055	1.40	1.390	35.31	64	1684	250'

* Non-stock item; minimum quantity purchase required.
† Green conductor for grounding only. Ampacities based on NEC Table 400.5(A)(1).
(S)Actual shipping weight may vary.

General Cable

Made in U.S.A.

RoHS Compliant Directive 2011/65/EU

MSHA Mine Safety and Health Administration

CAROL BRAND

Super Vu-Tron® Type SO

90°C, 600 Volt



TYPE SO, NON-UL – 600 VOLT

CATALOG NUMBER	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M‡(S)
			INCHES	mm	INCHES	mm		
77493*	18	16/30	0.030	0.76	0.180	4.57	10	19
77483*	16	26/30	0.030	0.76	0.200	5.08	13	25
77473*	14	41/30	0.045	1.14	0.240	6.09	18	40
77463*	12	65/30	0.045	1.14	0.265	6.60	25	50
77453*(1)	10	104/30	0.045	1.14	0.305	7.75	30	75

† Ampacities based on NEC Table 400.5(A)(1).
* Non-stock item; minimum quantity purchase required.
(S)Actual shipping weight may vary.
(1) Only 10 AWG construction is MSHA Approved.

Product Construction:

Conductors:
- 18 through 10 AWG stranded bare copper

Insulation:
- Premium-grade 90°C EPDM

Jacket:
- Super Vu-Tron®, black
- Temperature range: -40°C to +90°C

Jacket Marking:
- (SIZE) TYPE SO 600 VOLT CAROL SUPER VU-TRON® 90°C P-123-MSHA(1) (TRU-MARK SEQUENTIAL FOOTAGE)

Applications:
- Portable tools and equipment
- Portable appliances
- Small motors and associated machinery
- Flexible power leads

Features:
- Excellent resistance to oil and moisture
- Good tensile strength, elongation and aging characteristics
- High flexibility
- Excellent abrasion resistance
- Ozone-, sunlight (UV)- and weather-resistant
- TRU-Mark® sequential footage marking

Industry Approvals:
- MSHA Approved(1)
- RoHS Compliant

Packaging:
- Lengths cut to order

Type SJ

60°C, 300 Volt, UL/CSA Portable Cord

Product Construction:

Conductors:
- 18 through 10 AWG fully annealed stranded bare copper

Insulation:
- Premium-grade, color-coded EPDM
- Color code: See chart below

Jacket:
- Rubber, black
- Temperature range: -40°C to +60°C

Jacket Marking:
- CAROL (SIZE) (mm^2) TYPE SJ 60°C (UL) --- CSA TYPE SJ-FT2 300 VOLT ROHS MADE IN USA

Applications:
- Portable tools and equipment
- Portable appliances
- Small motors and associated machinery

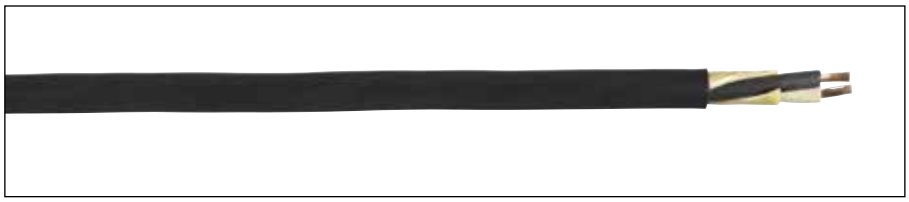
Features:
- Good flexibility in low temperatures
- Suitable for use in conditions where the cord is not subject to acid, grease, oil or solvents

Industry Approvals:
- UL Flexible Cord - UL 62
- CSA Flexible Cord - C22.2-49
- RoHS Compliant

Packaging:
- 250' (76.2 m)
- Other put-ups available on special order

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
2	Black, White
3	Black, White, Green
4	Black, White, Red, Green



TYPE SJ – 300 VOLT – UL/CSA

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M'(S)	STD. CTN.
				INCHES	mm	INCHES	mm			
01302*	2	18	16/30	0.030	0.76	0.285	7.24	10	50	1000'
01303*	3	18	16/30	0.030	0.76	0.305	7.75	10	63	1000'
01304*	4	18	16/30	0.030	0.76	0.330	8.38	7	76	250'
01305*	2	16	26/30	0.030	0.76	0.315	8.00	13	62	1000'
01306*	3	16	26/30	0.030	0.76	0.330	8.38	13	76	250'
01307*	4	16	26/30	0.030	0.76	0.365	9.27	10	97	250'
01361*	2	14	41/30	0.030	0.76	0.340	8.64	18	79	250'
01362*	3	14	41/30	0.030	0.76	0.370	9.40	18	106	250'
01366*	4	14	41/30	0.030	0.76	0.415	10.54	15	135	250'
01368*	2	12	65/30	0.030	0.76	0.410	10.41	25	117	250'
01369*	3	12	65/30	0.030	0.76	0.430	10.92	25	145	250'
01370*	4	12	65/30	0.030	0.76	0.470	11.94	20	182	250'
01376*	2	10	104/30	0.045	1.14	0.550	13.97	30	193	250'
01377*	3	10	104/30	0.045	1.14	0.580	14.73	30	243	250'
01378*	4	10	104/30	0.045	1.14	0.655	16.64	25	318	250'

* Non-stock item; minimum quantity purchase required.
† Green conductor for grounding only. Ampacities based on NEC Table 400.5(A)(1).
(S)Actual shipping weight may vary.

Carolprene® Type SVO

90ºC, 300 Volt, UL/CSA Portable Cord



TYPE SVO – 300 VOLT – UL/CSA

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M'(S)	STD. CTN.
				INCHES	mm	INCHES	mm			
13002	2	18	41/34	0.015	0.38	0.225	5.72	10	34	1000'
13003	3	18	41/34	0.015	0.38	0.235	5.97	10	40	1000'

† Green conductor for grounding only. Ampacities based on NEC Table 400.5(A)(1).
(S)Actual shipping weight may vary.

Product Construction:

Conductors:
- 18 AWG fully annealed stranded bare copper

Insulation:
- Premium-grade, color-coded 90ºC EPDM
- Color code: See chart below

Jacket:
- Carolprene®, black
- Temperature range: -20ºC to +90ºC

Jacket Marking:
- CAROL (SIZE) (mm²) TYPE SVO 90°C (UL) --- CSA TYPE SVO FT2 300 VOLT ROHS MADE IN USA

Applications:
- Vacuum cleaners
- Light-duty equipment
- Office equipment

Features:
- Maintains flexibility in cold temperatures
- Resistant to oil and moisture
- Good tensile strength, elongation and aging characteristics
- Excellent flex life
- Ozone-, sunlight (UV)- and weather-resistant

Industry Approvals:
- UL Flexible Cord - UL 62
- CSA Flexible Cord - C22.2-49
- RoHS Compliant

Packaging:
- 250' (76.2 m)
- Other sizes and put-ups available on special order
- 4C cables available as UL recognized AWM as special order

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
2	Black, White
3	Black, White, Green

Super Vu-Tron® Multi-Conductor Type SOOW

90°C, 600 Volt, UL/CSA Portable Cord

Product Construction:

Conductors:
- 18 and 16 AWG fully annealed stranded bare copper

Insulation:
- Premium-grade, color-coded 90°C EPDM
- Color code: See chart below

Jacket:
- Super Vu-Tron® 90°C, black
- Temperature range: -40°C to +90°C

Jacket Marking:
- CAROL SUPER VU-TRON® (SIZE) (mm^2) 90°C (UL) WATER RESISTANT SOOW CSA (-40°C) FT2 P-7K-123033 MSHA 600 VOLT ROHS MADE IN USA

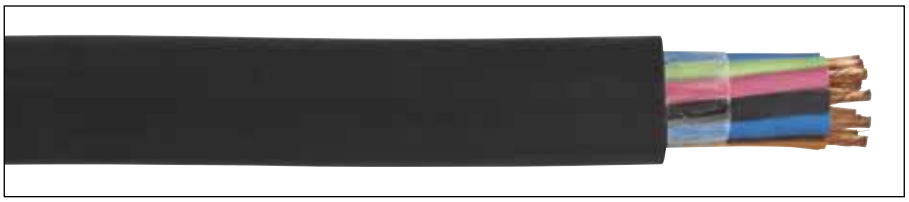
Applications:
- Control circuits
- Tools
- Heavy industrial, processing and construction equipment

Features:
- Extra-flexible stranding
- Abrasion-resistant
- Resists oils and solvents
- Flame-resistant
- Ozone-resistant
- 90°C rated conductors and jacket
- Water-resistant*
- UL Listed and CSA Certified for indoor and outdoor use
- Ozone-, sunlight (UV)- and weather-resistant

Industry Approvals:
- UL Flexible Cord - UL 62
- CSA Flexible Cord - C22.2-49
- MSHA Approved
- RoHS Compliant

Packaging:
- 5- through 8-conductor available on 250' (76.2 m), 500' (152.4 m), and 1000' (304.8 m) reels
- 9+ cond. available on long-length reels
- Other put-ups available on special order

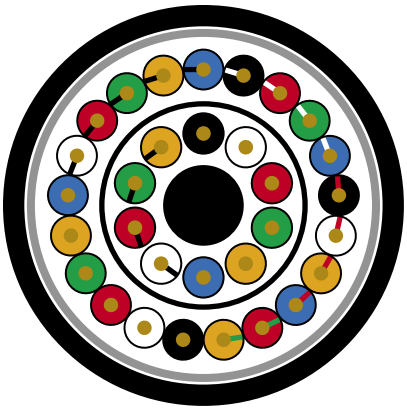
*Suitable for immersion in water if properly sealed and terminated.



TYPE S00W – 600 VOLT – UL/CSA

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M'(S)
				INCHES	mm	INCHES	mm		
09805	5	18	16/30	0.030	0.76	0.465	11.81	5.6	131
09806	6	18	16/30	0.030	0.76	0.495	12.57	5.6	142
09807	7	18	16/30	0.030	0.76	0.520	13.21	5.6	161
09808	8	18	16/30	0.030	0.76	0.530	13.46	4.9	173
09810	10	18	16/30	0.030	0.76	0.595	15.11	4.9	221
09812	12	18	16/30	0.030	0.76	0.600	15.24	3.5	235
09814	14	18	16/30	0.030	0.76	0.630	16.00	3.5	262
09816	16	18	16/30	0.030	0.76	0.700	17.78	3.5	306
09818*	18	18	16/30	0.030	0.76	0.760	19.30	3.5	341
09820	20	18	16/30	0.030	0.76	0.795	20.19	3.5	377
09822*	22	18	16/30	0.030	0.76	0.805	20.45	3.1	400
09824	24	18	16/30	0.030	0.76	0.850	21.59	3.1	453
09827*	27	18	16/30	0.030	0.76	0.865	21.97	3.1	475
09830*	30	18	16/30	0.030	0.76	0.915	23.24	3.1	524
09605	5	16	26/30	0.030	0.76	0.495	12.57	8.0	152
09606	6	16	26/30	0.030	0.76	0.520	13.21	8.0	184
09607	7	16	26/30	0.030	0.76	0.540	13.72	8.0	210
09608	8	16	26/30	0.030	0.76	0.575	14.61	7.0	228
09609	9	16	26/30	0.030	0.76	0.600	15.24	7.0	255
09610	10	16	26/30	0.030	0.76	0.620	15.75	5.0	260
09612	12	16	26/30	0.030	0.76	0.660	16.76	5.0	319
09614	14	16	26/30	0.030	0.76	0.730	18.54	5.0	343
09616	16	16	26/30	0.030	0.76	0.740	18.80	5.0	367
09618*	18	16	26/30	0.030	0.76	0.770	19.56	5.0	405
09620	20	16	26/30	0.030	0.76	0.810	20.57	5.0	444
09622*	22	16	26/30	0.030	0.76	0.900	22.86	4.5	510
09624	24	16	26/30	0.030	0.76	0.925	23.50	4.5	547
09626*	26	16	26/30	0.030	0.76	0.965	24.51	4.5	611
09630	30	16	26/30	0.030	0.76	1.010	25.65	4.5	685

† Values shown are for current-carrying conductors. A grounding conductor, or one which carries only the unbalance current from other conductors, is NOT counted in determining current carrying capacity. Ampacities based on NEC Table 400.5(A)(1).
* Non-stock item; minimum quantity purchase required.
(S)Actual shipping weight may vary.



COLOR CODE CHART

NO. OF COND.	COLOR	TRACER	NO. OF COND.	COLOR	TRACER	NO. OF COND.	COLOR	TRACER
1	Black	–	**8**	Red	Black	**15**	Blue	White
2	White	–	**9**	Green	Black	**16**	Black	Red
3	Red	–	**10**	Orange	Black	**17**	White	Red
4	Green	–	**11**	Blue	Black	**18**	Orange	Red
5	Orange	–	**12**	Black	White	**19**	Blue	Red
6	Blue	–	**13**	Red	White	**20**	Red	Green
7	White	Black	**14**	Green	White	**21**	Orange	Green

Note: Colors repeat after 21 conductors.

General Cable

Made in U.S.A. RoHS Compliant Directive 2011/65/EU MSHA Mine Safety and Health Administration CSA Certified Canadian Standard Association UL LISTED CAROL BRAND

Super Vu-Tron® Multi-Conductor Type SOOW

90°C, 600 Volt, UL/CSA Portable Cord

Product Construction:

Conductors:
- 14 through 10 AWG fully annealed stranded bare copper

Insulation:
- Premium-grade, color-coded 90°C EPDM
- Color code: See chart below

Jacket:
- Super Vu-Tron® 90°C, black
- Temperature range: -40°C to +90°C

Jacket Marking:
- CAROL SUPER VU-TRON® (SIZE) (mm^2) 90°C (UL) WATER RESISTANT SOOW CSA (-40°C) FT2 P-7K-123033 MSHA 600 VOLT ROHS MADE IN USA

Applications:
- Control circuits
- Tools
- Heavy industrial, processing and construction equipment

Features:
- Extra-flexible stranding
- Abrasion-resistant
- Resists oils and solvents
- Flame-resistant
- Ozone-resistant
- 90°C rated conductors and jacket
- Water-resistant*
- UL Listed and CSA Certified for indoor and outdoor use
- Ozone-, sunlight (UV)- and weather-resistant

Industry Approvals:
- UL Flexible Cord - UL 62
- CSA Flexible Cord - C22.2-49
- MSHA Approved
- RoHS Compliant

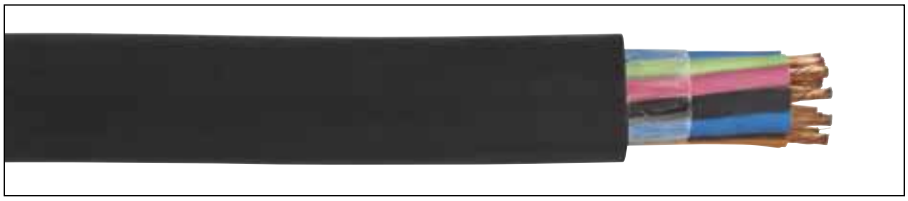
Packaging:
- 5- through 8-conductor available on 250' (76.2 m), 500' (152.4 m), and 1000' (304.8 m) reels
- 9+ cond. available on long-length reels
- Other put-ups available on special order

*Suitable for immersion in water if properly sealed and terminated.

COLOR CODE CHART

NO. OF COND.	COLOR	TRACER	NO. OF COND.	COLOR	TRACER
1	Black	–	12	Black	White
2	White	–	13	Red	White
3	Red	–	14	Green	White
4	Green	–	15	Blue	White
5	Orange	–	16	Black	Red
6	Blue	–	17	White	Red
7	White	Black	18	Orange	Red
8	Red	Black	19	Blue	Red
9	Green	Black	20	Red	Green
10	Orange	Black	21	Orange	Green
11	Blue	Black			

Note: Colors repeat after 21 conductors. Refer to page 21 for color diagram.



TYPE S00W – 600 VOLT – UL/CSA

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M'(S)
				INCHES	mm	INCHES	mm		
09405	5	14	41/30	0.045	1.14	0.645	16.26	12.0	266
09406	6	14	41/30	0.045	1.14	0.710	18.03	12.0	313
09407	7	14	41/30	0.045	1.14	0.755	19.18	12.0	326
09408	8	14	41/30	0.045	1.14	0.810	20.57	10.5	366
09409*	9	14	41/30	0.045	1.14	0.860	21.84	10.5	419
09410	10	14	41/30	0.045	1.14	0.875	22.23	10.5	436
09412	12	14	41/30	0.045	1.14	0.900	22.86	7.5	516
09414	14	14	41/30	0.045	1.14	1.000	25.40	7.5	597
09416	16	14	41/30	0.045	1.14	1.030	26.16	7.5	658
09418*	18	14	41/30	0.045	1.14	1.100	27.94	7.5	720
09420	20	14	41/30	0.045	1.14	1.155	29.34	7.5	799
09424	24	14	41/30	0.045	1.14	1.260	32.00	6.7	998
09428*	28	14	41/30	0.045	1.14	1.330	33.78	6.7	1080
09430*	30	14	41/30	0.045	1.14	1.335	33.97	6.0	1146
09205	5	12	65/30	0.045	1.14	0.715	18.16	16.0	326
09206	6	12	65/30	0.045	1.14	0.740	18.80	16.0	362
09207	7	12	65/30	0.045	1.14	0.790	20.07	16.0	415
09208	8	12	65/30	0.045	1.14	0.825	20.96	14.0	464
09209	9	12	65/30	0.045	1.14	0.900	22.86	14.0	510
09210	10	12	65/30	0.045	1.14	0.950	24.13	14.0	602
09212	12	12	65/30	0.045	1.14	1.010	25.65	10.0	662
09214	14	12	65/30	0.045	1.14	1.020	25.91	10.0	724
09216	16	12	65/30	0.045	1.14	1.135	28.83	10.0	869
09218*	18	12	65/30	0.045	1.14	1.175	29.85	10.0	912
09220	20	12	65/30	0.045	1.14	1.175	29.84	10.0	977
09224	24	12	65/30	0.045	1.14	1.360	34.54	9.0	1236
09226	26	12	65/30	0.045	1.14	1.380	35.05	9.0	1309
09227*	27	12	65/30	0.045	1.14	1.390	35.30	9.0	1335
09228*	28	12	65/30	0.045	1.14	1.455	36.95	9.0	1375
09230	30	12	65/30	0.045	1.14	1.455	36.96	9.0	1512
09005	5	10	104/30	0.045	1.14	0.770	19.56	20.0	423
09006	6	10	104/30	0.045	1.14	0.875	22.23	20.0	508
09007	7	10	104/30	0.045	1.14	0.900	22.86	20.0	549
09008*	8	10	104/30	0.045	1.14	0.935	23.75	17.5	625
09010	10	10	104/30	0.045	1.14	1.020	25.91	17.5	755
09012	12	10	104/30	0.045	1.14	1.070	27.18	12.5	867
09016*	16	10	104/30	0.045	1.14	1.230	31.24	12.5	1142
09020*	20	10	104/30	0.045	1.14	1.325	33.66	12.5	1445

† Values shown are for current-carrying conductors. A grounding conductor, or one which carries only the unbalance current from other conductors, is NOT counted in determining current carrying capacity. Ampacities based on NEC Table 400.5(A)(1).

* Non-stock item; minimum quantity purchase required.

(S)Actual shipping weight may vary.

CAROL BRAND® UL® LISTED CSA Certified Canadian Standard Association MSHA Mine Safety and Health Administration RoHS Compliant Directive 2011/65/EU Made in U.S.A. General Cable

Plastic Cord 3



Thermoplastic cord products have evolved into a product line where specialized, technologically advanced products are required to meet today's commercial and industrial applications.

No longer are plastic cord products used only in applications where oil resistance is needed; today typical applications require cord to perform well in environments of extreme heat and cold and on job sites and factory floors where resistance to oil, chemicals and abrasion is mandatory.

General Cable's role, as the producer of the premiere Carol® Brand plastic cord products, is to ensure that new product development, product innovation and quality not only keep pace with industry requirements but also set the trends.

Our plastic cord products carry a full range of listings and certifications with Underwriters Laboratories, Inc. and the Canadian Standard Association. In addition, many products meet or exceed the requirements of OSHA, MSHA and other relevant industry standards.

Carol is simply the most accepted brand in the industry, having proven itself on the job time after time. Our plastic cord line is the most comprehensive in the industry, ensuring that the proper Carol product can always be specified.

Index	Page
Carol® Ultra Flex® Types SJEOOW/SEOOW	24-25
Types SJTOW and STOW	26
Type SVT	27
Type SJT 60˚C	28
Type SJT 105˚C	29
Bus Drop Cable	30
Thermostat Wire	31-32
Thermostat Wire, Unjacketed	33

Carol® Ultra Flex® Types SJEOOW/SEOOW

105°C, 300 and 600 Volt, UL/c(UL) Portable Cord



CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M'(S)	STD. PKG.
				INCHES	mm	INCHES	mm			
UL TYPE SJEOOW, c(UL) TYPE SJTOOW-TPE — 300 VOLT										
89002	2	18	16/30	0.030	0.76	0.293	7.44	10	45	250'
89003	3	18	16/30	0.030	0.76	0.310	7.87	10	55	250'
89004	4	18	16/30	0.030	0.76	0.340	8.64	7	65	250'
89012	2	16	26/30	0.030	0.76	0.319	8.10	13	55	250'
89013	3	16	26/30	0.030	0.76	0.338	8.59	13	70	250'
89014	4	16	26/30	0.030	0.76	0.372	9.45	10	85	250'
89022	2	14	41/30	0.030	0.76	0.351	8.92	18	75	250'
89023	3	14	41/30	0.030	0.76	0.372	9.45	18	90	250'
89024	4	14	41/30	0.030	0.76	0.410	10.41	15	115	250'
89032	2	12	65/30	0.030	0.76	0.419	10.64	25	90	250'
89033	3	12	65/30	0.030	0.76	0.443	11.25	25	130	250'
89034	4	12	65/30	0.030	0.76	0.486	12.34	20	170	250'
89042*	2	10	104/30	0.045	1.14	0.555	14.10	30	170	250'
89043*	3	10	104/30	0.045	1.14	0.587	14.91	30	210	250'
89044*	4	10	104/30	0.045	1.14	0.644	16.36	25	275	250'
UL TYPE SEOOW, c(UL) TYPE STOOW-TPE — 600 VOLT										
89052	2	18	16/30	0.030	0.76	0.355	9.02	10	55	250'
89053	3	18	16/30	0.030	0.76	0.372	9.45	10	70	250'
89054	4	18	16/30	0.030	0.76	0.402	10.21	7	85	250'
89062	2	16	26/30	0.030	0.76	0.381	9.68	13	75	250'
89063	3	16	26/30	0.030	0.76	0.400	10.16	13	85	250'
89064	4	16	26/30	0.030	0.76	0.434	11.02	10	105	250'
89065	5	16	26/30	0.030	0.76	0.511	12.98	8	120	250'
89072	2	14	41/30	0.045	1.14	0.515	13.08	18	140	250'
89073	3	14	41/30	0.045	1.14	0.541	13.74	18	150	250'
89074	4	14	41/30	0.045	1.14	0.589	14.96	15	185	250'
89075	5	14	41/30	0.045	1.14	0.669	16.99	12	230	250'
89082	2	12	65/30	0.045	1.14	0.585	14.86	25	175	250'
89083	3	12	65/30	0.045	1.14	0.614	15.60	25	195	250'
89084	4	12	65/30	0.045	1.14	0.665	16.89	20	245	250'
89085	5	12	65/30	0.045	1.14	0.718	18.24	16	295	250'
89092	2	10	104/30	0.045	1.14	0.629	15.98	30	220	250'
89093	3	10	104/30	0.045	1.14	0.661	16.79	30	260	250'
89094	4	10	104/30	0.045	1.14	0.718	18.24	25	305	250'
89095	5	10	104/30	0.045	1.14	0.777	19.74	20	385	250'
89883	3	8	133/29	0.060	1.52	0.868	22.05	40	415	250'
89884	4	8	133/29	0.060	1.52	0.971	24.66	35	545	250'
89663	3	6	133/27	0.060	1.52	1.000	25.40	55	585	250'
89664	4	6	133/27	0.060	1.52	1.110	28.19	45	750	250'

† Ampacities based on 90°C conductor and 30°C ambient temperature per Table 400.5(A)(1) of the National Electrical Code®.
' Non-stock item; minimum quantity purchase required.
(S) Actual shipping weight may vary.

Product Construction:

Conductors:
- 18 through 6 AWG fully annealed stranded bare copper

Insulation:
- Thermoplastic Elastomer
- Color code: See chart below

Jacket:
- Ultra Flex® Thermoplastic Elastomer, black, white or yellow
- Temperature range: -50°C to +105°C

Jacket Marking:
- Carol® Ultra Flex® SJEOOW - CAROL® ULTRA FLEX® (SIZE) (mm²) E11368-8 WATER RESISTANT (UL) SJEOOW c(UL) SJTOOW-TPE (-50°C) 105°C 300 V FT2 P-07-KA120010-MSHA - ROHS - MADE IN USA (DATE CODE) (TRU-MARK SEQUENTIAL FOOTAGE)
- Carol® Ultra Flex® SEOOW - CAROL® ULTRA FLEX® (SIZE) (mm²) E11368-8 WATER RESISTANT (UL) SEOOW c(UL) STOOW-TPE (-50°C) 105°C 600 V FT2 P-07-KA120010-MSHA - ROHS - MADE IN USA (DATE CODE) (TRU-MARK SEQUENTIAL FOOTAGE)

Applications:

Indoor applications for:
- Portable power tools
- Industrial and consumer lighting fixtures
- Office equipment power supplies
- Construction site power
- Industrial and floor care equipment

Features:

- Lightweight
- Oil-resistant
- Very good flexibility
- Excellent molding characteristics
- Water-resistant*
- UL Listed and c(UL) Listed for indoor or outdoor use
- TRU-Mark® sequential footage marking

Industry Approvals:

- UL Flexible Cord - UL 62
- CSA Flexible Cord - C22.2-49
- MSHA Approved
- RoHS Compliant

Packaging:

- 250' (76.2 m), 1000' (304.8 m) reels
- Packaged with TRU-Mark® precision

Other AWG sizes, conductor counts and put-ups available on special order.

* Suitable for immersion in water if properly sealed and terminated.

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR**
2	Black, White
3	Black, White, Green
4	Black, White, Red, Green
5	Black, White, Red, Green, Orange

** Green conductor for grounding only.

CAROL BRAND UL LISTED c UL LISTED MSHA Mine Safety and Health Administration RoHS Compliant Directive 2011/65/EU Made in U.S.A. General Cable

Carol® Ultra Flex® Type SEOOW

105°C, 600 Volt, Non-UL Portable Cord

Product Construction:

Conductors:
- 8 through 2 AWG fully annealed stranded bare copper

Insulation:
- Thermoplastic Elastomer
- Color code: See chart below

Jacket:
- Ultra Flex® Thermoplastic Elastomer, black, white or yellow
- Temperature range: -50°C to +105°C

Jacket Marking:
- CAROL ULTRA FLEX® (NO. OF COND) (AWG) (mm^2) WATER RESISTANT SEOOW OR STOOW-TPE (-50°C) 105°C 600 V –– FT2 P-07-KA120010-MSHA – ROHS – MADE IN USA (DATE CODE) (TRU-MARK SEQUENTIAL FOOTAGE)

Applications:

Indoor applications for:
- Portable power tools
- Industrial and consumer lighting fixtures
- Office equipment power supplies
- Construction site power
- Industrial and floor care equipment

Features:

- Lightweight
- Oil-resistant
- Very good flexibility
- Excellent molding characteristics
- Water-resistant*
- Indoor or outdoor use (8-2 AWG)
- TRU-Mark® sequential footage marking

Industry Approvals:

- MSHA Approved
- RoHS Compliant

Packaging:

- 250' (76.2 m), 1000' (304.8 m) reels
- Packaged with TRU-Mark® precision

Other AWG sizes, conductor counts and put-ups available on special order.

*Suitable for immersion in water if properly sealed and terminated.



CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WT. LBS/M'(S)	STD. PKG.
				INCHES	mm	INCHES	mm			
NON-UL TYPE SEOOW - 600 VOLT										
89803	3	8	65/26	0.050	1.27	0.712	18.08	40	320	250'/1000'
89804	4	8	65/26	0.050	1.27	0.778	19.76	35	395	250'/1000'
89603	3	6	101/26	0.050	1.27	0.810	20.57	55	440	250'/1000'
89604	4	6	101/26	0.050	1.27	0.887	22.53	45	545	250'/1000'
89403	3	4	119/25	0.050	1.27	0.935	23.75	70	655	250'/1000'
89404	4	4	119/25	0.050	1.27	1.025	26.04	60	820	250'/1000'
89203	3	2	119/0.0223	0.050	1.27	1.158	29.41	95	985	250'/1000'
89204	4	2	119/0.0223	0.050	1.27	1.260	32.00	80	1245	250'/1000'

† Ampacities based on 90°C conductor and 30°C ambient temperature per Table 400.5(A)(1) of the National Electrical Code®.

(S) Actual shipping weight may vary.

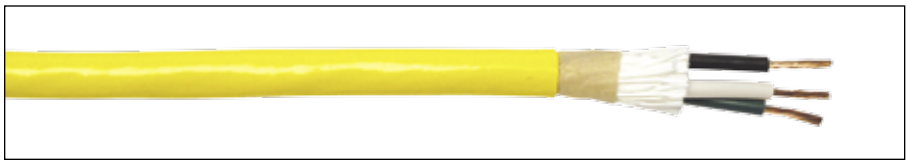
COLOR CODE CHART

NO. OF CONDUCTORS	COLOR**
2	Black, White
3	Black, White, Green
4	Black, White, Red, Green

** Green conductor for grounding only.

Types SJTOW and STOW

90°C, 300 and 600 Volt, UL/CSA Portable Cord



TYPE SJTOW — 300 VOLT — UL/CSA

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WEIGHT LBS/M'(S)
				INCHES	mm	INCHES	mm		
86902*	2	18	16/30	0.030	0.76	0.290	7.37	10	42
86903*	3	18	16/30	0.030	0.76	0.305	7.75	10	54
86904*	4	18	16/30	0.030	0.76	0.335	8.51	7	65
86912*	2	16	26/30	0.030	0.76	0.315	8.00	13	57
86913	3	16	26/30	0.030	0.76	0.330	8.38	13	70
86914*	4	16	26/30	0.030	0.76	0.365	9.27	10	86
86922*	2	14	41/30	0.030	0.76	0.345	8.76	18	67
86923	3	14	41/30	0.030	0.76	0.365	9.27	18	92
86924	4	14	41/30	0.030	0.76	0.415	10.54	15	114
86932*	2	12	65/30	0.030	0.76	0.410	10.44	25	95
86933	3	12	65/30	0.030	0.76	0.430	10.92	25	132
86934*	4	12	65/30	0.030	0.76	0.485	12.32	20	167

TYPE STOW — 600 VOLT — UL/CSA

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WEIGHT LBS/M'(S)
				INCHES	mm	INCHES	mm		
86952*	2	18	16/30	0.030	0.76	0.350	8.89	10	60
86953	3	18	16/30	0.030	0.76	0.365	9.27	10	72
86954*	4	18	16/30	0.030	0.76	0.395	10.03	7	85
86962*	2	16	26/30	0.030	0.76	0.375	9.58	13	76
86963	3	16	26/30	0.030	0.76	0.395	10.08	13	90
86964	4	16	26/30	0.030	0.76	0.425	10.80	10	107
86972*	2	14	41/30	0.045	1.14	0.505	12.83	18	120
86973	3	14	41/30	0.045	1.14	0.535	13.59	18	156
86974	4	14	41/30	0.045	1.14	0.585	14.86	15	184
86982*	2	12	65/30	0.045	1.14	0.585	14.86	25	165
86983	3	12	65/30	0.045	1.14	0.615	15.62	25	208
86984*	4	12	65/30	0.045	1.14	0.665	16.89	20	254

* Non-stock item; minimum quantity purchase required.
† Green conductor for grounding only. Ampacities based on NEC Table 400.5(A)(1).
(S) Actual shipping weight may vary.

Product Construction:

Conductors:
- 18 through 12 AWG fully annealed stranded bare copper

Insulation:
- Premium-grade, color-coded PVC
- Color code: See chart below

Jacket:
- Polyvinylchloride (PVC), gray or yellow
- Temperature range: -40°C to +90°C
- Voltage rating:
  300 volts Type SJTOW
  600 volts Type STOW

Jacket Marking:
- CAROL SJTOW -
  CAROL (SIZE) (mm²) 90°C (UL) E11368-8
  WATER RESISTANT SJTOW CSA LL69381
  (-40°C) FT2 ROHS MADE IN USA 300 V
- CAROL STOW -
  CAROL (SIZE) (mm²) 90°C (UL) E11368-8
  WATER RESISTANT STOW CSA LL69381
  (-40°C) FT2 ROHS MADE IN USA 600 V

Applications:
- Portable tools
- Motors
- Floor maintenance equipment
- Hospital equipment
- Sound equipment
- Washing machines
- Portable lights
- Lamps and similar equipment

Features:
- Oil- and water-resistant* jacket
- Resists:
  – Oils
  – Water
  – Acids
  – Alkalies
- Ozone-, sunlight (UV)- and weather-resistant
- UL Listed and CSA Certified for indoor and outdoor use

Industry Approvals:
- UL Flexible Cord - UL 62
- CSA Flexible Cord - C22.2-49
- RoHS Compliant

Packaging:
- 250' (76.2 m), 500' (152.4 m), and 1000' (304.8 m)
- Other sizes and put-ups available on special order

* Suitable for immersion in water if properly sealed and terminated.

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
2	Black, White
3	Black, White, Green
4	Black, White, Red, Green

CAROL BRAND UL LISTED CSA RoHS Compliant Directive 2011/65/EU Made in U.S.A. General Cable

Type SVT

60°C, 300 Volt, UL/CSA Portable Cord

Product Construction:

Conductors:
- 18 AWG annealed stranded bare copper

Insulation:
- Premium-grade, color-coded PVC
- Color code: See chart below

Jacket:
- Polyvinylchloride (PVC)
- Colors available: black, white, gray
- Temperature range: -20°C to +60°C
- Ribbed jacket

Jacket Marking:
- (SIZE) (mm^2) 60°C SVT (UL) E# --- CSA LL# FT2 ROHS MADE IN USA 300 V

Applications:
- Vacuum cleaners
- Food mixers
- Office equipment

Features:
- Resists:
  - Acids
  - Alkalies
  - Ozone

Industry Approvals:
- UL Listed
- CSA Certified
- RoHS Compliant

Packaging:
- 250' (76.2 m)
- Other sizes and put-ups available on special order

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
2	Black, White
3	Black, White, Green



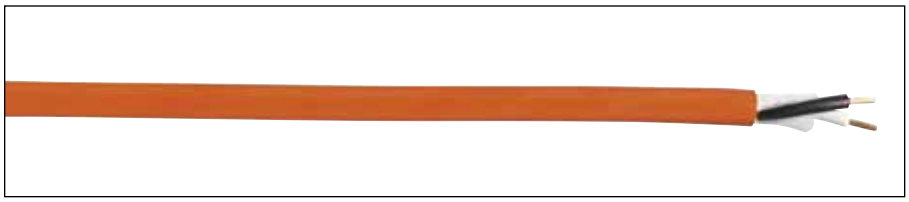
TYPE SVT — 300 VOLT — UL/CSA

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WEIGHT LBS/M'(S)	STD. CTN.
				INCHES	mm	INCHES	mm			
86002	2	18	41/34	0.015	0.38	0.235	5.97	10	35	1000'
86003	3	18	41/34	0.015	0.38	0.240	6.10	10	40	1000'

† Green conductor for grounding only. Ampacities based on NEC Table 400.5(A)(1).
(S) Actual shipping weight may vary.

Type SJT

60°C, 300 Volt, UL/CSA Portable Cord



TYPE SJT — 300 VOLT — UL

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WEIGHT LBS/M'(S)	STD. CTN.
				INCHES	mm	INCHES	mm			
86012*	2	18	16/30	0.030	0.76	0.285	7.24	10	45	1000'
86013	3	18	16/30	0.030	0.76	0.305	7.75	10	55	1000'
86022	2	16	26/30	0.030	0.76	0.315	8.00	13	50	1000'
86023	3	16	26/30	0.030	0.76	0.335	8.51	13	70	250'
86333	3	14	41/30	0.030	0.76	0.365	9.27	18	85	250'
86343	3	12	65/30	0.030	0.76	0.440	11.18	25	130	250'

* Non-stock item; minimum quantity purchase required.
** 600 Volt Type ST also available on special order.
† Green conductor for grounding only. Ampacities based on NEC Table 400.5(A)(1).
(S) Actual shipping weight may vary.

Product Construction:

Conductors:
- 18 through 12 AWG annealed stranded bare copper

Insulation:
- Premium-grade, color-coded PVC
- Color code: See chart below

Jacket:
- Polyvinylchloride (PVC)
  18 and 16 AWG - black only
  14 and 12 AWG - orange only
- Temperature range: -20°C to +60°C

Jacket Marking:
- (NO. COND) (SIZE) (mm^2) 60°C SJT E# (UL) --- CSA LL# FT2 ROHS MADE IN USA 300 V

Applications:
- Portable tools
- Motors
- Portable lights
- Lamps

Features:
- Resists:
  - Acids
  - Alkalies
  - Ozone

Industry Approvals:
- UL Listed
- CSA Certified
- RoHS Compliant

Packaging:
- 250' (76.2 m)
- Other sizes and put-ups available on special order

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
2	Black, White
3	Black, White, Green

Type SJT

105°C, 300 Volt, UL/CSA Portable Cord

Product Construction:

Conductors:
- 18 AWG fully annealed stranded bare copper

Insulation:
- Premium-grade, color-coded PVC
- Color code: See chart below

Jacket:
- Polyvinylchloride (PVC), white
- Temperature range: -20°C to +105°C

Jacket Marking:
- (SIZE) (mm^2) 105°C SJT E# (UL) --- CSA LL# FT2 ROHS MADE IN USA 300 V

Applications:
- For use in most hospital equipment

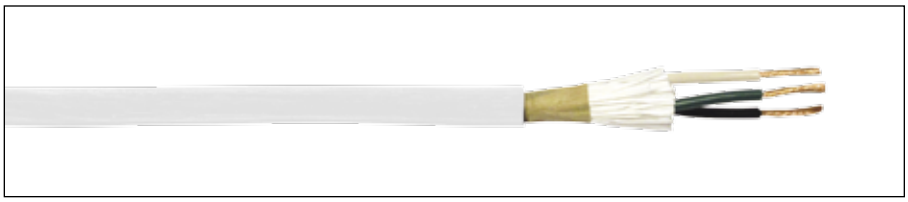
Features:
- Resists:
  - Acids
  - Alkalies
  - Ozone

Industry Approvals:
- UL Listed
- CSA Certified
- RoHS Compliant

Packaging:
- 250' (76.2 m)
- Other sizes and put-ups available on special order

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
2	Black, White
3	Black, White, Green



TYPE SJT — 300 VOLT — UL/CSA

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WEIGHT LBS/M'(S)	STD. CTN.
				INCHES	mm	INCHES	mm			
86112*	2	18	16/30	0.030	0.76	0.285	7.24	10	45	1000'
86113	3	18	16/30	0.030	0.76	0.310	7.87	10	55	1000'

* Non-stock item; minimum quantity purchase required.
† Green conductor for grounding only. Ampacities based on NEC Table 400.5(A)(1).
(S) Actual shipping weight may vary.

Bus Drop Cable

60ºC, 600 Volt, UL Listed



BUS DROP CABLE — 600 VOLT — UL

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS†	APPROX. NET WEIGHT LBS/M'(S)	STD. CTN.
				INCHES	mm	INCHES	mm			
03714	3	14	19	0.030	0.76	0.400	10.16	15	120	250'
03712	3	12	19	0.030	0.76	0.425	10.80	20	150	250'
03710	3	10	19	0.030	0.76	0.485	12.32	25	225	250'
03708	3	8	19	0.045	1.14	0.625	15.88	35	370	250'
03706	3	6	19	0.060	1.52	0.770	19.56	45	600	250'
03704	3	4	19	0.060	1.52	0.950	24.13	60	751	250'
03702	3	2	133	0.060	1.52	1.145	29.08	80	1097	250'

† Ampacities based on NEC Table 400.5(A)(1).
(S) Actual shipping weight may vary.

Product Construction:

Conductors:
- 14 through 2 AWG annealed stranded bare copper per ASTM B8

Insulation:
- Premium-grade, color-coded Polyvinylchloride (PVC)
- Color code: black, white, red

Jacket:
- Polyvinylchloride (PVC) jacket, gray
- Temperature range: -20°C to +60°C

Jacket Marking:
- (SIZE) BUS DROP CABLE 600 V E# (UL)

Applications:
- As branches from busways per NEC
- Connection of stationary equipment to facilitate relocation of equipment

Features:
- One uninsulated ground conductor per interstice (3 ground conductors total)
- Resistant to oils, lubricants, water, acids, alkalies, ozone and abrasion

Industry Approvals:
- UL Listed
- RoHS Compliant

Packaging:
- 250' reel (76.2 m) as standard
- 500' (152.4 m) and 1000' (304.8 m) reels also available
- Other put-ups available on special order

Thermostat Wire

105ºC, 150 Volt, UL Type CL2

Product Construction:

Conductors:
- 20 and 18 AWG annealed solid bare copper per ASTM B3

Insulation:
- Premium-grade, color-coded PVC
- Color code: See chart below

Jacket:
- Polyvinylchloride (PVC), white or brown
- Temperature range: -20ºC to +105ºC

Jacket Marking:
- CAROL AWG TYPE CL2 E# (UL) 105ºC SUNLIGHT RESISTANT - MADE IN USA

Applications:
- Thermostat control
- Heating and air conditioning installations
- Touch-plate systems
- Burglar alarms
- Intercom systems
- Door bells
- Annunciator and bell systems
- Remote control units
- Signal systems
- Other low-voltage installations

Industry Approvals:
- UL Listed Type CL2
- RoHS Compliant

Packaging:
- 4- through 10-conductor available on 250' (76.2 m) spools
- 2- and 3-conductor available on 500' (152.4 m) spools
- Other put-ups available on special order



20 AWG THERMOSTAT WIRE — 150 VOLT — UL TYPE CL2

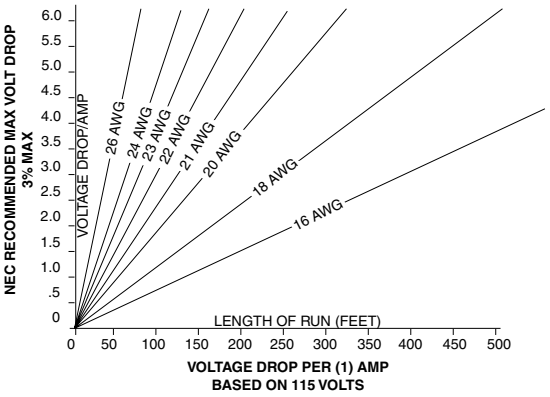
CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		APPROX. NET WEIGHT LBS/M'(S)	STD. CTN.
				INCHES	mm	INCHES	mm		
05482	2	20	Solid	0.008	0.203	0.126	3.20	11	1000'
05483	3	20	Solid	0.008	0.203	0.133	3.38	16	1000'
05484	4	20	Solid	0.008	0.203	0.142	3.61	19	500'
05485	5	20	Solid	0.008	0.203	0.160	4.06	24	500'
05486	6	20	Solid	0.008	0.203	0.175	4.45	27	500'
05487	7	20	Solid	0.008	0.203	0.175	4.45	31	500'
05488	8	20	Solid	0.008	0.203	0.189	4.80	35	500'
05489*	9	20	Solid	0.008	0.203	0.204	5.18	40	500'
05481*	10	20	Solid	0.008	0.203	0.222	5.64	45	250'

18 AWG THERMOSTAT WIRE — 150 VOLT — UL TYPE CL2

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		APPROX. NET WEIGHT LBS/M'(S)	STD. CTN.
				INCHES	mm	INCHES	mm		
05582	2	18	Solid	0.008	0.203	0.142	3.61	16	1000'
05583	3	18	Solid	0.008	0.203	0.150	3.81	22	1000'
05584	4	18	Solid	0.008	0.203	0.165	4.19	28	500'
05585	5	18	Solid	0.008	0.203	0.181	4.60	36	500'
05586	6	18	Solid	0.008	0.203	0.208	5.28	42	500'
05587	7	18	Solid	0.008	0.203	0.208	5.28	48	500'
05588	8	18	Solid	0.008	0.203	0.225	5.72	54	500'
05589*	9	18	Solid	0.008	0.203	0.243	6.17	61	500'
05581	10	18	Solid	0.008	0.203	0.264	6.71	69	250'

(S) Actual shipping weight may vary.

APPROXIMATE VOLTAGE DROP/AMP AT 68ºF



COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
2	White, Red
3	White, Red, Green
4	White, Red, Green, Blue
5	White, Red, Green, Blue, Yellow
6	White, Red, Green, Blue, Yellow, Brown
7	White, Red, Green, Blue, Yellow, Brown, Orange
8	White, Red, Green, Blue, Yellow, Brown, Orange, Black
9	White, Red, Green, Blue, Yellow, Brown, Orange, Black, Purple
10	White, Red, Green, Blue, Yellow, Brown, Orange, Black, Purple, Gray

General Cable

Made in U.S.A.

RoHS Compliant Directive 2011/65/EU

UL LISTED

CAROL BRAND

Thermostat Wire

60ºC, 30 Volt, CSA Type LVT



18 AWG THERMOSTAT WIRE — 30 VOLT — CSA TYPE LVT

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		APPROX. NET WEIGHT LBS/M[1(S)]	STD. CTN.
				INCHES	mm	INCHES	mm		
05092	2	18	Solid	0.016	0.41	0.210	5.33	25	2000'
05093*	3	18	Solid	0.016	0.41	0.220	5.59	33	500'
05094	4	18	Solid	0.016	0.41	0.242	6.15	41	1000'
05095	5	18	Solid	0.016	0.41	0.262	6.65	50	1000'
05096*	6	18	Solid	0.016	0.41	0.280	7.11	60	1000'
05097*	7	18	Solid	0.016	0.41	0.285	7.24	65	1000'
05098	8	18	Solid	0.016	0.41	0.304	7.75	74	1000'
05099*	9	18	Solid	0.016	0.41	0.328	8.33	83	1000'
05091*	10	18	Solid	0.016	0.41	0.360	9.14	92	250'

* Non-stock item; minimum quantity purchase required.
(S) Actual shipping weight may vary.

Product Construction:

Conductors:
- 18 AWG annealed solid bare copper per ASTM B3

Insulation:
- Premium-grade, color-coded PVC
- Color code: See chart below

Jacket:
- Polyvinylchloride (PVC), brown
- Temperature range: -20°C to +60°C

Jacket Marking:
- CAROL (SIZE) CSA LL# TYPE LVT FT4

Applications:
- Thermostat control
- Heating and air conditioning installations
- Touch-plate systems
- Burglar alarms
- Intercom systems
- Door bells
- Annunciator and bell systems
- Remote control units
- Signal systems
- Other low-voltage installations

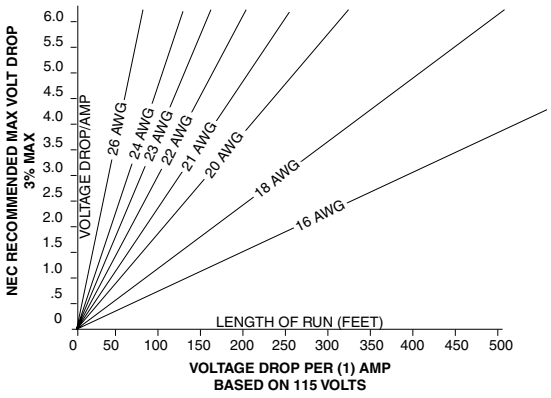
Industry Approvals:
- CSA Type LVT
- RoHS Compliant

Packaging:
- 4- through 10-conductor available on 250' (76.2 m) spools
- 2- and 3-conductor available on 500' (152.4 m) spools
- Other put-ups available on special order

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
2	White, Red
3	White, Red, Green
4	White, Red, Green, Blue
5	White, Red, Green, Blue, Yellow
6	White, Red, Green, Blue, Yellow, Brown
7	White, Red, Green, Blue, Yellow, Brown, Orange
8	White, Red, Green, Blue, Yellow, Brown, Orange, Black
9	White, Red, Green, Blue, Yellow, Brown, Orange, Black, Purple
10	White, Red, Green, Blue, Yellow, Brown, Orange, Black, Purple, Gray

APPROXIMATE VOLTAGE DROP/AMP AT 68ºF



CAROL BRAND

Certified Canadian Standard Association

RoHS Compliant Directive 2011/65/EU

Made in U.S.A.

General Cable

Thermostat Wire, Unjacketed

60ºC, Low-Voltage and Intercom Cable

Product Construction:

Conductors:
- 20 AWG annealed solid bare copper per ASTM B3

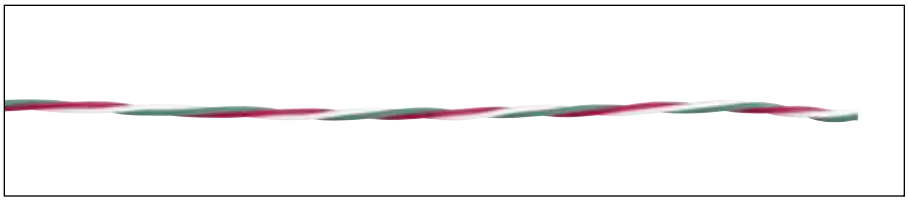
Insulation:
- Premium-grade, color-coded PVC
- Temperature range: -20ºC to +60ºC
- Color code: See chart below

Jacket:
- This product is unjacketed

Applications:
- Thermostat control
- Heating and air conditioning installations
- Touch-plate systems
- Burglar alarms
- Intercom systems
- Door bells
- Annunciator and bell systems
- Remote control units
- Signal systems
- Other low-voltage installations

Packaging:
- 4- through 8-conductor available on 250' (76.2 m) spools
- 2- and 3-conductor available on 500' (152.4 m) spools
- Other put-ups available on special order

Industry Approvals:
- RoHS Compliant



20 AWG — TWISTED CONDUCTORS — NO JACKET

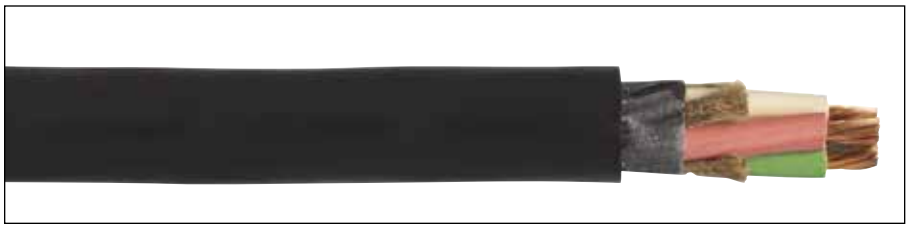
CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		APPROX. NET WEIGHT LBS/M'(S)	STD. CTN.
				INCHES	mm	INCHES	mm		
05782	2	20	Solid	0.008	0.203	0.096	2.44	7.5	4000'
05783	3	20	Solid	0.008	0.203	0.104	2.64	11.0	2000'
05784*	4	20	Solid	0.008	0.203	0.116	2.95	15.0	2000'
05785*	5	20	Solid	0.008	0.203	0.130	3.30	18.5	1000'
05786*	6	20	Solid	0.008	0.203	0.144	3.66	22.0	1000'
05788*	8	20	Solid	0.008	0.203	0.159	4.04	30.0	1000'

* Non-stock item; minimum quantity purchase required.
(S) Actual shipping weight may vary.

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
2	White, Red
3	White, Red, Green
4	White, Red, Green, Blue
5	White, Red, Green, Blue, Yellow
6	White, Red, Green, Blue, Yellow, Brown
8	White, Red, Green, Blue, Yellow, Brown, Orange, Black

Industrial Cord 4



No longer are industrial cord products used only in coal mines and industrial plants; today typical applications include providing temporary power to job sites, as well as flexible power leads for installation in conduit.

General Cable's role, as the producer of the premiere Carol® Brand industrial cord products, is to ensure that new product development, product innovation and quality not only keep pace with industry requirements but also set the trends.

Our industrial cord products carry a full range of listings and certifications with Underwriters Laboratories, Inc. and the Canadian Standard Association. In addition, many products meet or exceed the requirements of UL, CSA, OSHA, MSHA, ICEA and other relevant industry standards.

Carol is simply the most accepted brand in the industry, having proven itself on the job time after time. Our industrial cord line is the most comprehensive in the industry, ensuring that the proper Carol product can always be specified.

Index **Page**

Super Vu-Tron® Single Conductor Type W and Types RHH/RHW 35

Super Vu-Tron® Multi-Conductor Type W Round 36

Super Vu-Tron® Type G and Type G-GC Round 37

Super Vu-Tron® Canadian Type G-GC Round 38

Carol® Double Jacket Drill Cord 39

Carolprene® 105°C Welding Cable 40

Carolprene® 90°C Welding Cable 41

Super Vu-Tron® Welding Cable Types RHH/RHW 42

Super Vu-Tron® Entertainment Industry and Stage Lighting Cable 43

Super Vu-Tron® Single Conductor Type W Extra Flex 44

Diesel Locomotive Cable Types RHH/RHW-2 45

Super Vu-Tron® DLO 46

Super Vu-Tron® Single Conductor

90ºC (UL), Type W, 2000 Volt and Types RHH/RHW 600 Volt Portable Power Cable

Product Construction:

Conductor:
- 8 AWG through 500 kcmil fully annealed stranded bare copper

Insulation:
- Premium-grade 90ºC EPDM

Jacket:
- Super Vu-Tron® 90ºC, black
- Temperature range: -40°C to +90°C
- Voltage rating:
  600 volts Type RHH/RHW
  2000 volts Type W
- An open polyester braid reinforcement is applied between the insulation and jacket for mechanical strength

Jacket Marking:
- 8-1 AWG: CAROL SUPER VU-TRON® TYPE W PORTABLE POWER CABLE (UL) DRY 90°C WET 75°C 2000 V SUNLIGHT RESISTANT P-7K-123049-MSHA (SIZE) TYPE RHH OR RHW (UL) 600 V MADE IN USA
- 1/0-500 kcmil: CAROL SUPER VU-TRON® TYPE W PORTABLE POWER CABLE (UL) DRY 90°C WET 75°C 2000 V SUNLIGHT RESISTANT P-7K-123049-MSHA (SIZE) TYPE RHH OR RHW (UL) 600 V FOR CT USE --- CSA TYPE W (-40°C) 2 KV FT5 MADE IN USA

Applications:
- Portable power systems
- Entertainment industry activities such as theatre, television, night clubs, motion pictures, mobile communication vans, spotlights and sound systems
- Other similar applications that would require permanent or temporary power
- Permanent wiring of 600 volt power supplies, hoists, cranes and other applications where flexible power leads must be installed in conduit or raceways

Features:
- Water-resistant*
- Sunlight-resistant
- Designed to withstand severe environmental conditions
- Withstands exposure to oil, acids, alkalies, heat, flame, moisture and chemicals
- Meets or exceeds flame test requirements of MSHA and UL

Industry Approvals:
- UL Type W
- UL Type RHH or RHW
- MSHA Approved
- RoHS Compliant

Packaging:
- Lengths cut to order

*Suitable for immersion in water if properly sealed and terminated.



TYPE W 2000 VOLT (UL) AND TYPE RHH/RHW 600 VOLT (UL)

CATALOG NUMBER	NO. OF COND.	AWG OR kcmil	COND. STRAND	NOMINAL COND. O.D.		NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS		APPROX. NET WT. LBS/ M[1(S)]
				INCHES	mm	INCHES	mm	INCHES	mm	(1)	(2)	
83008*	1	8	133	0.160	4.06	0.060	1.52	0.470	11.94	55	80	145
83006	1	6	259	0.198	5.03	0.060	1.52	0.545	13.84	75	105	205
83004	1	4	259	0.245	6.22	0.060	1.52	0.595	15.11	95	140	270
83002	1	2	259	0.294	7.47	0.060	1.52	0.670	17.02	130	190	380
83001	1	1	259	0.346	8.79	0.080	2.03	0.730	18.54	150	220	465
83010	1	1/0†	259	0.384	9.75	0.080	2.03	0.790	20.07	170	260	550
83020	1	2/0†	259	0.441	11.20	0.080	2.03	0.865	21.97	195	300	675
83030	1	3/0†	259	0.482	12.24	0.080	2.03	0.910	23.11	225	350	790
83040	1	4/0†	259	0.555	14.10	0.080	2.03	0.960	24.38	260	405	940
83250	1	250†	627	0.615	15.62	0.105	2.67	1.045	26.54	290	455	1125
83350	1	350†	855	0.725	18.42	0.105	2.67	1.145	29.08	350	570	1465
83500	1	500†	1235	0.880	22.35	0.105	2.67	1.315	33.40	430	700	2010

* Non-stock item; minimum quantity purchase required.

(1) Ampacities based on 90°C conductor and 30°C ambient temperature based on Table 310.15(B)(16) in the National Electrical Code® for RHH/RHW with not more than three current-carrying conductors in raceway, cable or earth.

(2) Ampacities based on 90°C conductor and 30°C ambient temperature based on Table 310.15(B)(17) and Table 400.5(A)(2) in the National Electrical Code® for single-conductor cables.

(S) Actual shipping weight may vary.

† Designated for CT use.

General Cable

Made in U.S.A.

RoHS Compliant Directive 2011/65/EU

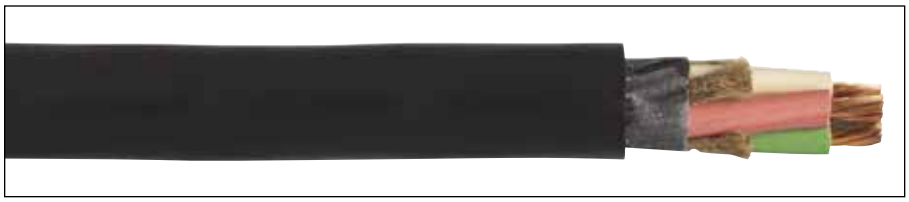
MSHA Mine Safety and Health Administration

UL LISTED

CAROL BRAND

Super Vu-Tron® Multi-Conductor Type W Round

90°C (UL), Type W, 2000 Volt Portable Power Cable



CATALOG NUMBER	NO. OF COND.	AWG OR kcmil	COND. STRAND	NOMINAL COND. O.D.		NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS(1)	APPROX. NET WT. LBS/M'(S)
				INCHES	mm	INCHES	mm	INCHES	mm		
2 CONDUCTOR – TYPE W – 2000 VOLT											
81312	2	8	133	0.160	4.06	0.060	1.52	0.770	19.56	74	325
81622	2	6	259	0.198	5.03	0.060	1.52	0.910	23.11	99	470
81642	2	4	259	0.245	6.22	0.060	1.52	1.020	25.91	130	620
81662	2	2	259	0.297	7.54	0.080	2.03	1.210	30.73	174	935
81372*	2	1	259	0.353	8.97	0.080	2.03	1.370	34.80	202	1305
81382*	2	1/0	259	0.385	9.78	0.080	2.03	1.435	36.45	234	1555
81392*	2	2/0	259	0.442	11.23	0.080	2.03	1.555	39.50	271	1860
81402*	2	3/0	259	0.480	12.19	0.080	2.03	1.670	42.42	313	2230
81412*	2	4/0	259	0.555	14.10	0.080	2.03	1.815	46.10	361	2655
3 CONDUCTOR – TYPE W – 2000 VOLT											
81313	3	8	133	0.160	4.06	0.060	1.52	0.945	24.00	74	470
81623	3	6	259	0.198	5.03	0.060	1.52	1.020	25.91	99	625
81643	3	4	259	0.245	6.22	0.060	1.52	1.135	28.83	130	810
81663	3	2	259	0.297	7.54	0.080	2.03	1.345	34.16	174	1190
81373*	3	1	259	0.353	8.97	0.080	2.03	1.455	36.96	202	1655
81383	3	1/0	259	0.385	9.78	0.080	2.03	1.585	40.26	234	1965
81393	3	2/0	259	0.442	11.23	0.080	2.03	1.675	42.55	271	2350
81403*	3	3/0	259	0.480	12.19	0.080	2.03	1.815	46.10	313	2890
81413*	3	4/0	259	0.555	14.10	0.080	2.03	1.950	49.53	361	3285
81423*	3	250	627	0.615	15.62	0.095	2.41	2.390	60.71	402	5070
81443*	3	350	855	0.725	18.42	0.095	2.41	2.680	68.07	495	6570
81473*	3	500	1235	0.880	22.35	0.095	2.41	3.030	76.96	613	8700
4 CONDUCTOR – TYPE W – 2000 VOLT											
81314	4	8	133	0.160	4.06	0.060	1.52	0.980	24.89	65	615
81624	4	6	259	0.198	5.03	0.060	1.52	1.070	27.18	87	800
81644	4	4	259	0.245	6.22	0.060	1.52	1.210	30.73	114	1040
81664	4	2	259	0.297	7.54	0.080	2.03	1.435	36.45	152	1580
81374	4	1	259	0.353	8.97	0.080	2.03	1.595	40.51	177	2045
81384	4	1/0	259	0.385	9.78	0.080	2.03	1.705	43.31	205	2430
81394	4	2/0	259	0.442	11.23	0.080	2.03	1.845	46.86	237	2950
81404	4	3/0	259	0.480	12.19	0.080	2.03	1.965	49.91	274	3430
81414	4	4/0	259	0.555	14.10	0.080	2.03	2.145	54.48	316	3885
5 CONDUCTOR – TYPE W – 2000 VOLT											
81315	5	8	133	0.160	4.06	0.060	1.52	1.030	26.16	52	650
81625	5	6	259	0.198	5.03	0.060	1.52	1.170	29.72	69	915
81645	5	4	259	0.245	6.22	0.060	1.52	1.360	34.54	91	1320
81665	5	2	259	0.297	7.54	0.080	2.03	1.595	40.51	121	1925
81375*	5	1	259	0.353	8.97	0.080	2.03	1.820	46.23	141	2675
81385	5	1/0	259	0.385	9.78	0.080	2.03	1.900	48.26	164	2885
81395*	5	2/0	259	0.442	11.23	0.080	2.03	2.060	52.32	189	3630
81405*	5	3/0	259	0.480	12.19	0.080	2.03	2.260	57.40	219	4900
81415*	5	4/0	259	0.555	14.10	0.080	2.03	2.460	62.48	252	5980

(1) Ampacities based on 90°C conductor and 30°C ambient temperature per Table 400.5(A)(2) of the National Electrical Code®.
* Non-stock item; minimum quantity purchase required.
** Green conductor for grounding only.
(S) Actual shipping weight may vary.

Product Construction:

Conductor:
- 8 AWG through 500 kcmil fully annealed stranded bare copper

Insulation:
- Premium-grade, color-coded 90°C EPDM
- Color code: See chart below

Jacket:
- Super Vu-Tron® 90°C, black
- Temperature range: -40°C to +90°C

Jacket Marking:
- SIZES SMALLER THAN 2-1/4" – CAROL SUPER VU-TRON® (SIZE) TYPE W PORTABLE POWER CABLE (UL) 2000 V DRY 90°C WET 75°C SUN RES P-7K-123049-MSHA---CSA TYPE W (-40°C) 2 KV FT5 MADE IN USA
- SIZES 2-1/4" AND LARGER – (SIZE) TYPE W CAROL SUPER VU-TRON® 90°C DRY AND WATER RESISTANT 75°C 2000 V SUN RES (UL) P-7K-123049 MSHA LR27161 MADE IN USA

Applications:
- Industrial and light- to medium-duty mining applications
- Heavy-duty service as power supply cable
- AC systems (grounded and ungrounded)
- Mobile and portable electrical equipment
- Motor and battery leads
- 2-conductor cables—use on DC or AC single-phase systems where grounding is not required
- 3-conductor cables—use on AC systems where no grounding is required or on DC systems with one conductor for grounding
- 4-conductor cables—use on two- or three-phase AC systems with one conductor used for grounding
- 5-conductor cables—use in applications where separating the system neutral from the frame ground is required

Features:
- Withstands severe environmental conditions
- Suitable for immersion in water*
- Indent-printed for easy identification
- Withstands exposure to oil, acids, alkalies, heat, moisture and most chemicals
- Rope lay stranding for maximum flex life
- Excellent impact resistance
- Cable core bound for superior flexibility and toughness
- Sunlight-resistant

Industry Approvals:
- CSA Type W
- MSHA Approved
- UL Type W
- RoHS Compliant

Packaging:
- Lengths cut to order

*Suitable for immersion in water if properly sealed and terminated.

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR**
2	Black, White
3	Black, White, Green
4	Black, White, Red, Green
5	Black, White, Red, Green, Orange

CAROL BRAND · UL LISTED · CSA Certified Canadian Standard Association · MSHA Mine Safety and Health Administration · RoHS Compliant Directive 2011/65/EU · Made in U.S.A. · General Cable

Super Vu-Tron® Type G and Type G-GC Round

90°C (UL), 2000 Volt Portable Power Cable

Product Construction:

Conductor:
- 8 AWG through 500 kcmil fully annealed stranded bare copper

Insulation:
- Premium-grade, color-coded 90°C EPDM
- Color code: See chart below
- Insulated grounds and ground checks

Jacket:
- Super Vu-Tron® 90°C, black
- Temperature range: -40°C to +90°C

Jacket Marking:
- TYPE G-GC (4/0 AND SMALLER) – CAROL SUPER VU-TRON® SIZE (mm²) TYPE G-GC PORTABLE POWER CABLE (UL) 2000 V DRY 90°C WET 75°C SUN RES P-7K-123049-MSHA --- CSA TYPE G-CG (-40°C) 2 KV FT5 MADE IN USA
- TYPE G-GC (LARGER THAN 4/0) - (SIZE) TYPE G-GC CAROL SUPER VU-TRON® 90°C DRY AND WATER RESISTANT 75°C 2000 V SUN RES (UL) P-7K-123049 MSHA LR27161 MADE IN USA
- TYPE G - CAROL SUPER VU-TRON® SIZE (mm²) TYPE G PORTABLE POWER CABLE (UL) 600/2000 V DRY 90°C WET 75°C SUN RES P-7K-123049 MHSA --- CSA TYPE G (-40°C) 2 KV FT5 MADE IN USA

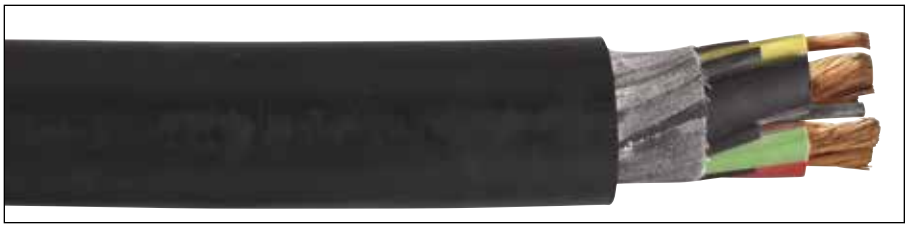
Applications:
- Industrial and light- to medium-duty mining applications
- Heavy-duty service as power supply cable
- Mobile and portable electrical equipment
- 3- and 4-conductor—use on three-phase AC systems where grounding is required

Features:
- Excellent impact and abrasion resistance
- Withstands exposure to oil, acids, alkalies, heat, moisture and most chemicals
- Suitable for immersion in water*
- Indent-printed for easy identification
- Rope lay stranding for maximum flex life
- Cable core bound for superior flexibility and toughness
- Non-wicking rubber fillers (G-GC)
- Canadian color code available upon request
- Sunlight-resistant

Industry Approvals:
- UL Type G, G-GC
- CSA
- MSHA Approved
- RoHS Compliant

Packaging:
- Lengths cut to order

*Suitable for immersion in water if properly sealed and terminated.



3 CONDUCTOR – TYPE G-GC – 2000 VOLT

CATALOG NUMBER	NO. OF COND.	AWG OR kcmil	COND. STRAND	NOMINAL COND. O.D. INCHES	NOMINAL COND. O.D. mm	YELLOW GROUND CHECK AWG SIZE	GREEN GROUND COND. AWG SIZE	NOMINAL INS. THICKNESS INCHES	NOMINAL INS. THICKNESS mm	NOMINAL O.D. INCHES	NOMINAL O.D. mm	CURR. AMPS(1)	APPROX. NET WT. LBS/M*(S)
82313	3	8	133	0.160	4.06	10	2#10	0.060	1.52	0.965	24.51	65	600
82623	3	6	259	0.198	5.03	10	2#10	0.060	1.52	1.025	26.04	87	770
82643	3	4	259	0.245	6.22	10	2#8	0.060	1.52	1.130	28.70	114	1015
82663	3	2	259	0.297	7.54	8	2#7	0.080	2.03	1.345	34.16	152	1480
82373	3	1	259	0.353	8.97	8	2#6	0.080	2.03	1.455	36.96	177	1795
82383	3	1/0	259	0.385	9.78	8	2#5	0.080	2.03	1.585	40.26	205	2245
82393	3	2/0	259	0.442	11.23	8	2#4	0.080	2.03	1.675	42.55	237	2570
82403	3	3/0	259	0.480	12.19	8	2#3	0.080	2.03	1.810	45.97	274	3230
82413	3	4/0	259	0.555	14.10	8	2#2	0.080	2.03	1.950	49.53	316	3700
82423(2)*	3	250	627	0.615	15.62	8	2#2	0.095	2.41	2.390	60.71	352	6060
82443(2)*	3	350	855	0.725	18.42	8	2#1/0	0.095	2.41	2.680	68.07	433	7400
82473(2)*	3	500	1235	0.880	22.35	8	2#2/0	0.095	2.41	3.030	76.96	536	10100

4 CONDUCTOR – TYPE G – 600/2000 VOLT

CATALOG NUMBER	NO. OF COND.	AWG OR kcmil	COND. STRAND	NOMINAL COND. O.D. INCHES	NOMINAL COND. O.D. mm	GREEN COND. AWG SIZE	NOMINAL INS. THICKNESS INCHES	NOMINAL INS. THICKNESS mm	NOMINAL O.D. INCHES	NOMINAL O.D. mm	CURRENT AMPS(1)	APPROX. NET WT. LBS/M*(S)
82314	4	8	133	0.160	4.06	4#12	0.060	1.52	1.045	26.54	52	690
82624	4	6	259	0.198	5.03	4#12	0.060	1.52	1.125	28.58	70	880
82644	4	4	259	0.245	6.22	4#10	0.060	1.52	1.225	31.12	91	1160
82664	4	2	259	0.297	7.54	4#9	0.080	2.03	1.435	36.45	122	1720
82374*	4	1	259	0.353	8.97	4#8	0.080	2.03	1.590	40.39	142	2200
82384	4	1/0	259	0.385	9.78	4#7	0.080	2.03	1.730	43.94	164	2705
82394	4	2/0	259	0.442	11.23	4#6	0.080	2.03	1.855	47.12	190	3190
82404	4	3/0	259	0.480	12.19	4#5	0.080	2.03	2.040	51.82	219	4005
82414	4	4/0	259	0.555	14.10	4#4	0.080	2.03	2.145	54.48	253	4560

(1) Ampacities based on 90°C conductor and 30°C ambient temperature per Table 400.5(A)(2) of the National Electrical Code®.
(2) UL Listed and CSA Certified.
* Non-stock item; minimum quantity purchase required.
(S) Actual shipping weight may vary.

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
3	Black, White, Red
4	Black, White, Red, Orange

General Cable

Made in U.S.A.

RoHS Compliant Directive 2011/65/EU

MSHA Mine Safety and Health Administration

Certified Canadian Standard Association

UL LISTED

CAROL BRAND

Super Vu-Tron® Canadian Type G-GC Round

90°C, 2000 Volt Portable Power Cable



3 CONDUCTOR – TYPE G-GC – 2000 VOLT

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL COND. O.D.		YELLOW GROUND CHECK AWG SIZE	GROUND COND. AWG SIZE	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURR. AMPS(1)	APPROX. NET WT. LBS/ M'(S)
				INCHES	mm			INCHES	mm	INCHES	mm		
83103	3	8	133	0.160	4.06	10	2#10	0.060	1.52	0.945	24.00	65	827
83113	3	6	259	0.198	5.03	10	2#10	0.060	1.52	1.025	26.04	87	770
83123	3	4	259	0.245	6.22	10	2#8	0.060	1.52	1.140	28.96	114	1015
83133	3	2	259	0.297	7.54	8	2#6	0.080	2.03	1.345	34.16	152	1480
83143	3	1	259	0.353	8.97	8	2#6	0.080	2.03	1.455	36.96	177	1795
83153	3	1/0	259	0.385	9.78	8	2#4	0.080	2.03	1.585	40.26	205	2245
83163	3	2/0	259	0.442	11.23	8	2#4	0.080	2.03	1.685	42.80	237	2570
83183	3	4/0	259	0.555	14.10	8	2#2	0.080	2.03	1.975	50.17	316	3700

(1) Ampacity rating based on CEC/CSA.
(S) Actual shipping weight may vary.

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR
3	Black, Red, Blue

Product Construction:

Conductor:
- 6 AWG through 4/0 AWG fully annealed stranded bare copper

Insulation:
- Premium-grade, color-coded 90°C EPDM
- Color code: See chart below
- Insulated yellow ground check

Jacket:
- Super Vu-Tron® 90°C, black
- Temperature range: -40°C to +90°C

Jacket Marking:
- CAROL SUPER VU-TRON® SIZE (mm^2) TYPE G-GC 2 KV 90°C (-40°C) FT5 CSA LR92874 P-7K-123049-MSHA MADE IN USA

Applications:
- Industrial and light- to medium-duty mining applications
- Heavy-duty service as power supply cable
- Mobile and portable electrical equipment
- 3- and 4-conductor—use on three-phase AC systems where grounding is required

Features:
- Excellent impact and abrasion resistance
- Withstands exposure to oil, acids, alkalies, heat, moisture and most chemicals
- Indent-printed for easy identification
- Rope lay stranding for maximum flex life
- Cable core bound for superior flexibility and toughness
- Non-wicking rubber fillers (GGC)
- Canadian color code
- Sunlight-resistant

Industry Approvals:
- CSA Flexible Cord - C22.2-96
- MSHA Approved
- RoHS Compliant

Packaging:
- Lengths cut to order

CAROL BRAND® CSA Certified Canadian Standard Association MSHA Mine Safety and Health Administration RoHS Compliant Directive 2011/65/EU Made in U.S.A. General Cable

Carol® Double Jacket Drill Cord

90°C, 600 Volt, MSHA Approved Remote Control & Drill Cord

Product Construction:

Conductors:
- 14 through 10 AWG fully annealed stranded bare copper
- ASTM B3/B174

Insulation
- Premium-grade, color-coded 90°C EPDM
- Color code: See chart below

Jacket
- 90°C, black, CPE or neoprene
- Temperature range: -40°C to +90°C
- An open polyester braid reinforcement is applied between layers for mechanical strength

Jacket Marking
- CPE jacket -
  CAROL (SIZE & NO. OF CONDS.) DOUBLE JACKET REMOTE CONTROL AND DRILL CORD 600 V 90°C P-07-KA110003-MSHA MADE IN USA
- Neoprene jacket -
  CAROL (SIZE & NO. OF CONDS.) NEOPRENE DOUBLE JACKET REMOTE CONTROL AND DRILL CORD 600 V 90°C P-07-KA110006-MSHA MADE IN USA



Applications:
- Industrial and light- to medium-duty mining applications
- Heavy-duty service as power supply cable
- AC systems (grounded and ungrounded)
- Heavy-duty and long service life applications
- Mobile and portable electrical equipment
- Motor and battery leads
- Wet or dry locations in underground mines in accordance with Schedule 26 of the U.S. Bureau of Mines
- 3-conductor cables – use on AC systems where no grounding is required or on DC systems with one conductor for grounding
- 4-conductor cables – use on two- or three-phase AC systems with one conductor used for grounding
- 5-conductor cables – use in applications where separating the system neutral from the frame ground is required

Features:
- Withstands severe environmental conditions
- Indent-printed for easy identification
- Withstands exposure to oil, acids, alkalies, heat, moisture and most chemicals
- Flexible stranding
- Excellent impact, crush and tear resistance
- Sunlight-resistant
- Reinforced jacket for increased durability
- TRU-Mark® sequential footage marking

Industry Approvals:
- RoHS Compliant
- Passes MSHA Flame Test
- Additional rating available upon request
- Other sizes and numbers of conductors available upon request

Applicable Standards:
- ICEA S-75-381

Packaging:
- Lengths cut to order

COLOR CODE CHART

NO. OF CONDUCTORS	COLOR**
2	Black, White
3	Black, White, Green
4	Black, White, Red, Green
5	Black, White, Red, Green, Orange
6	Black, White, Red, Green, Orange, Blue

** Green conductor for grounding only.

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL COND. O.D.		NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS(1)	APPROX. NET WT. LBS/M'(S)
				INCHES	mm	INCHES	mm	INCHES	mm		
CPE JACKET											
02861	2	14	41/30	0.072	1.96	0.045	1.14	0.640	16.26	18	210
02862	3	14	41/30	0.072	1.96	0.045	1.14	0.670	17.02	18	240
02868	4	14	41/30	0.072	1.96	0.045	1.14	0.715	18.16	15	285
02835	5	14	41/30	0.072	1.96	0.045	1.14	0.785	19.94	12	345
02845	5	12	65/30	0.096	2.44	0.045	1.14	0.840	21.34	16	405
02806	6	12	65/30	0.096	2.44	0.045	1.14	0.890	22.61	16	470
02855	5	10	104/30	0.117	2.97	0.045	1.14	0.895	22.73	20	495
NEOPRENE JACKET											
02961*	2	14	41/30	0.072	1.96	0.045	1.14	0.640	16.26	18	220
02962*	3	14	41/30	0.072	1.96	0.045	1.14	0.670	17.02	18	260
02968*	4	14	41/30	0.072	1.96	0.045	1.14	0.715	18.16	15	300
02935*	5	14	41/30	0.072	1.96	0.045	1.14	0.785	19.94	12	365
02945*	5	12	65/30	0.096	2.44	0.045	1.14	0.840	21.34	16	425
02906*	6	12	65/30	0.096	2.44	0.045	1.14	0.890	22.61	16	490
02955*	5	10	104/30	0.117	2.97	0.045	1.14	0.895	22.73	20	515

* Non-stock item; minimum quantity purchase required.

(1) Ampacities based on 90°C conductor and 30°C ambient temperature per NEC Table 400.5(A)(1) of the National Electrical Code®.

(S) Actual shipping weight may vary.

General Cable

Made in U.S.A.

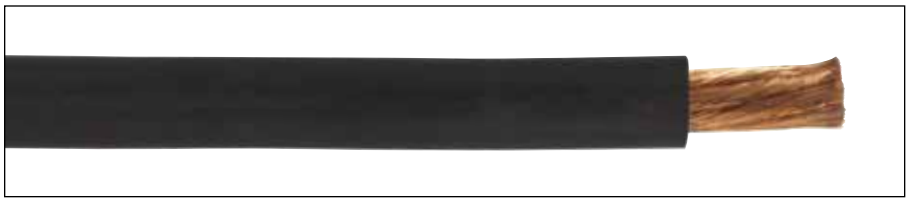
RoHS Compliant Directive 2011/65/EU

MSHA Mine Safety and Health Administration

CAROL BRAND

Carolprene® 105°C Welding Cable

105°C, 600 Volt, MSHA Approved



CAROLPRENE® 105°C WELDING CABLE – 600 VOLT – 30 AWG STRANDING

CATALOG NUMBER	AWG SIZE	NOMINAL STRAND	NOMINAL O.D.		APPROX. NET WT. LBS/M'(S)	STD. CTN.
			INCHES	mm		
01758*	6	259/30	0.420	10.67	140	1000'
01757*	4	416/30	0.475	12.07	200	1000'
01756*	2	655/30	0.520	13.21	280	1000'
01755*	1	827/30	0.575	14.61	350	1000'
01754*	1/0	1042/30	0.600	15.24	415	1000'
01753*	2/0	1316/30	0.645	16.38	510	1000'
01752*	3/0	1660/30	0.715	18.16	620	1000'
01751*	4/0	2062/30	0.765	19.43	760	1000'

* Non-stock item; minimum quantity required.
(S) Actual shipping weight may vary.

Product Construction:

Conductors:
- 6 AWG through 4/0 AWG fully annealed stranded bare copper

Jacket:
- Carolprene® 105°C, black
- Temperature range: -50°C to +105°C

Jacket Marking:
- CAROLPRENE (SIZE) AWG 105°C WELDING CABLE 600 VOLT P-07-KA1000015-MSHA MADE IN USA (TRU-MARK SEQUENTIAL FOOTAGE)

Applications:
- Secondary voltage resistance welding leads in heavy duty or mining applications
- Power supply applications not exceeding 600 volts AC
- Sizes 1/0 and larger for permanent wiring in conduit or tray of 600 V power supplies, hoists, cranes or other applications where flexible power leads must be installed in conduit, raceways or trays

Features:
- Sunlight-resistant
- Designed to withstand severe environmental conditions
- Withstands exposure to oil, acids, alkalies, heat, flame, moisture and chemicals
- Meets or exceeds flame test requirements of MSHA
- TRU-Mark® marking system and indent printed MSHA number

Industry Approvals:
- MSHA Approved
- RoHS Compliant

Packaging:
- 250' (76.2 m), 1000' (304.8 m) reels
- Other put-ups available on special order

WELDING CABLE AMPACITIES SINGLE CONDUCTOR

Required Cable Sizes: For Welding Cable Application

	length in feet for total circuit for secondary voltages only – do not use this table for 600 Volt in-line applications						
AMPS	100'	150'	200'	250'	300'	350'	400'
100	4	4	2	2	1	1/0	1/0
150	4	2	1	1/0	2/0	3/0	3/0
200	2	1	1/0	2/0	3/0	4/0	4/0
250	1	1/0	2/0	3/0	4/0		
300	1/0	2/0	3/0	4/0			
350	1/0	3/0	4/0				
400	2/0	3/0					
450	2/0	4/0					
500	3/0	4/0					
550	3/0	4/0					
600	4/0						

REQUIRED CABLE SIZES SHOWN IN AWG NUMBERS

The total circuit length includes both welding and ground leads (based on 4-volt drop) 60% duty cycle.

These values for current-carrying capacity are based on a copper temperature of 60°C (140°F), an ambient temperature of 40°C (104°F) and yield load factors from approximately 32% for the No. 2 AWG cable to approximately 23% for the No. 3/0 AWG cable, and higher for the smaller sizes. The sizes of cables generally used range from No. 2 AWG to No. 3/0 AWG. In actual service, the load factor may be much higher than indicated without overheating the cable, as the ambient temperature will generally be substantially lower than 40°C.

Suggested Ampacities For 600 Volt In-Line Applications

AWG	AMPERES	AWG	AMPERES
4/0	405	1	220
3/0	350	2	190
2/0	300	4	140
1/0	260	6	105

Ampacities for portable cable in accordance with NEC Table 400.5(A)(2).
May not be suitable for all installations per National Electrical Code®.

CAROL BRAND

MSHA Mine Safety and Health Administration

RoHS Compliant Directive 2011/65/EU

Made in U.S.A.

General Cable

Carolprene® 90°C Welding Cable

600 Volt

RED NOW A STOCK ITEM

NOW WITH TRU-Mark® Footage Marking System PRECISION

Product Construction:

Conductor:
- 6 AWG through 500 kcmil fully annealed stranded bare copper Class K

Jacket:
- Premium-grade 90°C EPDM, black or red
- Temperature range: -40°C to +90°C

Jacket Marking:
- CAROLPRENE (SIZE) WELDING CABLE 600 VOLT MADE IN USA (TRU-MARK SEQUENTIAL FOOTAGE)

Applications:
- Secondary voltage resistance welding leads
- Power supply applications not exceeding 600 volts AC

Features:
- Good flexibility
- Abrasion-resistant
- Good color retention
- TRU-Mark® sequential footage marking

Packaging:
- 250' (76.2 m), 500' (152.4 m), and 1000' (304.8 m) reels
- MCM sizes cut to length
- Other put-ups available on special order

Industry Approvals:
- RoHS Compliant

Suggested Ampacities For 600 Volt In-Line Applications

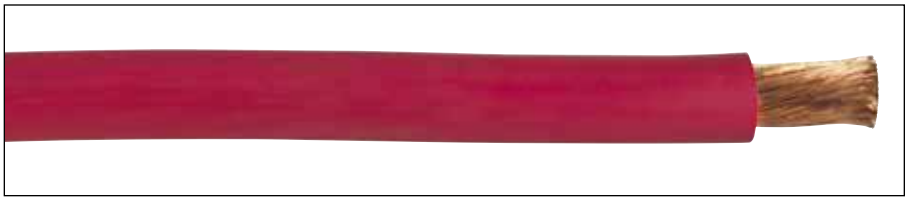
AWG OR kcmil	AMPERES	AWG	AMPERES
500 kcmil	695	1/0	190
350 kcmil	552	1	160
250 kcmil	445	2	140
4/0	310	4	100
3/0	265	6	75
2/0	223		

Ampacities for portable cable, continuous-duty (ambient temperature of 40°C).
May not be suitable for all installations per National Electrical Code®.

Ordering Part Number Example

01771.38.03

4/0 500' put-up in red
.03 for red jacket



CAROLPRENE® WELDING CABLE – 600 VOLT – CLASS K – 30 AWG STRANDING

CATALOG NUMBER	AWG OR kcmil	CONDUCTOR STRAND	NOMINAL O.D.		APPROX. NET WT. LBS/M[1](S)	STD. CTN.
			INCHES	mm		
01778	6	259/30	0.380	9.65	135	250'
01777	4	406/30	0.400	10.16	172	250'
01776	2	646/30	0.465	11.81	260	250'
01775	1	812/30	0.495	12.57	317	250'
01774	1/0	1025/30	0.560	14.22	400	250'
01773	2/0	1274/30	0.615	15.62	487	250'
01772	3/0	1613/30	0.670	17.02	605	250'
01771	4/0	2029/30	0.750	19.05	827	250'
99142*	250 kcmil	2496/30	0.830	21.08	976	250'
99432*	350 kcmil	3441/30	0.960	24.38	1338	250'
99202*	500 kcmil	5054/30	1.200	30.48	1995	250'

(S) Actual shipping weight may vary.
* Non-stock item; minimum quantity required.

WELDING CABLE AMPACITIES SINGLE CONDUCTOR

Required Cable Sizes: For Welding Cable Application

	length in feet for total circuit for secondary voltages only – do not use this table for 600 Volt in-line applications						
AMPS	100'	150'	200'	250'	300'	350'	400'
100	4	4	2	2	1	1/0	1/0
150	4	2	1	1/0	2/0	3/0	3/0
200	2	1	1/0	2/0	3/0	4/0	4/0
250	1	1/0	2/0	3/0	4/0		
300	1/0	2/0	3/0	4/0			
350	1/0	3/0	4/0				
400	2/0	3/0					
450	2/0	4/0					
500	3/0	4/0					
550	3/0	4/0					
600	4/0	REQUIRED CABLE SIZES SHOWN IN AWG NUMBERS					

The total circuit length includes both welding and ground leads (based on 4-volt drop) 60% duty cycle.

These values for current-carrying capacity are based on a copper temperature of 60°C (140°F), an ambient temperature of 40°C (104°F) and yield load factors from approximately 32% for the No. 2 AWG cable to approximately 23% for the No. 3/0 AWG cable, and higher for the smaller sizes. The sizes of cables generally used range from No. 2 AWG to No. 3/0 AWG. In actual service, the load factor may be much higher than indicated without overheating the cable, as the ambient temperature will generally be substantially lower than 40°C.

General Cable

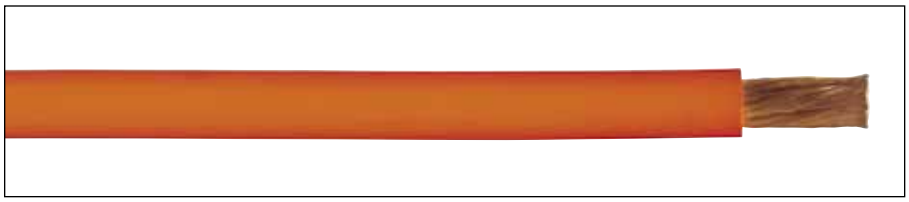
Made in U.S.A.

RoHS Compliant Directive 2011/65/EU

CAROL BRAND

Super Vu-Tron® Welding Cable

90°C, 600 Volt, UL/CSA, Types RHH/RHW



SUPER VU-TRON® WELDING CABLE—UL/CSA—CLASS M—34 AWG STRANDING

CATALOG NUMBER	AWG SIZE	CONDUCTOR STRAND	NOMINAL O.D.		APPROX. NET WT. LBS/M'(S)	STD. CTN.
			INCHES	mm		
01768*	6	660/34	0.370	9.40	125	250'
01767*	4	1045/34	0.425	10.80	191	250'
01766	2	1634/34	0.475	12.07	259	250'
01765	1	2090/34	0.530	13.46	331	250'
01764†	1/0	2597/34	0.575	14.61	401	250'
01763†	2/0	3300/34	0.630	16.00	511	250'
01762†	3/0	4214/34	0.700	17.78	615	250'
01761†	4/0	5225/34	0.800	20.32	844	250'

* Not MSHA Approved.
(S) Actual shipping weight may vary.
† Type RHH/RHW - 600 V for CT use.

Product Construction:

Conductor:
- 6 AWG through 4/0 AWG fully annealed stranded bare copper per ASTM B172 Class M

Jacket:
- Super Vu-Tron®, orange
- Temperature range: -50°C to +90°C

Jacket Marking:
- #6 - #1 AWG: CAROL SUPER VU-TRON® WELDING CABLE–EXTRA FLEXIBLE (UL) 600 VOLT (-50°C to +90°C) OIL RESISTANT P-123-141 MSHA (SIZE) --- CSA 90°C ARC WELDING CABLE FT1 MADE IN USA
- 1/0 - 4/0 AWG: CAROL SUPER VU-TRON® WELDING CABLE (SIZE) EXTRA FLEXIBLE (UL) 600 VOLT (-50°C to +90°C) OIL RESISTANT P-123-141 MSHA --- CSA 90°C ARC WELDING CABLE FT1 --- TYPE RHH OR RHW (UL) 600 V FOR CT USE MADE IN USA

Applications:
- Secondary voltage resistance welding leads
- Power supply applications not exceeding 600 volts AC
- Sizes 1/0 and larger for permanent wiring in conduit or tray of 600 V power supplies, hoists, cranes or other applications where flexible power leads must be installed in conduit, raceways or trays

Features:
- UL Listed
- CSA Certified
- Excellent flexibility to last longer in flex applications
- Abrasion-resistant
- Resists oils and solvents
- Rated -50°C for use in cold environments
- Weather-resistant
- Ozone-resistant
- Safety-colored for high visibility
- Assured longer service life, saving money in replacement costs, maintenance cost and downtime
- MSHA Approved for flame resistance
- Sunlight-resistant

Industry Approvals:
- UL Listed
- CSA Certified
- MSHA Approved
- Meets UL Vertical Flame Test per UL 854
- RoHS Compliant

Packaging:
- 250' (76.2 m), 500' (152.4 m), and 1000' (304.8 m) reels
- Other put-ups available on special order

WELDING CABLE AMPACITIES SINGLE CONDUCTOR

Required Cable Sizes: For Welding Cable Application

	length in feet for total circuit for secondary voltages only – do not use this table for 600 Volt in-line applications						
AMPS	**100'**	**150'**	**200'**	**250'**	**300'**	**350'**	**400'**
100	4	4	2	2	1	1/0	1/0
150	4	2	1	1/0	2/0	3/0	3/0
200	2	1	1/0	2/0	3/0	4/0	4/0
250	1	1/0	2/0	3/0	4/0		
300	1/0	2/0	3/0	4/0			
350	1/0	3/0	4/0				
400	2/0	3/0					
450	2/0	4/0					
500	3/0	4/0					
550	3/0	4/0					
600	4/0						

REQUIRED CABLE SIZES SHOWN IN AWG NUMBERS

The total circuit length includes both welding and ground leads (based on 4-volt drop) 60% duty cycle.

These values for current-carrying capacity are based on a copper temperature of 60°C (140°F), an ambient temperature of 40°C (104°F) and yield load factors of from approximately 32% for the No. 2 AWG cable to approximately 23% for the No. 3/0 AWG cable, and higher for the smaller sizes. The sizes of cables generally used range from No. 2 AWG to No. 3/0 AWG. In actual service, the load factor may be much higher than indicated without overheating the cable as the ambient temperature will generally be substantially lower than 40°C.

Suggested Ampacities For 600 Volt In-Line Applications

AWG	AMPERES	AWG	AMPERES
4/0	405	1	220
3/0	350	2	190
2/0	300	4	140
1/0	260	6	105

Ampacities for portable cable in accordance with NEC Table 400.5(A)(2).
May not be suitable for all installations per National Electrical Code®.

CAROL BRAND · UL LISTED · CSA Certified Canadian Standard Association · MSHA Mine Safety and Health Administration · RoHS Compliant Directive 2011/65/EU · Made in U.S.A. · General Cable

Super Vu-Tron® Entertainment Industry and Stage Lighting Cable

105ºC, 600 Volt, UL Type SC and CSA Type PPC

Product Construction:

Conductor:
- 8 AWG through 4/0 AWG fully annealed stranded bare copper per ASTM B172

Jacket:
- Super Vu-Tron® 105ºC, black
- Temperature range: -50ºC to +105ºC

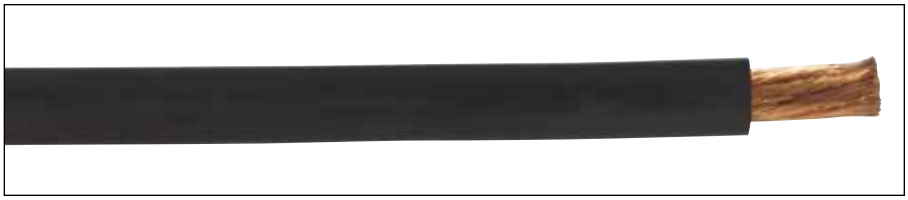
Jacket Marking:
- CAROL (SIZE) (UL) 600 VOLT TYPE SC (-50°C to +105°C) OIL RES 60°C MAX. AMPS NEC TABLE 400-5 (B) FOR 90°C OUTDOOR --- CSA TYPE PPC 105°C 600 VOLT FT5 ROHS MADE IN USA

Applications:
- Portable power systems
- Entertainment industry activities such as theater, television, night clubs, motion pictures, mobile communication vans, spotlights and sound systems
- Other similar applications that would require temporary power

Features:
- Sunlight-resistant
- Designed to withstand severe environmental conditions
- Withstands exposure to oil, acids, alkalies, heat, flame, moisture and chemicals
- Meets or exceeds flame test requirements of MSHA, CSA and UL
- Indent-printed

Industry Approvals:
- UL Listed
- CSA Certified
- RoHS Compliant

Packaging:
- Lengths cut to order



UL TYPE SC - CSA TYPE PPC - 600 VOLT

CATALOG NUMBER	AWG SIZE	NOMINAL STRAND	NOMINAL O.D.		APPROX. NET WT. LBS/M'(S)	CURRENT AMPS(1)
			INCHES	mm		
01109*	8	168/30	0.385	9.78	110	80
01108	6	259/30	0.420	10.67	152	105
01107	4	416/30	0.475	12.07	215	140
01106	2	655/30	0.520	13.21	296	190
01105	1	827/30	0.575	14.61	360	220
01104	1/0	1042/30	0.600	15.24	424	260
01103	2/0	1316/30	0.645	16.38	513	300
01102*	3/0	1660/30	0.715	18.16	644	350
01101	4/0	2062/30	0.765	19.43	824	405

(1) NEC Table 400.5(A)(2).
* Non-stock item; minimum quantity purchase required.
(S) Actual shipping weight may vary.

General Cable

Made in U.S.A.

RoHS Compliant Directive 2011/65/EU

Certified Canadian Standard Association

UL LISTED

CAROL BRAND

Super Vu-Tron® Single Conductor Type W Extra Flex

90°C, 2000 Volt, UL Listed



TYPE W - 2000 VOLT - UL

CATALOG NUMBER	AWG OR kcmil	NOMINAL STRAND	NOMINAL COND. O.D.		NOMINAL INS. THICKNESS		NOMINAL O.D.		APPROX. NET WT. LBS/M'(S)	CURRENT AMPS(1)
			INCHES	mm	INCHES	mm	INCHES	mm		
80611*	8	168/30	0.165	4.19	0.060	1.52	0.465	11.81	133	80
80621*	6	259/30	0.198	5.03	0.060	1.52	0.545	13.84	205	105
80631*	4	416/30	0.233	5.92	0.060	1.52	0.585	14.86	264	140
80641	2	655/30	0.293	7.44	0.060	1.52	0.650	16.51	361	190
80651*	1	827/30	0.330	8.38	0.080	2.03	0.730	18.54	465	220
80661*	1/0	1042/30	0.369	9.37	0.080	2.03	0.750	19.05	521	260
80671*	2/0	1316/30	0.412	10.46	0.080	2.03	0.825	20.96	644	300
80681*	3/0	1660/30	0.490	12.45	0.080	2.03	0.910	23.11	755	350
80691	4/0	2062/30	0.530	13.46	0.080	2.03	0.960	24.38	933	405
80701*	250 kcmil	2496/30	0.606	15.39	0.105	2.67	1.020	25.91	1150	455

(1) Ampacities based on 90°C conductor and 30°C ambient temperature, based on Table 310-17 and Table 400.5(A)(2) in the National Electrical Code for single conductor cables.

* Non-stock item; minimum quantity purchase required.

(S) Actual shipping weight may vary.



COLOR CODE CHART

COLOR	COLOR CODE
Black	01
Gray	10
Red	03
Orange	04
Yellow	05
Green	06
Blue	17

ORDERING INFORMATION

Three easy steps to ordering your Super Vu-Tron Type W Extra Flex Cable:

Catalog Number	Put-Up Code	Color Code
Choose Catalog Number from Catalog Table above	Choose Put-Up Code from Packaging Information (99 for cut-to-order – please specify length needed) (41 for 1000 ft reel put-up size)	Choose Color Code from the Color Code Chart

Examples:

80691.41.01	Type W Extra Flex, 4/0 size, 1,000 ft. reel put-up, black
80691.99.17	Type W Extra Flex, 4/0 size, long-length reel put-up, blue

Make It Yours: Custom print legends available for recurring stock and special orders - ask for details

Product Construction:

Conductor:
- 8 AWG through 250 kcmil fully annealed stranded bare copper per ASTM B172

Insulation:
- Premium-grade 90°C EPDM

Jacket:
- Super Vu-Tron® 90°C, black (standard)
  Other Available Colors:
  – Gray, red, orange, yellow, green, blue
  – See color code chart
- Temperature range: -40°C to +90°C
- An open polyester braid reinforcement is applied between the insulation and jacket for mechanical strength

Jacket Marking:
- CAROL SUPER VU-TRON® TYPE W PORTABLE POWER CABLE (SIZE) 2000 V 90°C DRY AND WATER RESISTANT 75°C SUN RES (UL) P-7K-123049-MSHA---CSA TYPE W (-40°C) FT5 (TRU-MARK SEQUENTIAL FOOTAGE)
- Custom print available by special order with minimum quantity purchase

Applications:
- Portable power systems
- Entertainment industry activities such as theater, television, nightclubs, motion pictures, mobile communication vans, spotlights and sound systems
- Other similar applications that would require temporary power

Features:
- Water-resistant
- Sunlight-resistant
- Designed to withstand severe environmental conditions
- Flexible and easier to work with in cold temperatures
- Withstands exposure to oil, acids, alkalies, heat, flame, moisture and chemicals
- No “memory” effect when coiling and uncoiling for use
- Meets or exceeds flame test requirements of MSHA and UL
- TRU-Mark® sequential footage marking

Industry Approvals:
- UL Listed
- MSHA Approved
- RoHS Compliant
- CSA Certified

Packaging:
- Lengths cut to order (99 put-up code)
- 1000' reel (41 put-up code)

CAROL BRAND UL LISTED CSA Certified Canadian Standard Association MSHA Mine Safety and Health Administration RoHS Compliant Directive 2011/65/EU Made in U.S.A. General Cable

Diesel Locomotive Cable 2000 Volts (EPR/XL-CPE)

UL Types RHH/RHW-2 2000 V and C(UL) RW90 1000 V
Flexible, Oil-, Sunlight- and Ozone-Resistant, Flame-Retardant, -40°C to 90°C

Product Construction:

Conductor:
- 14 AWG (2.08 mm) thru 1111.1 kcmil (562 mm) Class I fully annealed flexible stranded tin coated copper per AAR 589

Insulation:
- Flame-retardant, lead-free Cross-linked Ethylene Propylene (EP) with separator tape over the conductor to facilitate stripping

Jacket:
- Black, flame-retardant, sunlight-, ozone- and oil-resistant, lead-free Cross-linked Chlorinated Polyethylene (XL-CPE)
- Colors available upon request

Print:
- GENERAL CABLE® (MFG LOCATION) DIESEL LOCOMOTIVE 2000 V P-07-KA120005-MSHA C(UL)US TYPE RHH OR RHW-2 VW-1 (SIZE) AWG/kcmil (MM²) EP FOR CT USE* SR -40°C FT4 OR RW90 EP 1000 V ROHS MONTH/YEAR OF MFG SEQUENTIAL FOOTAGE MARK

*Applicable for sizes 1/0 AWG and larger only

Applications:
- For use up to 2000 V as power cables in wind turbine generator applications per UL Subject 6140
- Diesel electric locomotives
- Mining and earth-moving equipment
- General purpose use as flexible power leads
- Flexible power leads in cable trays in sizes 1/0 AWG and larger
- Accepted for listing as flame-resistant by MSHA



Features:
- Rated 90°C wet or dry per UL 44/CSA C.22.2-38
- Flexible tinned copper stranding
- Excellent resistance to oils, gear lubricants, ozone, sunlight, heat and flame
- Designed to withstand continuous flexing

Minimum Bend Radius:
- 8X O.D. for fixed installations or mobile applications

Torsion Requirements:
- +/-180° twists per meter for 5,000 cycles at -40°C with cable weight compensated to 18 meters

Compliances:
Industry Compliances:
- Type RHH/RHW-2 per UL 44, UL File # E90494
- c(UL)US Type RW90 per CSA C.22.2-38, UL File # E90494
- National Electrical Code (NEC)
- ICEA S-95-658/NEMA WC70
- "For CT Use" on 1/0 AWG and larger in accordance with NEC®
- Accepted for listing as flame resistant by MSHA
- RoHS Compliant

Compliances (cont'd.):
Flame Test Compliances:
- UL 2556 VW-1
- IEEE 1202/CSA FT4 for sizes 1/0 AWG and larger

AC Withstand Voltage Testing requirements per UL 44:

14 - 10 AWG	6000 V
8 - 2 AWG	7500 V
1 - 4/0 AWG	9000 V
262.6 kcmil - 444 kcmil	10000 V
535.3 kcmil - 929.9 kcmil	11000 V
1111.1 kcmil	13500 V

CATALOG NUMBER	COND. SIZE AWG/ kcmil	COND. SIZE mm²	COND. STRAND	NOMINAL COND. O.D. INCHES	NOMINAL COND. O.D. mm	NOM. INS. THICKNESS INCHES	NOM. INS. THICKNESS mm	JACKET THICKNESS INCHES	JACKET THICKNESS mm	NOMINAL O.D. INCHES	NOMINAL O.D. mm	APPROX. NET WEIGHT LBS/1000 FT	APPROX. NET WEIGHT kg/km
14 AWG - 1111.1 kcmil CONDUCTORS													
5310.01014	14	2.08	19W	0.070	1.8	0.045	1.1	0.015	0.4	0.20	5.1	30	45
5310.01012	12	3.31	19W	0.088	2.2	0.045	1.1	0.015	0.4	0.22	5.6	39	58
5310.01010	10	5.26	27W	0.117	3.0	0.045	1.1	0.015	0.4	0.25	6.4	56	83
5310.01008	8	8.36	37W	0.144	3.7	0.055	1.4	0.030	0.8	0.33	8.3	87	129
5310.01006	6	13.3	61W	0.190	4.8	0.060	1.5	0.030	0.8	0.38	9.7	131	195
5310.01004	4	21.1	105W	0.262	6.7	0.060	1.5	0.030	0.8	0.46	11.7	202	301
5310.01002	2	33.6	158W	0.315	8.0	0.060	1.5	0.030	0.8	0.51	13.0	285	424
5310.01001	1	42.4	224W	0.375	9.5	0.080	2.0	0.045	1.1	0.64	16.3	417	621
5310.01110	1/0	53.5	280W	0.435	11.0	0.080	2.0	0.045	1.1	0.70	17.8	494	735
5310.01210	2/0	67.4	329W	0.465	11.8	0.080	2.0	0.045	1.1	0.73	18.5	587	874
5310.01310	3/0	85	456W	0.535	13.6	0.080	2.0	0.045	1.1	0.80	20.3	718	1069
5310.01410	4/0	107	551W	0.581	14.8	0.080	2.0	0.045	1.1	0.84	21.3	845	1258
5310.01262	262.6	133	650W	0.617	15.7	0.090	2.3	0.065	1.7	0.94	23.9	1050	1563
5310.01313	313.1	158	777W	0.671	17.0	0.090	2.3	0.065	1.7	1.00	25.3	1195	1778
5310.01373	373.7	189	925W	0.735	18.7	0.090	2.3	0.065	1.7	1.06	26.9	1384	2060
5310.01444	444.4	225	1110W	0.786	20.0	0.090	2.3	0.065	1.7	1.11	28.2	1634	2432
5310.01535	535.3	271	1332W	0.877	22.3	0.090	2.3	0.065	1.7	1.20	30.5	1925	2865
5310.01646	646.4	327	1609W	0.960	24.4	0.090	2.3	0.065	1.7	1.29	32.8	2307	3433
5310.01777	777.7	394	1924W	1.054	26.8	0.090	2.3	0.065	1.7	1.38	35.1	2728	4060
5310.01929*	929.9	475	2318W	1.230	31.2	0.090	2.3	0.065	1.7	1.56	39.6	3570	5313
5310.01111*	1111.1	562	2745W	1.328	33.7	0.115	2.9	0.095	2.4	1.77	44.9	4232	6298

* Non-stock item; minimum runs apply. Please consult Customer Service for price and delivery.

General Cable

RoHS Compliant Directive 2011/65/EU

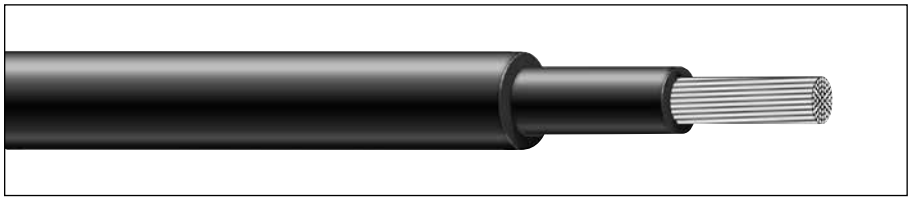
MSHA Mine Safety and Health Administration

c UL LISTED UL LISTED

CAROL BRAND

Super Vu-Tron® DLO

EPR/CPE, Diesel Locomotive Cable
2000 V DLO, 1000 V CSA Type RW90 FT4 TC



CATALOG NUMBER	AWG/ kcmil	COND. STRAND	NOM. INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS		APPROX. NET WEIGHT**	
			INCHES	mm	INCHES	mm	30°C[1]	30°C[2]	lbs/1000ft	kg/km
1/0 AWG - 1111 kcmil CONDUCTORS										
91911	1/0	280W	0.080	2.03	0.69	17.53	260	170	515	766
91920	2/0	329W	0.080	2.03	0.73	18.54	300	195	580	863
91930	3/0	456W	0.080	2.03	0.81	20.57	350	225	770	1146
91940	4/0	551W	0.080	2.03	0.87	22.10	405	260	930	1384
91926	262.6	650W	0.095	2.41	1.00	25.40	475	298	1130	1682
91931	313.1	777W	0.095	2.41	1.06	26.92	520	328	1295	1927
91937	373.7	925W	0.095	2.41	1.10	27.94	605	364	1545	2299
91944	444.4	1110W	0.095	2.41	1.23	31.24	660	402	1820	2709
91953	535.3	1332W	0.110	2.79	1.34	34.04	735	446	2195	3267
91964	646.4	1609W	0.110	2.79	1.45	36.83	820	496	2560	3810
91977	777.7	1924W	0.110	2.79	1.50	38.10	910	563	3050	4539
91929*	929.2	2299W	0.110	2.79	1.61	40.89	1005	594	3595	5350
91811*	1111	2745W	0.125	3.18	1.75	44.45	1110	637	4250	6325

[1] Ampacities based on 90°C conductor temperature and 30°C ambient temperature and Table 12E of the Canadian Electrical Code for permanent installation in tray.

[2] Based on CEC Part 1 Table 2 for 3 conductors in raceway (conduit) and an ambient temperature of 30°C.

* Non-stock item; minimum runs apply. Please consult Customer Service for price and delivery.

**Actual shipping weight may vary.

Product Construction:

Conductor:
- 1/0 AWG through 1111 kcmil stranded tinned annealed copper per AAR 589

Insulation:
- Flame-retardant, lead-free Cross-linked Ethylene Propylene (EP) with separator tape over the conductor to facilitate stripping

Jacket:
- Black, flame-retardant, sunlight-, ozone- and oil-resistant, lead-free Cross-linked Chlorinated Polyethylene (XL-CPE)
- Colors available upon request

Jacket Marking:
- CAROL SUPER VU-TRON® (SIZE) 90°C DLO 2000 V P-102 MSHA CSA RW90 1000 V (-40°C) FT1 FT4 SR TC

Applications:
- Diesel electric locomotives
- Telecom power supply
- Oil and gas drilling rigs
- Mining and earth-moving equipment
- Shipyards
- Motor leads
- For wiring exposed to the weather
- For use in raceways including cable trays in dry, damp or wet locations in accordance with Canadian Electrical Code

Features:
- 90ºC temperature rating, wet, damp or dry
- Excellent impact and abrasion resistance
- Resists oils, acids, alkalies, heat, flame
- Flexible tinned copper stranding
- Sunlight-resistant

Compliances:
- CSA Standard C22.2 No. 38
- CSA Standard C22.2 No. 230
- CSA Standard C22.2 No. 96

Industry Compliances:
- Accepted for listing as flame-resistant by MSHA
- CSA RW90 FT4 TC
- Outdoor use

Other Compliances:
- RoHS Compliant

Packaging:
- Lengths cut to order

CAROL BRAND® SA Certified Canadian Standard Association MSHA Mine Safety and Health Administration RoHS Compliant Directive 2011/65/EU General Cable

Specialty Cord 5



In today's world, the need for specialty cord products is constantly growing. General Cable offers a full line of Carol® Brand Cord products to meet a wide range of specialized applications.

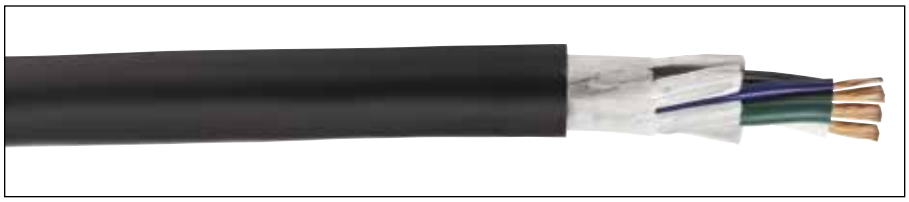
Specialty Cord includes a wide range of hook-up wire, heater cord, lamp cord and fixture wire.

Like Carol® Brand Rubber, Plastic and Industrial Cord products, these cables carry the latest regulatory listings and certifications with Underwriters Laboratories, Inc. and the Canadian Standard Association where applicable.

Index	Page
CarolGrene™ Ultra Flex® Jacketed Types EVJE, EVE, EVJT and EVT	48
CarolGrene™ Ultra Flex® Types EVJ and EV	49
Heater Cord Type HPN	50
Hook-Up Wire UL Types MTW, TFF, AWM and CSA TEW	51
Heavy Wall UL Types MTW, AWM, NEC Type THW and CSA TEW	52
Lamp Cord Type SPT	53
Low-Voltage Landscape Lighting Wire	54
Low-Voltage Sprinkler Wire	55

CarolGrene™ Ultra Flex® Jacketed Types EVJE, EVE, EVJT and EVT

105˚C, 300 and 600 Volt, UL Electrical Vehicle Charging Cord



CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL COND. O.D.		NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS(1) (2)	APPROX. NET WT. LBS/M'(S)
				INCHES	mm	INCHES	mm	INCHES	mm		
TYPE EVJE, EVJT											
EVJE163	3	16	26/30	0.061	1.55	0.030	0.76	0.361	9.17	13	75
	1	18	16/30	0.048	1.22	0.030	0.76				
EVJE143	3	14	41/30	0.077	1.96	0.030	0.76	0.390	9.91	18	95
	1	18	16/30	0.048	1.22	0.030	0.76				
EVJE123	3	12	65/30	0.096	2.44	0.030	0.76	0.454	11.53	25	130
	1	18	16/30	0.048	1.22	0.030	0.76				
EVJT143*	3	14	41/30	0.077	1.96	0.030	0.76	0.390	9.91	18	95
	1	18	16/30	0.048	1.22	0.030	0.76				
EVJT123*	3	12	65/30	0.096	2.44	0.030	0.76	0.454	11.53	25	130
	1	18	16/30	0.048	1.22	0.030	0.76				
TYPE EVE, EVT - 600 VOLT - UL											
EVE1603	3	16	26/30	0.061	1.55	0.030	0.76	0.468	11.89	13	110
	1	18	16/30	0.048	1.22	0.030	0.76				
EVE1403	3	14	41/30	0.077	1.96	0.045	1.14	0.560	14.22	18	150
	1	18	16/30	0.048	1.22	0.030	0.76				
EVE1203	3	12	65/30	0.094	2.39	0.045	1.14	0.588	14.94	25	200
	1	18	16/30	0.048	1.22	0.030	0.76				
EVE1003	3	10	104/30	0.118	3.00	0.045	1.14	0.675	17.15	30	270
	1	18	16/30	0.048	1.22	0.030	0.76				
EVE0803	3	8	168/30	0.165	4.19	0.060	1.52	0.906	23.01	74	465
	1	18	16/30	0.048	1.22	0.030	0.76				
EVE0608	2	6	133/27	0.203	5.16	0.060	1.52	0.961	24.41	99	515
	1	8	133/29	0.160	4.06	0.060	1.52				
	1	18	16/30	0.048	1.22	0.030	0.76				
EVT1403*	3	14	41/30	0.077	1.96	0.045	1.14	0.560	14.22	18	150
	1	18	16/30	0.048	1.22	0.030	0.76				
EVT1203*	3	12	65/30	0.094	2.39	0.045	1.14	0.588	14.94	25	200
	1	18	16/30	0.048	1.22	0.030	0.76				

(1) Ampacities for 10 AWG and smaller cords based on 30˚C ambient temperature per Table 400.5(A)(1) of the National Electrical Code®. Ampacities for 8 AWG and larger cords based on 30˚C ambient temperature per Table 400.5(A)(2) of the National Electrical Code®.
(2) Green conductor for grounding only.
* Non-stock item; minimum quantity purchase required.
(S) Actual shipping weight may vary.

Product Construction:

Conductor:
- 18 through 6 AWG fully annealed stranded bare copper
- ASTM B3

Insulation:
- Premium-grade, color-coded 105˚C Thermoplastic Elastomer for types EVJE & EVE
- PVC for types EVJT & EVT
- Color code: See chart below

Jacket:
- 105˚C, black, Thermoplastic Elastomer for types EVJE & EVE
- 105˚C, black, PVC for types EVJT & EVT
- Temperature range: -50°C to +105°C - TPE
  -40°C to +105°C - PVC

Jacket Marking:
- UL Type EVE - CAROLGRENE™ ULTRA FLEX® ELECTRIC VEHICLE CABLE -- (SIZE) (mm^2) E333326-8 (UL) EVE 105°C DRY 60°C WET 600 V FT2 - ROHS - MADE IN USA
- UL Type EVJE - CAROLGRENE™ ULTRA FLEX® ELECTRIC VEHICLE CABLE -- (SIZE) (mm^2) E333326-8 (UL) EVJE c(UL) 105°C DRY 60°C WET 300 V FT2 - ROHS - MADE IN USA

Applications:
- Level 1 - 120 volt charging units
- Level 2 - 240 volt charging units
- Compatible with SAE J1772 EV plug standard
- UL 2594 and NEC 625 residential and commercial charging stations
- Ideal for charging electric vehicles (EV), neighborhood electric vehicles (NEV), battery electric vehicles (BEV), low-speed vehicles (LSV), personal electric vehicles (PEV), plug-in hybrid vehicles (PHV), and plug-in hybrid electric vehicles (PHEV)

Features:
- Superior flexibility (EVE & EVJE)
- Lightweight
- Water-resistant
- Oil-resistant jacket
- Excellent molding characteristics
- Suitable for immersion in water*
- UL Listed for outdoor use

Industry Approvals:
- UL 62 for Type EVE/EVJE/EVT/EVJT
- RoHS Compliant

Other AWG sizes, conductor counts, and put-ups available on special order.

* Suitable for immersion in water if properly sealed and terminated.

COLOR CODE CHART

CONDUCTORS	COLORS
POWER	Black, White, Green
SIGNAL	Blue

CAROLGRENE™ UltraFlex®

CAROL® BRAND

UL® LISTED

RoHS Compliant Directive 2011/65/EU

Made in U.S.A.

General Cable

CarolGrene™ Ultra Flex® Types EVJ and EV

90°C, 300 and 600 Volt, UL Electrical Vehicle Charging Cord

Product Construction

Conductor:
- 18 through 4 AWG fully annealed stranded bare copper
- ASTM B3

Insulation:
- Premium-grade, color-coded 90°C EPDM
- Color code: See chart below

Jacket:
- Carolprene® rubber, black

Jacket Marking:
- UL Type EV - CAROLGRENE™ ELECTRIC VEHICLE (SIZE) (mm²) E333326 (UL) EV CSA 90°C DRY 60°C WET 600 V FT2 ROHS MADE IN USA
- UL Type EVJ - CAROLGRENE™ ELECTRIC VEHICLE (SIZE) (mm²) E333326 (UL) EVJ CSA 90°C DRY 60°C WET 300 V FT2 ROHS MADE IN USA

Applications:
- Level 1 - 120 volt charging units
- Level 2 - 240 volt charging units
- Compatible with SAE J1772 EV plug standard
- UL 2594 and NEC 625 residential and commercial charging stations.
- Ideal for charging electric vehicles (EV), neighborhood electric vehicles (NEV), battery electric vehicles (BEV), low-speed vehicles (LSV), personal electric vehicles (PEV), plug-in hybrid vehicles (PHV), and plug-in hybrid electric vehicles (PHEV)

Features:
- Superior flexibility in cold temperatures
- Lightweight
- Water-resistant
- Oil-resistant jacket
- 105°C rating also available
- Suitable for immersion in water*
- UL Listed for outdoor use

Industry Approvals:
- UL 62 for Type EV and EVJ
- RoHS Compliant

Other AWG sizes, conductor counts, and put-ups available on special order.

*Suitable for immersion in water if properly sealed and terminated.



CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL COND. O.D.		NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS(1) (2)	APPROX. NET WT. LBS/M'(S)
				INCHES	mm	INCHES	mm	INCHES	mm		
TYPE EVJ - 300 VOLT - UL											
EVJ163	3	16	26/30	0.061	1.55	0.030	0.76	0.360	9.14	13	85
	1	18	16/30	0.048	1.22	0.030	0.76				
EVJ143	3	14	41/30	0.072	1.83	0.030	0.76	0.390	9.91	18	110
	1	18	16/30	0.048	1.22	0.030	0.76				
EVJ123	3	12	65/30	0.094	2.39	0.030	0.76	0.455	11.56	25	155
	1	18	16/30	0.048	1.22	0.030	0.76				
TYPE EV - 600 VOLT - UL											
EV1403	3	14	41/30	0.072	1.83	0.045	1.14	0.545	13.84	18	185
	1	18	16/30	0.048	1.22	0.030	0.76				
EV1203	3	12	65/30	0.094	2.39	0.045	1.14	0.580	14.73	25	220
	1	18	16/30	0.048	1.22	0.030	0.76				
EV1003	3	10	104/30	0.117	2.97	0.045	1.14	0.630	16.00	30	275
	1	18	16/30	0.048	1.22	0.030	0.76				
EV0803	3	8	168/30	0.160	4.06	0.060	1.52	0.885	22.48	74	465
	1	18	16/30	0.048	1.22	0.030	0.76				
EV0608*	2	6	133/27	0.203	5.16	0.060	1.52	0.985	25.02	99	570
	1	8	133/29	0.160	4.06	0.060	1.52				
	1	18	16/30	0.048	1.22	0.030	0.76				
EV0406	2	4	133/25	0.242	6.15	0.060	1.52	1.080	27.43	130	777
	1	6	133/27	0.203	5.16	0.060	1.52				
	1	18	16/30	0.048	1.22	0.030	0.76				

(1) Ampacities for 10 AWG and smaller cords based on 30°C ambient temperature per Table 400.5(A)(1) of the National Electrical Code®. Ampacities for 8 AWG and larger cords based on 30°C ambient temperature per Table 400.5(A)(2) of the National Electrical Code®.
(2) Green conductor for grounding only.
* Non-stock item; minimum quantity purchase required.
(S) Actual shipping weight may vary.

COLOR CODE CHART

CONDUCTORS	COLORS
POWER	Black, White, Green
SIGNAL	Blue

CAROLGRENE™ UltraFlex®

General Cable

Made in U.S.A. RoHS Compliant Directive 2011/65/EU UL LISTED CAROL BRAND

Heater Cord Type HPN

90ºC, 300 Volt, UL/CSA Portable Cord



TYPE HPN - 300 VOLT - UL/CSA

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		CURRENT AMPS*	APPROX. NET WT. LBS/M'(S)	STD. CTN.
				INCHES	mm	INCHES	mm			
25202	2	18	41/34	0.045	0.76	0.145 X 0.285	3.68 X 7.24	10	31	1000'
25212	2	16	65/34	0.045	1.14	0.155 X 0.300	3.94 X 7.62	15	38	1000'

(S) Actual shipping weight may vary.

* Ampacities based on NEC Table 400.5(A)(1).

Product Construction:

Conductor:

- 18 through 16 AWG fully annealed stranded bare copper

Insulation/Jacket:

- Carolprene®, black
- Temperature range: -20ºC to +90ºC

Jacket Marking:

- CAROL 2/C (SIZE) (mm²) TYPE HPN (UL) E-11368 HEATER CORD 90°C CSA FT2 LL-9993 - CPE 300 VOLT MADE IN USA

Applications:

- Portable heaters
- Toasters
- Irons
- Soldering irons
- Paint removers
- Other heat-related applications for industrial, commercial and home use

Features:

- Heat-resistant
- Oil-resistant

Industry Approvals:

- UL Listed
- CSA Certified

Packaging:

- 250' (76.2 m) spools
- Other put-ups available on special order

Hook-Up Wire UL Types MTW, TFF, AWM and CSA TEW

90ºC, 600 Volt, MTW, TFF, 105ºC, 1000 Volt, AWM, 600 Volt TEW

Product Construction:

Conductor:

- 18 through 8 AWG fully annealed stranded bare copper

Insulation:

- Premium-grade, color-coded PVC
- Temperature range:
  MTW: -40ºC to +90ºC
  AWM: -40ºC to +105ºC
  TEW: -30ºC to +105ºC
- Color code: See chart below

Jacket Marking:

- 18 and 16 AWG:
  CAROL (SIZE) 600 V E# MTW (UL) OR TFF OR 1000 V AWM VW-1 --- CSA TEW 105˚C FT1 ROHS MADE IN USA
- 14 through 8 AWG:
  CAROL (SIZE) 600 V E# MTW (UL) OR 1000 V AWM VW-1 --- CSA TEW 105˚C FT1 ROHS MADE IN USA

Applications:

- Motor and transformer lead
- External wiring of machinery

Features:

- Outstanding oil, flame and moisture resistance
- Extra-flexible

Industry Approvals:

- UL Type MTW/AWM
- CSA TEW
- Passes VW-1 Vertical Flame Test
- OSHA Acceptable
- AWM Style 1015 – 18-8 AWG
- AWM Style 1335 – 18-10 AWG
- AWM Style 1336 – 8 AWG
- AWM Style 1032
- RoHS Compliant

Packaging:

- 18 and 16 AWG:
  500' (152.4 m) spools
  2500' (762 m) spools
- 14 through 10 AWG:
  500' (152.4 m) spools
  2500' (762 m) reels
- 8 AWG: 500' (152.4 m) reels
- Other put-ups available on special order

COLOR CODE CHART

STOCK COLORS	ORDERING SUFFIX	STOCK COLORS	ORDERING SUFFIX
Black	01	Orange	04
White	02	Brown	08
Red	03	Purple	19
Blue	07	Gray	10
Green	06	Pink	13
Yellow	05		



UL TYPE MTW, AWM, TFF, CSA TYPE TEW - 600 VOLT

CATALOG NUMBER	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		STOCK COLORS	APPROX. NET WT. LBS/M'(S)
			INCHES	mm	INCHES	mm		
76502	18	16/30	0.031	0.79	0.110	2.79	1-12	10
76512	16	26/30	0.031	0.79	0.123	3.12	1-12	14
76812	14	19/.0147	0.031	0.79	0.136	3.45	1-12	20
76822	12	19/.0185	0.031	0.79	0.155	3.94	1-7	28
76832	10	19/.0234	0.031	0.79	0.176	4.47	1-5	42
76843	8	19/.0295	0.045	1.14	0.242	6.15	1-5	72

(S) Actual shipping weight may vary.

General Cable

Made in U.S.A.

RoHS Compliant Directive 2011/65/EU

Passes UL VW-1 Flame Test

Passes UL VW-1 Flame Test
Underwriters Laboratories, Inc.

Certified Canadian Standard Association

UL LISTED

CAROL BRAND

Heavy Wall UL Types MTW, AWM, NEC Type THW and CSA TEW

90ºC, 600 Volt



AWM, MTW, THW - 600 VOLT - UL

CATALOG NUMBER	AWG SIZE	COND. STRAND	NOMINAL INS. THICKNESS		NOMINAL O.D.		APPROX. NET WT. LBS/M'(S)
			INCHES	mm	INCHES	mm	
76954	6	19/.0372	0.064	1.63	0.315	8.00	110
76994	4	19/.0469	0.065	1.65	0.365	9.27	150

(S) Actual shipping weight may vary.

Product Construction:

Conductor:
- 6 and 4 AWG fully annealed stranded bare copper

Insulation:
- Premium-grade, color-coded PVC, black
- Temperature range:
  MTW: -40ºC to +90ºC
  AWM: -40ºC to +105ºC
  TEW: -30ºC to +105ºC

Jacket Marking:
- CAROL (SIZE) 600 V E# MTW OR THW (UL) OR 1000 V AWM VW-1 --- CSA TEW 105˚C FT1 ROHS MADE IN USA

Applications:
- Motor and transformer lead
- External wiring of machinery

Features:
- Outstanding oil, flame and moisture resistance
- Extra-flexible

Industry Approvals:
- UL Type AWM
- UL and NMTBA Type MTW
- NEC Type THW
- CSA TEW
- Passes UL VW-1 Vertical Flame Test
- RoHS Compliant

Packaging:
- 500' (152.4 m) reels
- Other put-ups available on special order

Lamp Cord Type SPT

60ºC, 300 Volt, UL/CSA

Product Construction:

Conductor:
- 18 and 16 AWG fully annealed bare or tinned copper

Insulation:
- Premium-grade, color-coded PVC
- Temperature range: -20ºC to +60ºC
- Color code: See chart below

Jacket Marking:
- E# (UL) (NO. COND) (SIZE) (mm²) SPT-1 (or STP-2) 60°C FT2 300 VOLT CSA LL69381 RoHS

Applications:
- Small appliances
- Lamps
- Radios
- Jukeboxes

Industry Approvals:
- UL Listed
- CSA Certified
- RoHS Compliant

Packaging:
- 250' (76.2 m) spools
- Other put-ups available on special order

JACKET COLOR CODE CHART

A	Black or White or Brown
B	Clear Silver (tinned copper)
C	Clear Gold
D	Clear



TYPE SPT-1

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOM. INSULATION THICKNESS		NOMINAL O.D.		CURRENT AMPS(1)	APPROX. NET WEIGHT LBS/M(S)	JACKET COLOR CHART
				INCHES	mm	INCHES	mm			
02301	2	18	41/34	0.030	0.76	0.107 X 0.210	2.72 X 5.330	10	22	A
02304	2	18	41/34	0.030	0.76	0.107 X 0.210	2.72 X 5.330	10	22	D
02305	2	18	41/34	0.030	0.76	0.107 X 0.210	2.72 X 5.330	10	22	C
02306	2	18	41/34	0.030	0.76	0.107 X 0.210	2.72 X 5.330	10	22	B

TYPE SPT-2

CATALOG NUMBER	NO. OF COND.	AWG SIZE	COND. STRAND	NOM. INSULATION THICKNESS		NOMINAL O.D.		CURRENT AMPS(1)	APPROX. NET WEIGHT LBS/M(S)	JACKET COLOR CHART
				INCHES	mm	INCHES	mm			
02303	2	16	65/34	0.045	1.14	0.155 X 0.295	3.94 X 7.490	13	37	A

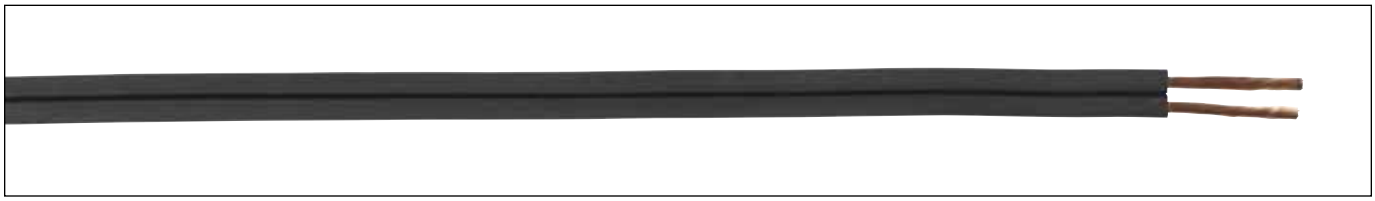
(1) Ampacities based on NEC Table 400.5(A)(1).
(S) Actual shipping weight may vary.

General Cable

Made in U.S.A. RoHS Compliant Directive 2011/65/EU CSA Certified Canadian Standard Association UL LISTED CAROL BRAND

Low-Voltage Landscape Lighting Wire

60ºC, 150 Volt, UL; 60ºC, 30 Volt, CSA



LOW-VOLTAGE LANDSCAPE LIGHTING WIRE - 150 VOLT - UL; 30 VOLT - CSA

CATALOG NUMBER	NO. OF COND.	AWG SIZE	NOM. INS. THICKNESS		NOMINAL O.D.		POWER RATING[1]			APPROX. NET WT. LBS/M'[S]
			INCHES	mm	INCHES	mm	VOLTS	AMPS	WATTS	
02309	2	16	0.045	1.14	0.155 X 0.296	3.94 X 7.52	150	13	1950	35
02310	2	14	0.045	1.14	0.170 X 0.354	4.32 X 8.99	150	18	2700	45
02311	2	12	0.045	1.14	0.190 X 0.385	4.83 X 9.78	150	25	3750	62
02312	2	10	0.045	1.14	0.200 X 0.400	5.08 X 10.16	150	30	4500	90
02313	2	8	0.060	1.52	0.270 X 0.550	6.86 X 13.97	150	55	8250	175

[1] Amps and watts are offered ONLY as a guide to the end user.
[S] Actual shipping weight may vary.

Product Construction:

Conductor:
- 8 through 16 AWG fully annealed stranded bare copper per ASTM B3

Insulation:
- Premium-grade PVC, black
- Duplex parallel design for easy tear-down during installation
- Polarity ridge on one leg for positive circuit identification
- Temperature range: -20°C to +60°C

Jacket Marking:
- CAROL (SIZE) UNDERGROUND LOW ENERGY CIRCUIT CABLE SUNLIGHT RESISTANT FOR LOW VOLTAGE OUTDOOR LIGHTING E# (UL) -- CSA LL# LVLL 30 V FT1

Applications:
- Low-voltage landscape lighting
- Low-voltage security lighting

Industry Approvals:
- UL Listed underground low-energy circuit cable
- UL Listed for outdoor applications
- UL Listed for direct burial applications
- CSA Approved
- RoHS Compliant

Packaging:
- 500' (513.4 m) spools
- Other put-ups available on special order

CAROL BRAND UL LISTED Certified Canadian Standard Association RoHS Compliant Directive 2011/65/EU Made in U.S.A. General Cable

Low-Voltage Sprinkler Wire

60ºC, 30 Volt, UL



LOW-VOLTAGE SPRINKLER WIRE - 30 VOLT - UL

CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FEET)	POWER RATING[1]			APPROX. NET WT. LBS/M'[S]
				VOLTS	AMPS	WATTS	
23804	4	18	500	30	5.6	168	18
23805	5	18	500	30	5.6	168	22
23807	7	18	500	30	4.9	147	31
23810	10	18	500	30	3.5	105	44

[1] Amps and watts are offered ONLY as a guide to the end user.
[S] Actual shipping weight may vary.

Product Construction:

Conductor:
- 18 AWG fully annealed solid bare copper per ASTM B3

Insulation:
- Premium-grade, color-coded PVC
- Premium-grade PE jacket, black
- Nylon rip cord to facilitate jacket removal
- Temperature range: -20°C to +60°C
- Color code: See chart below

Jacket Marking:
- CAROL (SIZE) 30 V SPRINKLER SYSTEMS WIRE - DIRECT BURIAL E54567 (UL)

Applications:
- Low-voltage golf course satellite sprinkler control
- Residential sprinkler solenoid control

Industry Approvals:
- UL Listed under a UL Miscellaneous Wire file
- UL Listed for outdoors applications
- UL Listed for direct burial applications
- RoHS Compliant

Packaging:
- 500' reels
- Other put-ups available on special order

COLOR CODE CHART

1	Black	**4**	Green	**7**	Blue	**10**	Purple
2	White	**5**	Orange	**8**	Brown		
3	Red	**6**	Yellow	**9**	Gray		

Made in U.S.A. RoHS Compliant Directive 2011/65/EU UL LISTED

Outdoor Extension Cords 6



General Cable, under the Carol® Brand name, offers a complete line of high-quality Outdoor Extension Cords designed to provide the best electrical performance for your application.

Carol's FrogHide® Ultra Flex® extension cords are the most flexible, durable rubber outdoor cords on the market with a name you won't forget. FrogHide cords are molecularly bonded to the caps and connectors, with heavy-duty strain reliefs built in for lasting strength, even in rough applications. Plus, they are resistant to water, oil, ozone and chemicals. FrogHide cords feature an exclusive personal identification system, so you can claim them as your own. They are easy to spot on the job, thanks to the bold, bright green color. FrogHide extension cords come with a limited lifetime warranty.

Lifetime Plus® Super Flex® extension cords have a connector end that lights up to indicate the power is on. Twice as flexible as other extension cords, the high- visibility yellow cord resists moisture and will not crack in arctic cold or melt in desert heat. The super-tough jacket provides extra resistance to cracking and abrasion. Lifetime Plus extension cords remain flexible to -50˚C.

The Carol line of All Weather extension cords and High Visibility All Weather extension cords are designed for excellent performance, even in freezing temperatures. These blue outdoor cords remain flexible to -50˚C.

Safety Orange® general-purpose outdoor extension cords and Powr-Centers® are basic necessities for every household tool box. The familiar orange jacket provides excellent visibility for improved safety on the job.

Index	Page
FrogHide® Ultra Flex® Extension Cords	57
Lifetime Plus® Super Flex® Lighted Extension Cords	58
Safety Orange® Extension Cords	59
Outdoor Powr-Center® Extension Cords	60
All Weather Extension Cords	61
High Visibility All Weather Extension Cords	61

CAROL BRAND®

General Cable

FrogHide® Ultra Flex® Extension Cords

3-Conductor Grounded • Type SJOW • -40°C to 90°C • 300 Volts



CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	AMPS	WATTS				
06425.63.06	3	14	25	Green	125	15	1875	10	3.0	30	079407064250
06450.63.06	3	14	50	Green	125	15	1875	6	6.0	36	079407064502
06400.63.06	3	14	100	Green	125	13	1625	4	11.4	46	079407064007
06225.61.06	3	12	25	Green	125	15	1875	6	4.3	26	079407062256
06250.61.06	3	12	50	Green	125	15	1875	4	7.9	32	079407062508
06200.61.06	3	12	100	Green	125	15	1875	2	15.9	32	079407062003

Product Description:

Carol® Brand FrogHide® Ultra Flex® extension cords are the most flexible, durable rubber outdoor cords on the market with a name you won't forget. FrogHide cords are bonded to the caps and connectors with heavy-duty strain reliefs built in for lasting strength, even in rough applications. Plus, they are resistant to water, oil, ozone and chemicals. FrogHide cords feature an exclusive personal identification system, so you can claim them as your own. They are easy to spot on the job, thanks to the bold, bright green color. FrogHide extension cords come with a limited lifetime warranty.

Product Warranty:

Carol® Brand FrogHide® Ultra Flex®
Limited Lifetime Warranty

This product is covered by a limited lifetime warranty against manufacturing defects. If you are not satisfied with this cord, return it with the original packaging to General Cable, 4 Tesseneer Drive, Highland Heights, KY 41076 for evaluation. This warranty does not cover damage to the cord from long-term use, abuse or from failure to follow electrical codes, laws and regulations relating to building or construction, including Article 590 of the National Electrical Code®. This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

Product Construction:

Conductor:
- 14 AWG or 12 AWG stranded bare copper

Insulation:
- Premium-grade, color-coded 90°C EPDM

Jacket:
- CPE; green
- Temperature range: -40°C to 90°C
- Voltage rating: 300 volts

NEMA Configuration:
- 5-15P/5-15R

Applications:
- Chain saws
- Wet/dry vacs
- Orbital sanders
- Other outdoor equipment

Features:
- New technology molecularly bonds cap and connector
- Ultra-flexible
- Heavy-duty strain relief
- Personal identification system
- Resistant to water, oil, ozone and chemicals
- Limited lifetime warranty
- 3-conductor grounded

Industry Approvals:
- UL Listed
- OSHA Acceptable

General Cable

OSHA Acceptable Occupational Safety and Health Administration

UL LISTED

CAROL BRAND

Lifetime Plus® Super Flex® Lighted Extension Cords

3-Conductor Grounded • Type SJTW • -50ºC to 60˚C • 300 Volts

CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	TYPE	POWER RATING			PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
						VOLTS	AMPS	WATTS				
03387.63.05	3	16	25	Yellow	SJTW	125	13	1625	12	1.7	20	079407033874
03390.63.05	3	14	25	Yellow	SJTW	125	15	1875	12	2.5	30	079407033904
03391.63.05	3	14	50	Yellow	SJTW	125	15	1875	6	4.7	28	079407033911
03392.63.05	3	14	100	Yellow	SJTW	125	13	1625	4	9.2	37	079407033928
03397.61.05	3	12	25	Yellow	SJTW	125	15	1875	6	3.7	22	079407033973
03398.61.05	3	12	50	Yellow	SJTW	125	15	1875	4	7.0	28	079407033980
03399.61.05	3	12	100	Yellow	SJTW	125	15	1875	2	13.1	26	079407033997
03350.63.05	3	12	2	Yellow	SJTW	125	15	1875	6	1.0	6	079407033508
03351.61.05	3	12	25	Yellow	SJTW	125	15	1875	6	4.2	25	079407416592
03352.61.05	3	12	50	Yellow	SJTW	125	15	1875	4	7.5	30	079407416608
03353.61.05	3	12	100	Yellow	SJTW	125	15	1875	2	13.6	27	079407416615



Product Description:

Lifetime Plus® Super Flex® extension cords have a connector end that lights up to indicate the power is on. Twice as flexible as other extension cords, the high-visibility yellow cord resists moisture and will not crack in arctic cold or melt in desert heat. The super-tough jacket provides extra resistance to cracking and abrasion. The Lifetime Plus extension cords have a limited lifetime warranty and remain flexible to -40˚C.

Product Construction:

Conductor:
- 16 AWG, 14 AWG or 12 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded PVC

Jacket:
- PVC; yellow
- Temperature range: -40˚C to 60˚C
- Voltage rating: 300 volts

NEMA Configuration:
- 5-15P/5-15R

Applications:
- Chain saws
- Wet/dry vacs
- Orbital sanders
- Other outdoor equipment

Features:
- Lights up with power
- Super-flexible
- Weather- and water-resistant
- Limited lifetime warranty
- 3-conductor grounded

Industry Approvals:
- UL Listed
- OSHA Acceptable

CAROL BRAND UL LISTED OSHA Acceptable Occupational Safety and Health Administration

General Cable

Safety Orange® Extension Cords

3-Conductor Grounded • Type SJTW • -40ºC to 60˚C • 300 Volts



CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	AMPS	WATTS				
03318.63.04	3	16	10	Orange	125	13	1625	24	0.8	19	079407033188
03327.63.04	3	16	25	Orange	125	13	1625	24	1.8	43	079407033270
03354.63.04	3	16	50	Orange	125	13	1625	12	3.4	40	079407033546
03302.63.04	3	16	100	Orange	125	10	1250	4	6.6	26	079407033027
03328.63.04	3	14	25	Orange	125	15	1875	6	2.4	14	079407033287
03356.63.04	3	14	50	Orange	125	15	1875	4	4.6	18	079407033560
03304.63.04	3	14	100	Orange	125	13	1625	2	9.0	18	079407033041
06826.63.04	3	12	25	Orange	125	15	1875	4	3.4	14	079407068265
06853.63.04	3	12	50	Orange	125	15	1875	2	6.6	13	079407068531
06801.63.04	3	12	100	Orange	125	15	1875	2	13.0	26	079407068012

Product Construction:

Conductor:
- 16 AWG through 12 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded PVC

Jacket:
- PVC; orange
- Temperature range: -40˚C to 60˚C
- Voltage rating: 300 volts

NEMA Configuration:
- 5-15P/5-15R

Applications:
- General use indoor/outdoor cord
- Vacuum cleaners
- Floor polishers
- Sanders
- Other power equipment

Features:
- Indoor/outdoor use
- 3-conductor grounded

Industry Approvals:
- UL Listed
- OSHA Acceptable

General Cable

OSHA Acceptable Occupational Safety and Health Administration

UL LISTED

CAROL BRAND

Outdoor Powr-Center® Extension Cords

3-Conductor Grounded • Types STW, SJEOOW and SJTW • -40°C to 60°C • 300 and 600 Volts

CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	AMPS	WATTS				
STW-600 V											
00594.63.04	3	12	2	Orange	125	15	1875	6	1.0	6	079407005949
00596.61.04	3	12	50	Orange	125	15	1875	2	11.1	22	079407005963
00597.61.04	3	12	100	Orange	125	15	1875	2	21.7	43	079407005970
SJTW-300 V											
00690.63.04	3	14	10	Orange	125	15	1875	12	1.2	15	079407006908
00691.63.04	3	14	25	Orange	125	15	1875	6	2.6	16	079407006915
00692.63.04	3	14	50	Orange	125	15	1875	4	4.7	19	079407006922
00694.63.04	3	12	10	Orange	125	15	1875	12	1.8	22	079407006946
00696.63.04	3	12	50	Orange	125	15	1875	2	7.0	14	079407006960
00697.63.04	3	12	100	Orange	125	15	1875	2	13.4	27	079407006977
ALL WEATHER HIGH VISIBILITY SJEOOW-300 V											
00790.63.07	3	14	10	Blue	125	15	1875	12	1.3	16	079407007905
00791.63.07	3	14	25	Blue	125	15	1875	6	2.7	16	079407007912
00792.63.07	3	14	50	Blue	125	15	1875	4	4.8	19	079407007929
00793.63.07	3	14	100	Blue	125	13	1625	2	9.0	18	079407007936
00787.63.05	3	12	50	Yellow	125	15	1875	2	6.5	13	079407007875
00788.63.05	3	12	100	Yellow	125	15	1875	2	13.0	26	079407007882



Product Construction:

Conductor:
- 14 AWG or 12 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded PVC

Jacket:
- PVC; orange, TPE; blue or yellow
- Temperature range: -40°C to 60°C
- Voltage rating: 300 and 600 volts

NEMA Configuration:
- 5-15P/5-15R

Applications:
- General use indoor/outdoor cord
- Chain saws
- Wet/dry vacs
- Orbital sanders
- Other power equipment

Features:
- Indoor/outdoor use
- 3 grounded outlets

Industry Approvals:
- UL Listed
- OSHA Acceptable

CAROL BRAND UL LISTED OSHA Acceptable Occupational Safety and Health Administration

General Cable

All Weather Extension Cords

3-Conductor Grounded • Type SJEOOW • -50˚C to 105˚C • 300 Volts



CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	AMPS	WATTS				
03654.63.07	3	16	25	Blue	125	13	1625	4	1.8	7	079407036547
03655.63.07	3	16	50	Blue	125	13	1625	4	3.2	13	079407036554
03660.63.07	3	14	25	Blue	125	15	1875	4	2.2	9	079407036608
03661.63.07	3	14	50	Blue	125	15	1875	4	4.3	17	079407036615
03662.63.07	3	14	100	Blue	125	13	1625	2	8.0	16	079407036622
03667.63.07	3	12	50	Blue	125	15	1875	2	6.5	13	079407036677
03668.63.07	3	12	100	Blue	125	15	1875	2	12.5	25	079407036684

Product Description:

The Carol® line of All Weather Extension Cords are designed for excellent performance, even in freezing temperatures. The blue outdoor cords remain flexible and resist cracking to -50˚C.

Product Construction:

Conductor:
- 16 AWG through 12 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded PVC

Jacket:
- TPE; blue
- Temperature range: -50˚C to 105˚C
- Voltage rating: 300 volts

NEMA Configuration:
- 5-15P/5-15R

Applications:

- Snow blowers
- Engine heaters
- Battery chargers
- Other outdoor equipment

Features:

- Flexible from -50˚C to 105˚C
- For harsh weather conditions
- 3-conductor grounded

Industry Approvals:

- UL Listed
- OSHA Acceptable

High Visibility All Weather Extension Cords

3-Conductor Grounded • Type SJEOOW • -50˚C to 105˚C • 300 Volts



CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	AMPS	WATTS				
03685.61.05	3	10	50	Yellow	125	15	1875	2	12.5	25	079407036851
03686.61.05	3	10	100	Yellow	125	15	1875	2	24.5	49	079407036868

Product Construction:

Conductor:
- 10 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded premium PVC

Jacket:
- TPE; yellow
- Temperature range: -50˚C to 105˚C
- Voltage rating: 300 volts

NEMA Configuration:
- 5-15P/5-15R

Applications:

- Heavy construction equipment
- Air compressors
- Circular saws
- Generators

Industry Approvals:

- UL Listed
- OSHA Acceptable

General Cable

OSHA Acceptable Occupational Safety and Health Administration

UL LISTED

CAROL BRAND

Application-Specific Extension Cords 7



General Cable offers a complete line of Power Supply Replacement Cords for use with power tools and household appliances. The three-conductor cords have either right angle or straight caps with a variety of plug configurations. The free ends are conveniently slit for ease of connection.

Carol® Brand Range Cords and Dryer Cords are available in three-wire and four-wire constructions, with an assortment of plug configurations. They are designed to accommodate virtually any household oven/range or clothes dryer.

Carol offers a wide assortment of Major Appliance Extension Cords with a variety of plug and cap configurations for use with air conditioners, refrigerators, freezers, microwave ovens, dehumidifiers and other large household appliances.

Index	Page
Pro Flex® Rubber Extension Cords	63
Coiled Power Tool Extension Cords and Power Supply Cords	63
Power Supply Replacement Cords	63-64, 66
Range Cords	65
Dryer Cords	65
Air Conditioner Replacement Cords	65
Major Appliance Cords	66

Pro Flex® Rubber Extension Cords

3-Conductor Grounded • Type SJ • 60˚C • 300 Volts



CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			NEMA CONFIG.	PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	AMPS	WATTS					
06610.63.01	3	16	10	Black	125	13	1625	5-15P/5-15R	24	0.7	17	079407066100
06625.63.01	3	16	25	Black	125	13	1625	5-15P/5-15R	24	1.7	40	079407066254
06911.63.01	3	14	25	Black	125	15	1875	5-15P/5-15R	6	2.3	14	079407069118

Product Construction:

Conductor:
- 16 AWG through 14 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded EPDM

Jacket:
- CPE; black
- Temperature: 60˚C
- Voltage rating: 300 volts

Applications:
- Floor polishers
- Sanders

Features:
- General use indoor cord
- 3-conductor grounded

Industry Approvals:
- UL Listed
- OSHA Acceptable for indoor use

Coiled Power Tool Extension Cords and Power Supply Cords

2 and 3 Conductor • Type SJT • 60˚C • 300 Volts



CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			NEMA CONFIG.	PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	AMPS	WATTS					
06014.60.04	3	16	10	Orange	125	13	1625	5-15P/5-15R	10	1.1	11	079407060146
02551.70.01	3	16	12	Black	125	15	1875	5-15P	10	1.1	11	079407025510

Product Construction:

Conductor:
- 16 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded PVC

Jacket:
- PVC; orange or black
- Voltage rating: 300 volts

Applications:
- Workshop and tool bench use

Features:
- Coiled cord expands from 3' to 10' or 12'
- Right-angle plug helps prevent the cord from being pulled from the socket

Features (cont'd.):
- 06014.60.04 and 02551.70.01 are 3-conductor grounded

Industry Approvals:
- UL Listed
- OSHA Acceptable

Power Supply Replacement Cords with Switch

3-Conductor Grounded • Type SJ • 60˚C • 300 Volts

CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			NEMA CONFIG.	SWITCH SPEED	PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	AMPS	WATTS						
02332.70.01	3	16	10	Black	125	10	1250	5-15P	1 Speed (On/Off)	25	0.9	22	079407023325
02333.70.01	4	16	10	Black	125	10	1250	5-15P	2 Speed (On/High/Low)	25	0.9	22	079407023332



Product Construction:

Conductor:
- 16 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded EPDM

Jacket:
- CPE; black

Applications:
- For replacement use
- For fan replacements

Features:
- Switch
- Straight plug
- Conductor stripped 5/8"
- Jacket removed 2"

Industry Approvals:
- UL Listed
- CSA

General Cable

UL LISTED CAROL BRAND

Power Supply Replacement Cords

3-Conductor Grounded • Types SJ, SJOW and SJOOW • 60˚C • 300 Volts

CATALOG NUMBER	CORD TYPE	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			NEMA CONFIG.	PLUG CONFIG.	PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
						VOLTS	AMPS	WATTS						
02685.70.01	SJOOW	3	18	8	Black	125	10	1250	5-15P	Straight	25	0.6	14	079407026852
02686.70.01	SJOW	3	16	8	Black	125	13	1625	5-15P	Straight	35	0.7	24	079407026869
04932.70.01	SJ	3	16	12	Black	125	13	1625	5-15P	Straight	50	0.8	40	079407049325
04929.70.01	SJ	3	16	9	Black	125	13	1625	5-15P	Straight	50	0.6	30	079407049295
04926.70.01	SJ	3	16	6	Black	125	13	1625	5-15P	Straight	50	0.6	28	079407049264



Product Construction:

Conductor:
- 18 AWG or 16 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded EPDM

Jacket:
- CPE; black

Applications:
- For replacement use

Features:
- For replacement use
- Straight plug

Industry Approvals:
- UL Listed
- CSA

Power Supply Replacement Cords

2 and 3 Conductor • Types SJT and ST • 60˚C • 300 Volts and 600 Volts

CATALOG NUMBER	CORD TYPE	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			NEMA CONFIG.	PLUG CONFIG.	PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
						VOLTS	AMPS	WATTS						
300 Volt														
02523.73.01	SJT	3	18	3	Black	125	10	1250	5-15P	Straight	50	0.2	12	079407025237
01364.70.01	SJT	3	18	8'2"	Black	125	10	1250	5-15P	Straight	50	0.5	25	079407213641
02052.70.01	SJT	3	18	12	Black	125	10	1250	5-15P	Straight	50	0.7	36	079407020522
02524.73.01	SJT	3	16	3	Black	125	13	1625	5-15P	Straight	50	0.3	14	079407025244
02547.70.01	SJT	3	16	6	Black	125	13	1625	5-15P	Straight	25	0.5	13	079407018444
01513.70.01	SJT	3	16	8'2"	Black	125	13	1625	5-15P	Straight	45	0.7	32	079407315130
04949.60.10	SJT	3	16	9	Gray	125	13	1625	5-15P	Straight	50	0.7	35	079407049493
01614.70.01	SJT	3	16	12	Black	125	13	1625	5-15P	Straight	50	0.9	44	079407016143
01278.70.01	SJT	2	16	8	Black	125	13	1625	1-15P	Straight	30	0.5	14	079407012787
01950.70.01	SJT	3	14	8	Black	125	15	1875	5-15P	Straight	50	0.8	41	079407019502
600 Volt														
01951.70.01	ST	3	12	8	Black	125	15	1875	5-15P	Straight	25	1.8	45	079407719518



With Switch	CORD TYPE	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			NEMA CONFIG.	PLUG CONFIG.	SWITCH SPEED	PKG. PER CTN.	WT./UNIT LBS	WT./CTN. LBS	UPC CODE
						VOLTS	AMPS	WATTS							
01732.70.01	SJT	3	18	8	Black	125	10	1250	5-15P	Straight	1 Speed (On/Off)	25	0.7	18	079407017324
02053.70.01	SJT	3	18	12	Black	125	10	1250	5-15P	Straight	1 Speed (On/Off)	15	0.8	12	079407020539

With Strain Relief	CORD TYPE	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			NEMA CONFIG.	PLUG CONFIG.	STRAIN RELIEF	PKG. PER CTN.	WT./UNIT LBS	WT./CTN. LBS	UPC CODE
						VOLTS	AMPS	WATTS							
02548.70.01	SJT	3	16	6	Black	125	13	1625	5-15P	Straight	7" From Free End	25	0.5	13	079407025480

With Receptacle Only	CORD TYPE	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			NEMA CONFIG.	RECEPTACLE CONFIG.	PKG. PER CTN.	WT./UNIT LBS	WT./CTN. LBS	UPC CODE
						VOLTS	AMPS	WATTS						
04530.73.01	SJT	3	16	3	Black	125	13	1625	5-15R	Straight	50	0.2	9	079407045303

Product Construction:

Conductor:
- 18 AWG through 12 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded PVC

Jacket:
- PVC; black or gray

Applications:
- For replacement use

Features:
- Straight plug
- Conductor stripped 5/8"
- Jacket removed 1 1/2"

Industry Approvals:
- UL Listed
- CSA

CAROL BRAND

UL LISTED

Certified Canadian Standard Association

General Cable

Range Cords

Type SRDT • 50 Amps • 60˚C • 300 Volts



CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			NEMA CONFIG.	PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	AMPS	WATTS					
05604.63.10	3	2#6 & 1#8	4	Gray	250	50	12500	10-50P	12	1.8	22	079407056040
05606.63.10	3	2#6 & 1#8	6	Gray	250	50	12500	10-50P	12	2.6	31	079407056064
00604.63.01	4	2#6 & 2#8	4	Black	250	50	12500	14-50P	12	2.2	27	079407006045
00606.63.01	4	2#6 & 2#8	6	Black	250	50	12500	14-50P	6	3.2	19	079407006069

Product Construction:

Conductor:
- 8 AWG through 6 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade PVC; black or gray

Applications:
- Ranges in homes built prior to 1997 (3-conductor)
- Ranges in homes built after 1997 (4-conductor)

Features:
- Right-angle cap
- Eyelet ends for safer hookups
- Strain-relief clamp protects cord from damage caused by pulling or stretching

Industry Approvals:
- UL Listed

Dryer Cords

Type SRDT • 30 Amps • 60˚C • 300 Volts



CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			NEMA CONFIG.	PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	AMPS	WATTS					
05654.63.10	3	3#10	4	Gray	250	30	7500	10-30P	12	1.2	14	079407056545
05656.63.10	3	3#10	6	Gray	250	30	7500	10-30P	12	1.5	18	079407056569
01004.63.01	4	4#10	4	Black	250	30	7500	14-30P	12	1.5	18	079407010042
01006.63.01	4	4#10	6	Black	250	30	7500	14-30P	6	2.1	12	079407010066

Product Construction:

Conductor:
- 10 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded PVC

Jacket:
- PVC; black or gray

Applications:
- Dryers in homes built prior to 1997 (3-conductor)
- Dryers in homes built after 1997 (4-conductor)

Features:
- Right-angle cap
- Eyelet ends for safer hookups

Features (cont'd):
- Strain-relief clamp protects cord from damage caused by pulling or stretching

Industry Approvals:
- UL Listed
- Meets revised 1997 NEC requirements

Air Conditioner Replacement Cords

3-Conductor Grounded • Type SPT-3 • 60˚C • 300 Volts



CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			PLUG CONFIG.	NEMA CONFIG.	PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	AMPS	WATTS						
04194.60.17	3	14	3	Beige	125	15	1875	Straight	5-15P	24	0.3	8	079407041947
04195.60.17	3	14	6	Beige	125	15	1875	Straight	5-15P	24	0.6	15	079407041657
04199.60.17	3	12	6	Beige	250	20	5000	Right Angle	6-20P	24	0.9	22	079407041992

Product Construction:

Conductor:
- 12 AWG and 14 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded PVC

Jacket:
- PVC; beige

Applications:
- For replacement use with air conditioners

Features:
- Conductor stripped 5/8"
- Free end slit 1 1/2"

Industry Approvals:
- UL Listed

General Cable

UL LISTED CAROL BRAND

Major Appliance Cords

3-Conductor Grounded • Type SPT-3 • 15 and 20 Amps • 60˚C • 300 Volts

CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			NEMA CONFIG.	PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	AMPS	WATTS					
00436.63.17	3	14	6	Beige	125	15	1875	5-15P/5-15R	24	0.6	15	079407004362
00439.63.17	3	14	9	Beige	125	15	1875	5-15P/5-15R	24	0.9	21	079407004393
00442.63.17	3	14	12	Beige	125	15	1875	5-15P/5-15R	12	1.2	14	079407004423
00762.63.17	3	12	9	Beige	250	20	5000	6-20P/6-20R	24	1.4	34	079407007622
00772.63.17	3	12	9	Beige	125	20	2500	5-20P/5-20R	24	1.4	34	079407007721

Product Construction:

Conductor:
- 12 and 14 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade PVC; beige

Applications:
- Air conditioners
- Refrigerators
- Freezers
- Microwaves
- Dehumidifiers

Features:
- Molded right-angle plug

Industry Approvals:
- UL Listed



Power Supply Replacement Cords

3-Conductor Grounded • Types SPT-1 and SPT-3 • 60˚C • 300 Volts

CATALOG NUMBER	CORD TYPE	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			NEMA CONFIG.	PLUG CONFIG.	PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
						VOLTS	AMPS	WATTS						
02050.70.10	SPT-1	3	18	8	Gray	125	10	1250	5-15P	Straight	50	0.4	21	079407020508
02522.73.01	SPT-3	3	16	6	Black	125	13	1625	5-15P	Straight	25	0.6	14	079407025220
04106.73.10	SPT-3	3	16	6	Gray	125	13	1625	5-15P	Right Angle	50	0.4	22	079407041060
04103.73.10	SPT-3	3	16	3	Gray	125	13	1625	5-15P	Right Angle	100	0.3	26	079407041039
04806.73.10	SPT-3	3	16	6	Gray	125	13	1625	5-15P	Straight	50	0.4	19	079407048069
04803.73.10	SPT-3	3	16	3	Gray	125	13	1625	5-15P	Straight	100	0.3	27	079407048038

Product Construction:

Conductor:
- 18 AWG and 16 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded PVC

Jacket:
- PVC; black, gray or beige

Applications:
- For replacement use

Features:
- Conductor stripped 5/8”
- Free end slit 1 1/2”

Industry Approvals:
- UL Listed



CAROL BRAND UL LISTED

General Cable

Plug-it® Extension Cord Accessories 8



Index	Page
Plug-it® Fluorescent Utility Light	68
Plug-it® Powr-Center® Adapter	68
Powr-Reel™ with 3 Outlets	69
Plug-it® Ground Fault Circuit Interrupter (GFCI) and Surge Protector Plug	69

The Plug-it® Fluorescent Light turns your extension cord into a light. The portable light has no permanent cord attached, providing easy storage when not in use. Ideal for contractors and do-it-yourselfers alike, the impact-resistant Plug-it® Fluorescent Light has a 13-watt bulb that runs cool to the touch when in operation. A cord-locking screw secures extension cords and resists disconnection when in use.

Also available in the Plug-it® series are adapters, Powr-Reels™ and the GFCI.

- The Plug-it® Powr-Center® Adapter features three outlets in a “T” configuration, adapting a single extension cord for more uses.
- The Plug-it® Ground Fault Circuit Interrupter (GFCI) and Surge Protector Plug connects to any standard extension cord. This handy pocket-size adapter detects power leaks and cuts off electricity in less than a second to prevent electric shock. It is designed for use anywhere ground fault protection is desired, including job sites, workshops, garages, kitchens, bathrooms or outdoor outlets, and features convenient test and reset buttons.

Plug-it® Fluorescent Utility Light

Cordless • Cool-Running • Impact-Resistant

CATALOG NUMBER	MAXIMUM BULB SIZE (WATTS)	PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
07505.73.05	13	8	1.3	10	079407075058



Product Description:

The impact-resistant Plug-it® Fluorescent Light has a 13-watt bulb that runs cool to the touch when in operation. A cord-locking screw secures the extension cord and resists disconnection when in use.

Product Construction:

Body:
- PVC; yellow

Lens:
- Clear butyrate

Bulb:
- PLS 13-watt fluorescent

Applications:

- Temporary lighting
- For general use only
- Not for use in hazardous locations

Features:

- Turns an extension cord into a light
- Connects to 3-conductor grounded extension cord
- Cool-running 13-watt fluorescent bulb
- Rubberized hood
- Impact-resistant body and lens
- Swivel hook
- Locking screw system assures secure cord connections

Industry Approvals:

- UL Listed

Plug-it® Powr-Center® Adapter

"T" Configuration—Adapt extension cords for different uses

Product Construction:

Body:
- PVC; beige

Applications:

- Adapts a single extension cord for multiple uses

Features:

- 3 convenient outlets

CATALOG NUMBER	VOLTS	AMPS	WATTS	PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE	COLOR
04781.96.17	125	15	1875	5	0.6	3	079407047819	Beige

Industry Approvals:

- UL Listed



Powr-Reel™ with 3 Outlets

3-Conductor Grounded • Type SJO • 90˚C • 300 Volts



CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	AMPS	WATTS				
44623.61.05	3	16	25	Yellow	125	10	1250	4	2.7	11	079407446230

Product Construction:

Conductor:
- 16 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded 90˚C EPDM

Jacket:
- CPE; yellow
- Voltage rating: 300 volts

Applications:
- Shop tools

Features:
- Tangle-Proof® instant cord storage
- Sturdy metal reel case
- Rubber cord
- 3 grounded outlets
- Cord locks in place; pull on cord to engage retractable reel

Industry Approvals:
- UL Listed
- OSHA Acceptable

Plug-it® Ground Fault Circuit Interrupter (GFCI) and Surge Protector Plug



CATALOG NUMBER	POWER RATING			PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
	VOLTS	AMPS	WATTS				
D7524.13.05	125	15	1875	6	0.3	2	079407075249

Product Description:
The Plug-it® Ground Fault Circuit Interrupter and Surge Protector Plug detects power leaks and cuts off electricity in less than one second to prevent electric shock.

Product Construction:

Body:
- PVC; yellow

Applications:
- Use anywhere GFCI protection is desired: job sites, kitchens, bathrooms, garages and workshops

Features:
- Detects power leaks and cuts electricity off in less than a second to prevent electric shock
- Test and reset buttons
- Use with any standard extension cord
- Use indoor or outdoor
- Protects electrical circuitry from voltage fluctuations
- Maximum clamping voltage - 790 volts
- MOV - 80 joules

Industry Approvals:
- UL Listed
- OSHA Acceptable

Specialty Extension Cords and Lighting 9



Carol® Brand Specialty Extension Cord Products are uniquely designed for specific uses by contractors, do-it-yourselfers and homeowners alike.

The Shock Safe® 3-outlet Powr-Center® has a built-in ground fault circuit interrupter (GFCI) for detecting power leaks. Featuring weather-resistant test and reset buttons, the GFCI cuts off electricity to prevent electric shock.

Carol offers 3-outlet Powr-Centers® for use when multiple outlets are needed indoors. The three-conductor cords are designed specifically for household, office or workshop use.

Carol offers three-conductor standard Utility Lights with plastic or metal guards. Our Brooder Lamp and Clamp Lights are also available to meet your lighting needs.

Index **Page**

Shock Safe® Ground Fault Circuit Interrupter (GFCI) Powr-Center®	71
Household Powr-Centers®	71
Plastic Guard Utility Light	72
Metal Guard Utility Light	72
Brooder and Heat Lamp	73
Clamp Light	73

Shock Safe® Ground Fault Circuit Interrupter (GFCI) Powr-Center®

3 Conductor • Type SJTW • -40ºC to 60˚C • 300 Volts



POWR-CENTER® WITH 3 OUTLETS

CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	AMPS	WATTS				
04000.63.05	3	12	2	Yellow	125	15	1875	6	1.3	8	079407040001

Product Description:

The Shock Safe® 3-outlet Powr-Center® has a built-in GFCI for detecting power leaks. Featuring weather-resistant test and reset buttons, the GFCI cuts off electricity to prevent electric shock.

Product Construction:

Conductor:
- 12 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded PVC

Jacket:
- PVC; yellow
- Temperature range: -40˚C to 60˚C
- Voltage rating: 300 volts

Applications:

- Power tools
- Appliances

Features:

- Integral GFCI detects power leaks and cuts off electricity to prevent electric shock
- Test and reset buttons
- 3-conductor grounded

Industry Approvals:

- UL Listed
- OSHA Acceptable

Household Powr-Centers®

3-Conductor Grounded • Types SPT-3 and SJT • 60˚C • 300 Volts



CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	AMPS	WATTS				
TYPE SPT-3											
00655.63.04	3	14	3	Orange	125	15	1875	10	0.6	6	079407006557
TYPE SJT											
00565.63.17	3	16	9	Beige	125	13	1625	12	0.7	8	079407005659

Product Construction:

Conductor:
- 16 AWG or 14 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded PVC

Jacket:
- PVC; orange or beige
- Voltage rating: 300 volts

Applications:

- Clocks
- Lamps
- Holiday lighting
- Other household appliances

Features:

- 3 grounded outlets

Industry Approvals:

- UL Listed

Plastic Guard Utility Light

3-Conductor Grounded • Type SJT • 300 Volts

CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	AMPS	WATTS				
04497.60.05	3	16	50	Yellow	125	13	1650	6	3.5	21	079407044979

Product Construction:

Conductor:
- 16 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded PVC

Jacket:
- PVC; yellow
- Voltage rating: 300 volts

Applications:
- Temporary lighting
- For general use only
- Not for use in hazardous locations

Features:
- Side outlet
- On/off switch
- 75-watt bulb maximum
- Swivel hook
- Polypropylene guard

Industry Approvals:
- UL Listed
- OSHA Acceptable for general use



Metal Guard Utility Light

3-Conductor Grounded • Type SJT • 300 Volts

CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING			NEMA CONFIG.	PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	AMPS	WATTS					
04455.60.05	3	16	25	Yellow	125	13	1650	15-15P	12	1.8	22	079407044559
04457.60.05	3	16	50	Yellow	125	13	1650	15-15P	6	3.5	21	079407044573

Product Construction:

Conductor:
- 16 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded PVC

Jacket:
- PVC; yellow
- Voltage rating: 300 volts

Applications:
- Temporary lighting
- For general use only
- Not for use in hazardous locations

Features:
- Side outlet
- Metal hook
- On/off switch
- 75-watt bulb maximum
- 3-conductor grounded

Industry Approvals:
- UL Listed
- OSHA Acceptable for general use



CAROL BRAND UL LISTED

General Cable

Brooder and Heat Lamp

2-Conductor Polarized • Type SJTW • 105˚C • 300 Volts • Non-UL

CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING		NEMA CONFIG.	PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	WATTS					
04127.60.01	2	18	8	Black	125	250	1-15P	12	1.0	12	079407041275



Product Construction:

Conductor:
- 18 AWG stranded bare copper per ASTM B174

Insulation:
- Premium-grade, color-coded PVC

Jacket:
- PVC; black
- Voltage rating: 300 volts

Applications:
- Temporary lighting
- Egg hatching

Features:
- 10 1/2" bell shade
- Porcelain socket
- Hanging clamp
- Swivel clamp with protective vinyl sleeve
- Protective bulb guard
- 250-watt bulb maximum

Clamp Light

2-Conductor Polarized • Type SPT-2 • 105˚C • 300 Volts

CATALOG NUMBER	NO. OF COND.	AWG SIZE	LENGTH OF CORD (FT)	COLOR OF JACKET	POWER RATING		NEMA CONFIG.	PKG. PER CTN.	WT./ UNIT LBS	WT./ CTN. LBS	UPC CODE
					VOLTS	WATTS					
04170.60.02	2	18	6	White	125	150	1-15P	12	0.8	10	079407041701



Product Construction:

Conductor:
- 18 AWG stranded bare copper per ASTM B174

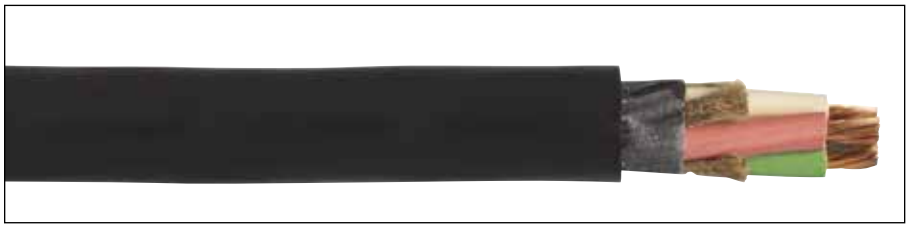
Insulation:
- Premium-grade PVC; white
- Voltage rating: 300 volts

Applications:
- Temporary lighting

Features:
- 8 1/2" bell shade
- Clamp with protective vinyl sleeve
- Adjustable ball joint
- Switch socket

Industry Approvals:
- UL Listed

General Information 10



As a helpful aid to our customers, this general information section provides useful wire and cable definitions that can assist the designer or application specialist in determining the best cord product specification.

Understanding and using proper wire and cable terminology gains additional importance, given the global application and use of cord and cordset products.

Quick-reference unit conversion and temperature conversion charts included in this section provide you with an understanding of the worldwide applications of our cord products.

Index	Page
Glossary	75-89
Unit Conversion Factors	90
Temperature Conversion Chart	91

Glossary

AAR: Association of American Railroads.

AC: Alternating Current (a.c.). Current in which the charge-flow periodically reverses and is represented by: $I = I_{\circ} \cos (2 f + \phi)$ where, I is the current, $I_{\circ}$ is the amplitude, f the frequency, ϕ the phase angle.

ALS: A type of cable consisting of insulated conductors enclosed in a continuous, closely fitting aluminum tube.

ANSI: Abbreviation for American National Standards Institute.

ASME: Abbreviation for American Society of Mechanical Engineers.

ASTA: United Kingdom approval agency.

ASTM: Abbreviation for the American Society for Testing and Materials, a non-profit industry-wide organization which publishes standards, methods of test, recommended practices, definitions and other related material.

AWM: UL designation for appliance wiring material.

Abrasion Resistance: Ability of a wire, cable or material to resist surface wear.

Accelerated Aging: A test that attempts to duplicate long-time environmental aging in comparatively short time spans.

Accelerator: A chemical additive which hastens a chemical reaction under specific conditions.

Adhesive-Bonded: Cables bonded by adding an adhesive coating to the surface of the cable components, then joining and curing the adhesive to form a cable. See *Bonded Cables.*

Admittance: The measure of the ease with which an alternative current flows in a circuit. The reciprocal of impedance.

Aerial Cable: A cable suspended in the air on poles or other overhead structure.

Aging: The change in properties of a material with time under specific conditions.

Air Core Cable: A cable in which the interstices in the cable core are not filled with a moisture barrier.

Alligator Clip: A mechanical device shaped like alligator jaws used as a temporary connection on the end of interconnections wire.

Alloy: A metal formed by combining two or more different metals to obtain desirable properties.

Aluminum-Steel Conductor: A composite conductor made up of a combination of aluminum and steel wires.

Ambient Temperature: The temperature of a medium (gas or liquid) surrounding an object.

American Wire Gauge (AWG): The standard system used for designating wire diameter. The lower the AWG number, the larger the diameter. Also called the Brown and Sharpe (B&S) Wire Gauge.

Ampacity: See *Current Carrying Capacity.*

Ampere's Law: The magnetic intensity at any point near a current carrying conductor can be computed on the assumption that each infinitesimal length of the conductor produces at the point of an infinitesimal magnetic density. The resulting magnetic intensity at the point is the vector sum of the contributions of all the elements of the conductor.

Ampere: The unit of current. One ampere is the current flowing through one ohm of resistance at one volt potential.

Analog: Transmission data densities by continuously variable quantities.

Anneal: Relief of mechanical stress through heat and gradual cooling. Annealing copper renders it less brittle.

Annular Conductor: A number of wires stranded in three reversed concentric layers around a core.

Anti-Oxidant: A substance which prevents or slows down oxidation of material exposed to air.

Appliance Wire and Cable: A classification covering insulated wire and cable for internal wiring of appliances and equipment.

Arc Resistance: The time required for an arc to establish a conductive path in a material.

Armored Cable: A cable provided with a wrapping of metal for mechanical protection.

Attenuation: Power loss in an electrical system. In cables, generally expressed in db per unit length, usually 100 ft.

Audio Frequency: The range of frequencies audible to the human ear. Usually 20-20,000 Hz.

B & S Gauge: The same as American Wire Gauge (AWG).

BCF: Abbreviation for billion conductor feet. A quantity derived by multiplying the number of conductors in a cable by the amount of cable. Usually used to indicate plant capacity or an annual requirement.

Band Marking: A continuous circumferential band applied to a conductor at regular intervals for identification.

Band Width: The frequency range of electrical signals transmitted.

Banded Cable: Two or more cables banded together by stainless steel strapping.

Barrel-Packed: Method of coiling into a fiber drum for shipment.

Belt: Number of layers of insulation on a conductor, or number of layers of jacket on a cable.

Belted-Type Cable: Multiple conductor cable having a layer of insulation over the assembled insulated conductors.

Bend Radius: The radius of the bend (usually designated as a multiple of product diameter) at which a wire product can safely be bent without significantly affecting its ability to function.

Bifilar: A winding made non-inductive by winding together (as one wire) two wires carrying current in opposite directions.

Bimetallic Wire: A wire formed of two different metals joined together (not alloyed). It can include wire with a steel core clad wire, or plated or coated wire.

Binder: A spirally served tape or thread used for holding assembled cable components in place awaiting subsequent manufacturing operations.

Binding Post: A device for clamping or holding electrical conductors in a rigid position.

Bond Strength: Amount of adhesion between bonded surfaces, e.g., in cemented ribbon cable.

Glossary

Bondable Wire: An insulated wire treated to facilitate adherence to materials such as potting compounds. Also, magnet wires used in making coils when bonding the turns together is desired.

Bonded Cable: Cable consisting of pre-insulated conductors or multiconductor components laid-in parallel and bonded into a flat cable. See *Adhesive-Bonded.*

Bonded Construction: An insulation construction in which the glass braid and nylon jacket are bonded together.

Booster: A device inserted into a line (or cable) to increase the voltage.

Boot: (1) Protective covering over a cable wire, or connector in addition to the normal jacketing or insulation. (2) A form placed around wire termination of a multiple-contact connector to contain the liquid potting compound before it hardens.

Braid: A fibrous or metallic group of filaments interwoven in cylindrical form to form a covering over one or more wires.

Braid Angle: The smaller of the two angles formed by the shielding strand and in the axis of the cable being shielded.

Braid Carrier: A spool or bobbin on a braid which holds one group of strands or filaments consisting of a specific number of ends. The carrier revolves during braiding operations.

Braid Ends: The number of strands used to make up one carrier. The strands are wound side by side on the carrier bobbin and lie parallel in the finished braid.

Braiding Machine: Machine used to apply braids to wire and cable and to produce braided sleeving and braids for tying or lacing purposes. Braiding machines are identified by the number of carriers.

Breakdown (Puncture): A disruptive discharge through the insulation.

Breakdown Voltage: The voltage at which the insulation between two conductors breaks down.

Breakout: The point at which a conductor or group of conductors breaks out from a multiconductor cable to complete circuits at various points along the main cable.

British Standard Wire Gauge: A modification of the Birmingham Wire Gauge and the legal standard of Great Britain for all wires. Also known as Standard Wire Gauge (SWG), New British Standard (NBS), English Legal Standard and Imperial Wire Guide.

Building Wire: Wire used for light and power, 600 volts or less, usually not exposed to outdoor environment.

Bunched Stranding: A group of strands twisted together in a random manner and the same direction without regard to geometric arrangement of specific strands.

Buncher: A machine that twists wires together in random arrangement.

Bundle: (fiber optic) A number of fibers grouped together, usually carrying a common signal.

Buried Cable: A cable installed directly in the earth without use of underground conduit. Also called Direct Burial Cable.

Bus: Wire used to connect two terminals inside of an electrical unit.

Bushing: A mechanical device used as a lining for an opening to prevent abrasion to wire and cable.

Butt: Joining of two conductors end-to-end, with no overlap and with the axes in line.

Butt Splice: A splice wherein two wires from opposite ends butt against each other, or against a stop, in the center of a splice.

Butt Wrap: Tape wrapped around an object or conductor in an edge-to-edge condition.

Byte: Typically a group of eight binary digits.

C-SJ: Same as SJ except extra-flexible conductor.

C-SJO: Same as SJO except extra-flexible conductor.

CATV: Acronym for Community Antenna Television.

CCTV: Acronym for Closed-Circuit Television.

CEBEC: Belgium Approval Agency; Comite Electrotechnique Belge Service de la Marque.

CE Code, CEC: Canadian Electrical Code.

CEE: Consortium for Energy Efficiency.

CENELEC: European Standards Agency; European Committee for Electrotechnical Norms.

CSA: Abbreviation for Canadian Standards Association, a non-profit independent organization which operates a listing service for electrical and electronic materials and equipment. The Canadian counterpart of the Underwriters Laboratories.

CV: Abbreviation for continuous vulcanization.

Cable: A stranded conductor with or without insulation and other coverings (single-conductor cable) or a combination of conductors (multiple-conductor cable). In fiber optics, a jacketed fiber or jacketed bundle in a form which can be terminated.

Cable Assembly: Typically, the cable and associated connectors; ready to install.

Cable Clamp: A device used to give mechanical support to the wire bundle or cable at the rear of a plug or receptacle.

Cable Clamp Adapter: A mechanical adapter that attaches to the rear of a plug or receptacle to allow the attachment of a cable clamp.

Cable Core: The portion of an insulated cable lying under a protective covering.

Cable Core Binder: A wrapping of tapes or cords around the conductors of a multiple-conductor cable used to hold them together.

Cable Filler: The material used in multiple-conductor cables to occupy the interslices formed by the assembly of the insulated conductors, thus forming a cable core.

Cable Sheath: The protective covering applied to cables.

Cable Vulcanizer: Compression molding machine used to repair cable jacketing that has had a part removed for splicing, for adding connectors or other devices or for replacing damaged sections.

Cabling: Twisting together two or more insulated conductors by machine to form a cable. In fiber optics, a method by which a group or bundle of fibers is mechanically assembled.

Cabling Factor: Used in the formula for calculating the diameter of an unshielded, unjacketed cable. D=Kd, where D is the cable diameter, K is the factor and d is the diameter of one insulated conductor.

Capacitance: The ratio of the electrostatic charge on a conductor to the potential difference between the conductors required to maintain that charge.

Glossary

Capacitance, Direct: The capacitance measured from one conductor to another conductor through a single insulating layer.

Capacitance, Mutual: The capacitance between two conductors (typically of a pair) with all other conductors, including shield, short circuited to ground.

Carrier: The woven element of a braid consisting of one or more ends (strands) which creates the interlaced effect. Also, a spindle, spool, tube or bobbin (on a braiding machine) containing yarn or wire, employed as a braid.

CBO: Rubber-insulated Brewery Cord.

Certificate of Compliance (C of C): A written statement; normally generated by a Quality Control Department, which states that the product being shipped meets customer's specifications.

Certified Test Report (CTR): A report reflecting actual test data on the cable shipped. Tests are normally conducted by the Quality Control Department, and show that the product being shipped meets the required test specifications.

Characteristic Impedance: The impedance that when connected to the output terminals of a transmission line, of any length, makes the line appear indefinitely long.

Chlorinated Polyethylene (CPE): Rubbery polymer used for insulation and jacketing of wire and cable. Manufactured by Dow Chemical under the trade name Tyrin.

Chlorosulfonated Polyethylene (CSPE): A rubbery polymer used for insulations and jackets. Manufactured by E.I. DuPont under the trade name of Hypalon.

Cigarette Wrap: Tape insulation wrapped longitudinally instead of spirally over a conductor.

Circuit: A complete path over which electrons can flow from the negative terminals of a voltage source through parts and wires to the positive terminals of the same voltage source.

Circuit Sizes: A popular term for building wire sizes 14 through 10 AWG.

Circular Mil: The area of a circle one mil (.001") in diameter; 7.854x10 7 sq. in. Used in expressing wire cross sectional area.

Cladding: Method of applying a layer of metal over another metal whereby the junction of the two metals is continuously welded. In fiber optics, a sheathing intimately in contact with the core of a higher refractive index material which serves to provide optical insulation and protection to the reflection interface.

Closed End Splice: An insulated splice in which two or more wires overlap and enter the splice from the same end of the barrel.

Coaxial Cable: A cable consisting of two cylindrical conductors with a common axis, separated by a dielectric.

Coaxial Connector: A connector that has a coaxial construction and is used with coaxial cable.

Coil Effect: The inductive effect exhibited by a spiral-wrapped shield, especially above audio frequencies.

Cold Flow: Permanent deformation of the insulation due to mechanical force of pressure (not due to heat softening).

Color Code: A color system for wire or circuit identification by use of solid colors, tracers braids, surface printing, etc.

Common Axis Cabling: In multiple cable constructions, a twisting of all conductors about a "common axis" to result in smaller-diameter constructions. Tends to result in greater susceptance to electromagnetic and electrostatic interference.

Compact Conductor: Stranded conductor rolled to deform the round wires to fill the normal interstices between the wires in a strand.

Composite (Clad) Wire: A wire having a core of one metal with a fused outer shell of different metals.

Composite Conductor: Two or more strands of different metals assembled and operated in parallel.

Compound: An insulating or jacketing material made by mixing two or more ingredients.

Compression Cable: A pipe type cable in which the pressure medium is separated from the insulation by a membrane or sheath.

Concentric: A central core surrounded by one or more layers of helically wound strands in a fixed round geometric arrangement.

Concentric Strand: A strand that consists of a central wire or core surrounded by one or more layers of spirally laid wires.

Concentric-Lay Cable: A concentric-lay conductor, or a multiple-conductor cable composed of a central core surrounded by one or more layers of helically laid insulated conductors.

Concentricity: The measurement of the location of the center of the conductor with respect to the geometric center of the circular insulation.

Conductance: The ability of a conductor to carry an electric charge. The ratio of the current flow to the potential difference causing the flow. The reciprocal of resistance.

Conductivity: The capacity of a material to carry electrical current—usually expressed as a percentage of copper conductivity (copper being one hundred percent).

Conductor: A wire (or combination of wires not insulated from one another) suitable for carrying electric current.

Conduit: A tube or trough in which insulated wires and cables are run.

Connector: A device used to provide rapid connect/disconnect service for electrical cable and wire terminations.

Contact: The part of a connector which actually carries the electrical current and is touched together or separated to control the flow.

Contact Inspection Hole: A hole in the cylindrical rear portion of contact used to check the depth to which a wire has been inserted.

Contact Size: The largest size wire which can be used with the specific contact. Also, the diameter of the engagement end of the pin.

Continuity Check: A test to determine whether electrical current flows continuously throughout the length of a single wire or individual wires in a cable.

Continuous Vulcanization: Simultaneous extrusion and vulcanization of rubber-like wire coating materials.

Glossary

Contrahelical: Cable spiraling in an opposite direction than the preceding layer within a wire or cable.

Control Cable: A multiconductor cable made for operation in control of signal circuits.

Controlled Impedance Cable: Package of two or more insulated conductors where impedance measurements between respective conductors are kept essentially constant throughout the entire length.

Copolymer: A compound resulting from the polymerization of two different monomers.

Copper-Clad: Steel with a coating of copper welded to it before drawing as opposed to copper-plated. Synonymous with Copperweld.

Copperweld: The trade name of Flexo Wire Division (Copperweld Steel Corp.) for their copper-clad steel conductors.

Cord: A small, flexible insulated cable.

Cord Set: Portable cords fitted with a wiring device at one or both ends.

Core: In cables, a component or assembly of components over which other materials are applied, such as additional components, shield, sheath or armor. In fiber optics, the transparent glass or plastic section with a high refractive index through which the light travels by internal reflections.

Corona: A discharge due to ionization of air around a conductor due to a potential gradient exceeding a certain critical value.

Corona Resistance: The time that the insulation will withstand a specified level of field-intensified ionization that does not result in the immediate complete breakdown of the insulation.

Corrosion: The destruction of the surface of a metal by chemical reaction.

Coverage: The calculated percentage which defines the completeness with which a metal braid covers the underlying surface. The higher percentage of coverage, the greater the protection against external interference.

Covering: Textile braid or jacket of rubber, plastics or other materials applied over wire and cables to provide mechanical protection and identification.

Crazing: The minute cracks on the surface of plastic materials.

Creep: The dimensional change with time of a material under load.

Creepage: The conduction of electricity across the surface of a dielectric.

Creepage Path: The path across the surface of a dielectric between two conductors.

Creepage Surface: An insulating surface which provides physical separation as a form of insulation between two electrical conductors of different potential.

Crimp: Act of compressing a connector barrel around a cable in order to make an electrical connection.

Crimp Termination: Connection in which a metal sleeve is secured to a conductor by mechanically crimping the sleeve with pliers, presses, or automated crimping machines.

Cross-linked: Inter-molecular bonds between long-chain thermoplastic polymers by chemical or electron bombardment means. The properties of the resulting thermosetting material are usually improved.

Crosstalk: Undesired electrical currents in conductors caused by electromagnetic or electrostatic coupling from other conductors or from external sources. Also, leakage of optical power from one optical conductor to another.

Cure: To change the physical properties of a material by chemical reaction.

Curing Cycle: The time, temperature and pressure required for curing.

Curl: The degree to which a wire tends to form a circle after removal from a spool. An indication of the ability of the wire to be wrapped around posts in long runs.

Current: The rate of transfer of electricity. Practical unit is the ampere which represents the transfer of one coulomb per second. In a simple circuit, current (I) produced by a cell or electromotive force (E) when there is an external resistance (R) and internal resistance (r) is:

$$I = \frac{E}{R + r}$$

Current-Carrying Capacity: The maximum current an insulated conductor can safely carry without exceeding its insulation and jacket temperature limitations.

Cut-Through Resistance: The ability of a material to withstand mechanical pressure usually a sharp edge or small radius, without separation.

Cycle: The complete sequence including reversal of the flow of an alternating electric current.

D.C.: Abbreviation for Direct Current.

DEMKO: Approval agency of Denmark.

DRT: Plastic range and dryer cord (CSA).

Decibel (db): A unit to express differences of power level. Used to express power gain in amplifiers or power loss in passive circuits or cables.

Delay Line: A cable made to provide very low velocity of propagation with long electrical delay for transmitted signals.

Depth of Crimp: Thickness of the crimped portion of a connector measured between two opposite points on the crimped surface.

Derating Factor: A factor used to reduce the current-carrying capacity of a wire when used in environments other than that for which the value was established.

Dielectric: An insulating medium which intervenes between two conductors and permits electrostatic attraction and repulsion to take place across it.

Dielectric Breakdown: The voltage required to cause an electrical failure or breakthrough of the insulation.

Dielectric Constant (K): The ratio of the capacitance of a condenser with dielectric between the electrodes to the capacitance when air is between the electrodes. Also called Permittivity and Specific Inductive Capacity.

Dielectric Loss: Power dissipated in an insulating medium as the result of the friction caused by molecular motion when an AC electric field is applied.

Dielectric Strength: The voltage which an insulation can withstand before breakdown occurs. Usually expressed as a voltage gradient (such as volts per mil).

Dielectric Test: A test in which a voltage higher than the rated voltage is applied for a specified time to determine the adequacy of the insulation under normal conditions.

Glossary

Digital: Transmission data representative by discrete characters.

Dip Coating: An insulating coating applied to the conductor by passing the conductor through an applicator containing liquid insulating medium.

Direct Burial Cable: A cable installed directly in the earth.

Direct Capacitance: The capacitance measured directly from conductor to conductor through a single insulating layer.

Direct Current: An electric current which flows in only one direction.

Direct Current Resistance (DCR): The resistance offered by any circuit to the flow of direct current.

Direction of Lay: The lateral direction in which the strands of a conductor run over the top of the cable conductor as they recede from an observer looking along the axis of the conductor or cable. Also applies to twisted cable.

Discrete Wiring: Wire or wires having distinct identity and purpose.

Disruptive Discharge: A sudden, large increase in current through an insulation medium due to the complete failure of the medium under the electrostatic stress.

Disturbed Conductor: A conductor that receives energy generated by the field of another conductor or an external source, such as a transformer.

Drain Wire: In a cable, the uninsulated wire laid over the component or components and used as a ground connection.

Draw Feed Stock: Rod or wire that is subsequently drawn to a smaller size.

Drawing: In wire manufacture, pulling the metal through a die or series of dies to reduce diameter to a specified size.

Dual Coaxial Cable: Two individually insulated conductors laid parallel or twisted and placed within an overall shield and sheath.

Duct: An underground or overhead tube for carrying electrical conductors.

Duplex: Two-way data transmission on a four-wire transmission line.

Duplex Cable: A cable composed of two insulated single-conductor cables twisted together.

Duplex Parallel: Typically used in the thermo-couple industry to denote two parallel conductors of dissimilar metals insulated in parallel without twist and jacketed. Commonly applied to thermo-couple grades and extension wires.

Durometer: A measure of hardness.

E: Symbol for voltage. Usually used to represent direct voltage or the effective (root-mean-square) value of an alternating voltage.

EFTS: Abbreviation for Electronic Funds Transfer System.

EIA: Abbreviation for Electronic Industries Association.

EMI: Abbreviation for electromagnetic interference.

EPDM: Ethylene-propylene-diene monomer rubber.

EPR: Ethylene-propylene rubber.

ESTA: Australian approval agency, Electricity Trust of South Australia.

ETPC: Abbreviation for electrolytic tough pitch copper. It has a minimum conductivity of 99.9%.

Eccetricity: Like concentricity, a measure of the center of a conductor's location with respect to the circular cross-section of the insulation. Expressed as a percentage of displacement of one circle within the other.

Eddy Current: Circulating currents induced in conducting materials by varying magnetic fields.

Elastomer: A rubber or rubber-like material which will stretch repeatedly to 200 percent or more and return rapidly and with force to its approximate original shape.

Electro-Tinned: Electrolytic process of tinning wire using pure tin.

Electrode: A conductor through which a current enters or leaves a nonmetallic conductor.

Electromagnetic Coupling: Energy transfer by means of a varying magnetic field.

Electromagnetic Field: A rapidly moving electric field and its associated moving magnetic field.

Electromagnetic Induction: The production of a voltage in a coil due to a change in the number of magnetic lines of force (flux linkages) passing through the coil.

Electromotive Force (e.m.f.): Pressure or voltage. The force which causes current to flow in a circuit.

Electronic Wire and Cable: A length of conductive or semiconductive material used in an electronic application.

Elongation: The fractional increase in the length of a material stressed in tension.

Embossing: A marker identification by means of thermal indentation leaving raised lettering on the sheath material of cable.

Emergency Overload: Load which occurs when larger-than-normal currents are carried through a cable or wire over a certain period of time.

Enameled Wire: A conductor with a baked-on enamel film insulation. In addition to magnet wire, enameled insulation is used on thermocouple-type wires and other wires.

Ends: In braiding, the number of essentially parallel wires of threads on a carrier.

Energize: To apply rated voltage to a circuit or device in order to activate it.

Equilay: More than one layer of helically laid wires with the direction of lay reversed for successive layers, but with the length of lay the same for each layer.

Etched Wire: A process applied to fluoroplastic wire in which the wire is passed through a sodium bath to create a rough surface to allow epoxy resin to bond the fluoroplastic.

External Interference: The effects of electrical waves or fields which cause sounds other than the desired signal; static.

External Wiring: Electronic wiring which interconnects subsystems within the system.

Extruded Cable: Cable with conductors which are uniformly insulated and formed by applying a homogeneous insulation material in a continuous extrusion process.

Extrusion: Method of continuously forcing plastic, rubber or elastomer material through an orifice to apply insulation or jacketing over a conductor or cable core.

FAA: Federal Aeronautics Administration.

Glossary

FEP: Fluorinated ethylene propylene.

FI: Approval agency of Finland; Electrical Inspectorate.

FR-1: A flammability rating established by Underwriters Laboratories for wires and cables that pass a specially designed vertical flame test.

Farad: A unit of electrical capacity.

Fatigue Resistance: Resistance to metal crystallization which leads to conductors or wires breaking from flexing.

Feed-Through Insulators: Insulators that carry a metal conductor through the chassis while preventing the 'hot' lead from shorting to the ground chassis.

Feedthrough: (1) A conductor that connects patterns on opposite sides of a PCB. Also called Interfacial Connection. (2) A connector or terminal block, usually having double- ended terminals which permit simple distribution and bussing of electrical circuits.

Ferrule: A short tube used to make solderless connections to shielded or coaxial cable.

Fiber: A thread or threadlike structure. Also, a single discrete element used to transmit optical (light wave) information.

Fiber Optics: A lightwave or optical communications system in which electrical information is converted to light energy transmitted to another location through optical fibers and is there converted back into electrical information.

Fiber Tubing: A loose, crush-resistant cylinder applied over individual fibers to provide mechanical protection.

Field: An area of influence around a magnet or electric charge.

Field Coil: A suitable insulated winding to be mounted on a field pole to magnetize it.

Figure 8 Cable: An aerial cable configuration in which the conductors and the steel strand which supports the cable are integrally jacketed. A cross-section of the finished cable approximates the figure "eight."

Filament: Fiber characterized by extreme length.

Filled Cable: A telephone cable construction in which the cable core is filled with a material that will prevent moisture from entering or passing through the cable.

Filler: (1) A material used in multiconductor cables to occupy large interstices formed by the assembled conductors. (2) An inert substance added to a compound to improve properties or decrease cost.

Film: A thin, plastic sheet.

Fine Stranded Wire: Stranded wire with component strands of 36 AWG or smaller.

Flame Resistance: The ability of a material not to propagate flame once the heat source is removable.

Flammability: The measure of the material's ability to support combustion.

Flashover: A disruptive discharge around or over the surface of a solid or liquid insulator.

Flat Braid: A woven braid of tinned copper strands rolled flat at time of manufacture to a specified width.

Flat Cable: A cable with two smooth or corrugated, but essentially flat, surfaces.

Flat Conductor: A wire having a rectangular cross-section as opposed to a round or square conductor.

Flat Conductor Cable: A cable with a plurality of flat conductors.

Flex Life: The measurement of the ability of a conductor or cable to withstand repeated bending.

Flexibility: The ease with which a cable may be bent.

Flexible: That quality of a cable or cable component which allows for bending under the influence of outside force, as opposed to limpness which is bending due to the cable's own weight.

Floating: Referring to a circuit which has no connection to ground.

Flux: (1) The lines of force which make up an electrostatic field. (2) The rate of flow of energy across or through a surface. (3) A substance used to promote or facilitate fusion.

Foamed Plastics: Insulations having a cellular structure.

Foil: A thin, continuous sheet of metal.

Free Connector: A connector for attachment to the free end of a wire or cable.

Funnel Entry: Flared or widened entrance to a terminal or connector wire barrel.

Fuse Wire: Wire made from an alloy that melts at a relatively low temperature.

Fused Coating: A metallic coating which has been melted and solidified, forming a metallurgical bond to the base material.

Fused Conductors: Individual strands of heavy tinned copper wire stranded together and then bonded together by induction heating.

Fused Spiral Tape: A PTFE insulated hookup wire. The spiral-wrapped conductor is passed through a sintering oven where overlaps are fused together.

GTO: Gast tube sign and oil-burner ignition cable. 5,000V-15,000V.

Galvanometer: An instrument for detecting or measuring small electrical current.

Gas-Filled Cable: A self-contained pressure cable in which the pressure medium is an inert gas having access to the insulation.

Gauge: A term used to denote the physical size of a wire.

Gimmick: A short length of wire soldered onto a circuit component and used as a small adjustable capacitor.

Ground: A conductive connection between an electrical circuit and the earth or other large conducting body to serve as an earth, thus making a complete electrical circuit.

Ground Conductor: A conductor in a transmission cable or line that is grounded.

Ground Insulation: The insulation used between a winding and the magnetic core or other structural parts, usually at ground potential.

Ground Loop: The generation of undesirable current flow within a ground conductor, owing to the circulation currents which originate from a second source of voltage.

Ground Plane: Expanded copper mesh which is laminated into some flat cable constructions as a shield.

Ground Potential: Zero potential with respect to the ground or earth.

HPN: Two-conductor, neoprene-insulated heater cord. Parallel construction. For use in damp locations.

Glossary

HSJ: Same as type HS but with #18, #16 and #14 conductors and differing thickness of jacket.

Hard-Drawn Copper Wire: Copper wire that has not been annealed after drawing.

Harness: An arrangement of wires and cables, usually with many breakouts, which have been tied together or pulled into a rubber or plastic sheath, used to interconnect an electric circuit.

Hash Mark Stripe: A non-continuous helical stripe applied to a conductor for identification.

Heat Distortion: Distortion of flow of a material or configuration due to the application of heat.

Heat Seal: Method of sealing a tape-wrap jacket by means of thermal fusion.

Heater Cord: Flexible stranded copper conductor, cotton-wrapped with rubber insulation and asbestos roving.

Helical Stripe: A continuous, colored, spiral stripe applied to a conductor for circuit identification.

Helix: Spiral winding.

Henry: The unit of inductance.

Hertz (Hz): A term replacing cycles-per-second as an indication of frequency.

Heterogeneous Insulation: A cable insulating system composed of two or more layers of different insulating materials.

Hi-Pot: A test designed to determine the highest voltage that can be applied to a conductor without breaking through the insulation.

High-Temperature Wire and Cable: Electrical wire and cables having thermal operating characteristics of 150°C and higher.

High Voltage: Generally, a wire or cable with an operating voltage of over 600 volts.

Holding Strength: Ability of a connector to remain assembled to a cable when under tension.

Homogeneous Insulation: A complete cable insulation structure whose components cannot be identified as layers of different materials.

Hook-Up Wire: A wire used for low-current, low-voltage (under 1000 volts) applications within enclosed electronic equipment.

Hot Stamping: Method of alpha numerical coding. Identification markings are made by pressing heated type and marking foil into softened insulation surfaces.

Hot Tin Dip: A process of passing bare wire through a bath of molten tin to provide a coating.

HS: 600 V-rated rubber-insulated heater cord.

HSJ: 300 V-rated rubber-insulated heater cord.

Hybrid Cable: Multi-conductor cable containing two or more types of components.

Hygroscopic: Capable of absorbing moisture from the air.

Hypalon: DuPont's trade name for their chlorosulfonated polyethylene, an ozone-resistant synthetic rubber.

ICEA: Abbreviation for Insulated Cable Engineers Association.

IEC: European Standardization agency, International Electrotechnical Commission.

IEEE: Abbreviation for Institute of Electrical and Electronics Engineers.

Ignition Cable: Cable designed for Automotive Ignition Systems.

ISA: Instrument Society of America.

Impedance: The total opposition that a circuit offers to the flow of alternating current or any other varying current at a particular frequency. It is a combination of resistance R and reactance X, measured in ohms.

Impedance Matching: Connecting cables and devices together which have the same impedance value in ohms.

Impulse: A surge of unidirectional polarity.

Impulse Strength: The voltage breakdown of insulation under voltage surges on the order of microseconds in duration.

Impulse Test: An insulation test in which the voltage applied is an impulse voltage of specified wave shape.

Inductance: The property of a circuit or circuit element that opposes a change in current flow, thus causing current changes to lag behind voltage changes. It is measured in henrys.

Inductive Coupling: Crosstalk resulting from the action of the electromagnetic field of one conductor on the other.

Insertion Tool: A small, hand-held tool used to insert contacts into a connector.

Insulated Wire: A conductor of electricity covered with a non-conducting material.

Insulating Joint: A device which mechanically couples and electrically insulates the sheath and armor of contiguous lengths of cable.

Insulation: A material having high resistance to the flow of electric current. Often called a dielectric in radio frequency cable.

Insulation Adhesion: The degree of tightness of the insulation over the base conductor measured in terms of force required to remove a specified length of insulation from the wire.

Insulation Crimp: The area of a terminal, splice or contact that has been formed around the insulation of the wire.

Insulation Grip: Extended cylinders at the rear of crimp-type contacts designed to accept the bared wire and a small length of its insulation.

Insulation Piercing: A method of crimping whereby lances cut the insulation of the wires and enter into the strands to make electrical contact.

Insulation Resistance: The ratio of the applied voltage to the total current between two electrodes in contact with a specific insulation, usually expressed in megohms-M feet.

Insulation System: All of the insulation materials used to insulate a particular electrical or electronic product.

Integral Belt: A layer of insulation or semi-conductive material applied by extrusion over two or more insulated, twisted or parallel conductors to form a round, smooth diameter.

Glossary

Interconnecting Cable: The wiring between modules, between units or the larger portions of a system.

Interconnecting Wire: The physical wiring between components (outside a module), between modules, between units or between larger portions of a system or systems.

Interconnection: Mechanically joining devices together to complete an electrical circuit.

Interface: The two surfaces on the contact side of both halves of a multiple-contact connector which face each other when the connector is assembled.

Internal Wiring: Electronic wiring which interconnects components, usually within a sealed subsystem.

Interstices: Voids or valleys between individual strands in a conductor or between insulated conductors in a multiconductor cable.

Ionization Voltage (Corona Level): The minimum value of falling rms voltage which sustains electrical discharge within the vacuous or gas-filled spaces in the cable construction or insulation.

Irradiation: In insulations, the exposure of the material to high-energy emissions for the purpose of favorably altering the molecular structure.

JAN Specification: Joint Army-Navy specification (replaced by current Military Specifications).

Jack: A plug-in type terminal widely used in electronic apparatus for temporary connections.

Jacket: A rubber or synthetic covering applied over primary insulation, braids, shields, cable components or over the cable itself. In fiber optics, a covering, frequently plastic, over a fiber bundle of fibers, or cable which protects against the environment.

Jumper: A short length of conductor used to make a temporary connection between terminals, around a break in a circuit or around an instrument.

Junction: A point in a circuit where two or more wires are connected.

kcmil: One thousand circular mils (MCM)

KEMA KEUR: Approval agency of the Netherlands.

KV: Kilovolt (1000 volts).

KVA: Kilovolt ampere.

KW: Kilowatt.

Kilo: A numerical prefix denoting 1000 (10^3).

Kynar: Pennwalt trade name for polyvinylidene fluoride. Typically used as insulation for wire wrap wire.

Lacing and Harnessing: A method of grouping wires by securing them in bundles of designated patterns.

Lacquer: A liquid resin or compound applied to textile braid to prevent fraying, moisture absorption, etc.

Laminated Tape: A tape consisting of two or more layers of different materials bonded together.

Lay: The length measured along the axis of a wire or cable required for a single strand (in stranded wire) or conductor (in cable) to make one complete turn about the axis of the conductor or cable.

Layer: Consecutive turns of a coil lying in a single plane.

Leaching and Non-Leaching: In a leaching wire, the plasticizer will migrate when exposed to heat. A non-leaching wire will retain its plasticizer under extreme temperature conditions and remain flexible after baking.

Lead: A wire, with or without terminals, that connects two points in a circuit.

Lead-Cured: A cable that is cured or vulcanized in a metallic lead mold.

Lead Dress: The placement or routing of wire and component leads in an electrical circuit.

Lead-in: The conductor or conductors that connect the antenna proper to electronic equipment.

Leakage Current: The undesirable flow of current through or over the surface of an insulation.

Life Cycle: A test to determine the length of time before failure in a controlled, usually accelerated, environment.

Limits of Error: The maximum deviation (in degrees of percent) of a thermocouple or thermocouple extension wire from standard emf-temperature to be measured.

Limpness: The ability of a cable to lay flat or conform to a surface.

Line Balance: The degree to which the conductors of a cable are alike in their electrical characteristics with respect to each other, to other conductors and to ground.

Line Drop: A voltage loss occurring between any two points in a transmission line due to the resonance reactance or leakage of the line.

Line Loss: The total of the various energy losses occurring in a transmission line.

Line Voltage: Voltage existing in a cable or circuit.

Local Area Network (LAN): A baseband or broadband interactive bi-directional communication systems for information exchange on a common transmission line.

Longitudinal Shield: A tape shield, flat or corrugated, applied longitudinally with the axis of the core being shielded.

Longitudinal Wrap: Tape applied longitudinally with the axis of the core being covered.

Loop Resistance: The total resistance of two conductors measured round trip from one end. Commonly used term in the thermocouple industry.

Looping-in: Wiring method which avoids tee joints by carrying the conductor or cable to and from the point to be supplied.

Loss: Energy dissipated without accomplishing useful work.

Loss Factor: The product of the dissipation and dielectric constant of an insulating material.

Lossy Line: A cable having large attenuation per unit of length.

Low-Loss Dielectric: An insulating material that has a relatively low dielectric loss, such as polyethylene or Teflon.

Low-Noise Cable: Cable configuration specially constructed to eliminate spurious electrical disturbances caused by capacitance changes or self-generated noise induced by either physical abuse or adjacent circuitry.

Low Tension: Low voltage, as applied to ignition cable.

Lug: Termination, usually crimped or soldered to the conductor, with provision for screwing on to the terminal.

Glossary

MATV: Acronym for Master Antenna Television System—a combination of components providing multiple television receiver operations from one antenna or group of antennas normally on a single building.

MCM: One thousand circular mils.

MHz: Megahertz.

MTW: Thermoplastic insulated machine tool wire.

Magnet Wire: Insulated wire intended for use in windings on motor, transformer and other coils for electromagnetic devices.

Magnetic Field: The region within which a body or current experiences magnetic force.

Magnetic Flux: The rate of flow of magnetic energy across or through a surface (real or imaginary).

Magnetic Noise: Caused by change in current level, e.g., ac powerline (creates magnetic field around the cable); this magnetic field causes the magnetic noise.

Marker Tape: A tape laid parallel to the conductors under the sheath in a cable, imprinted with the manufacturer's name and the specification to which the cable is made.

Meg or Mega: A numerical prefix denoting 1,000,000 (10^6).

Megarad: A unit for measuring radiation dosage.

Messenger: Supporting member, usually a high-strength steel wire, used to suspend aerial cable. The messenger may be an integral part of the cable, or exterior to it (lashed messenger).

Mft: A popular abbreviation for 1000 ft.

Mho: The unit of conductivity. The reciprocal of an ohm.

Micro: A numerical prefix denoting one-millionth (10^{-6}).

Microfarad: One-millionth of a farad, commonly abbreviated μF.

Micromicrofarad: One-millionth of a microfarad (uuf, uufd, mmf, mmfd, $\mu\mu$F are common abbreviations.)

Microwave: A short (usually less than 30 cm) electrical wave.

Mil: A unit used in measuring diameter of a wire or thickness of insulation over a conductor. One-one thousandth of an inch (.001").

Mineral Insulated: Cable and thermocouple wire consisting of one or more conductors surrounded by magnesium oxide insulation and enclosed in a liquid- and gas-tight metallic sheathing.

Miniature Wire: Insulated conductors of approximately 20-34 AWG.

Mining Cable: A flame-retardant cable specially constructed to withstand severe physical abuse for underground use in mines or tunnels.

Mis-Match: A termination having a different impedance than that for which a circuit or cable is designed.

Mode: One of the components of a general configuration of a propagating wave font.

Modem: Device which places and receives data signals over a common carrier's communication facility.

Modulus of Elasticity: The ratio of stress to strain in an elastic material.

Moisture Absorption: The amount of moisture, in percentage, that a material will absorb under specified conditions.

Moisture Resistance: The ability of a material to resist absorbing moisture from the air or when immersed in water.

Molded Plug: A connector molded on either end of a cord or cable.

Monomer: The basic chemical unit used in building a polymer.

Motor Lead Wire: Wire which connects to the fragile magnet wire found in coils, transformers and stator or field windings.

Multiconductor: More than one conductor within a single cable complex.

Multiple-Conductor Cable: A combination of two or more conductors cabled together and insulated from one another and from sheath or armor where used.

Multiple-Conductor Concentric Cable: An insulated central conductor with one or more tubular stranded conductors laid over it concentrically and insulated from one another.

Multiplexing: Simultaneous transmission of two or more messages over the same cable pair.

Mutual Capacitance: Capacitance between two conductors when all other conductors, including ground, are connected together and then regarded as an ignored ground.

Mylar®: DuPont trademark for polyester film.

NEMA: National Electrical Manufacturers Association.

NEMKO: Approval agency of Norway.

NFPA: Abbreviation for National Fire Protection Association. Administrative Sponsor of the National Electrical Code® (ANSI Standards Committee CI).

National Electrical Code®: A set of regulations governing construction and installation of electrical wiring and apparatus in the United States, established by the American National Board of Fire Underwriters.

National Electrical Code® Article 725: The NEC Article which covers remote control signal and communication power limited circuits that are not an integral part of the device or appliance.

National Electrical Code® Article 760: The NEC Article which covers the fire and burglar alarms installation of wire and equipment operating at 600 Volts or less.

National Electrical Code® Article 800: The NEC Article which covers telephone, telegraph as well as outside wiring for fire and burglar alarms.

NEC Type CL2: A Class 2 power-limited type cable for general use applications within a building under NEC Article 725, this type design is "Listed" by UL. These cables meet a 70,000 BTU flame test.

NEC Type CL2P: A Class 2 power-limited cable which is suitable for use in plenums in accordance with NEC Article 725. The cable meets the requirements of UL 910 the Steiner Tunnel test which classifies fire and smoke characteristics. The cable is "Listed" by UL.

NEC Type CL2R: A Class 2 power-limited cable which is suitable for use in riser shafts in accordance with NEC Article 725. These cables meet the UL 1666 flame test and are "Listed" by UL.

Glossary

NEC Type CL2X: A Class 2 power-limited cable which is suitable for restricted applications (sic . . . less than 0.25" in diameter in residences, exposed lengths less than 10-ft.) or else in raceways under NEC Article 725. These cables meet a VW-1 flame test and are "Listed" by UL.

NEC Type CM: A general application communications cable, Listed by UL, for use within buildings under NEC Article 800. It meets the requirements of the 70,000 BTU flame test.

NEC Type FPL: A general application fire-protection cable for use within buildings in accordance with NEC Article 760. These cables are Listed by UL and meet the 70,000 BTU flame test.

Neoprene: A synthetic rubber with good resistance to oil, chemical and flame. Also called polychloroprene.

Non-Contaminating: Type of PVC jacket material whose plasticizer will not migrate into the dielectric of a coaxial cable and thus avoids contaminating and destroying the dielectric.

Nylon: Thermoplastic with good chemical and abrasion resistance.

OSHA: Abbreviation for Occupational Safety and Health Act. Specifically the Williams-Steiger law passed in 1970 covering all factors relating to safety in places of employment.

OVE: Approval agency in Austria; Oesterreichischer Verband fur Elektrotechnik (Austrian Electrotechnical Association).

Off Center: Conductor displaced within the cross-section of its insulation.

Offgassing: Percentage of a specified gas released during the combustion of insulation or jacketing material.

Ohm: A unit of electrical resistance.

Oil Aging: Cable aged in an accelerated manner by placement in an oil bath and heated to a pre-set temperature for a stated time.

Oil-Filled Cable: A self-contained pressure cable in which the pressure medium is low viscosity oil having access to the insulation.

Open Cell: Foamed or cellular material with cells which are generally interconnected.

Oscillatory Surge: A surge which includes both positive and negative polarity values.

Outgassing: The dissipation of gas from a dielectric evidencing decomposition.

Overall Diameter: Finished diameter over wire or cable.

Overcoat Conductor: A stranded conductor made from individual strands of tin-coated wire stranded together, and then given an overall tin coat.

Overlap: The amount the trailing edge laps over the leading edge of a spiral tape wrap.

Oxygen Index: Percentage of oxygen necessary to support combustion in a gas mixture.

Ozone: Reactive form of oxygen, typically found around electrical discharges and present in the atmosphere in small quantities.

PCB: Printed Circuit Board.

PIC: A general term for any type of plastic-insulated telephone cable.

PLSJ: All-rubber, parallel-jacketed, two-conductor, light-duty cord for pendent or portable use in damp locations. 300V.

PLT: Same as PLSJ, except thermoplastic insulation.

POSJ: All-rubber, parallel light-duty rip-cord for use on lamps and small appliances. 300V, 60°C.

POT: Thermoplastic, parallel, light-duty rip-cord. 300V, 60°C to 105°C.

PTFE: Abbreviation for Polytetrafluoroethylene.

Packing Fraction: (fiber optic) The ratio of active cross-sectional area of fiber core, or cores, to the total end surface of the fiber, or fiber bundle.

Pair: Two insulated wires of a single circuit associated together; also known as a "balance" transmission line.

Parallel Pair: A duplex construction of two insulated conductors laid parallel and then covered overall with a braid or jacket.

Parallel Stripe: A stripe applied longitudinally on a wire or cable parallel to the axis of the conductor.

Patch Cable: A cable with plugs or terminals on each end of the conductors to temporarily connect circuits of equipment together.

Patch Cord: Braid covered with plugs or terminals on each end to connect jacks or blocks in switchboards or programming systems.

Pay-Off: The process of feeding a cable or wire from a bobbin, reel or other package.

Percentage Conductivity: Conductivity of a material expressed as a percentage of that of copper.

Periodicity: The uniformly spaced variations in the insulation diameter of a transmission cable that result in reflections of a signal, when its wavelength or a multiple thereof is equal to the distance between two diameter variations.

Permittivity: See *Dielectric Constant.*

Pick: Distance between two adjacent crossover points of braid filaments. The measurement in picks per inch indicates the degree of coverage.

Pico: A numerical prefix denoting one-millionth of one-millionth (10^{-12}).

Picofarad: One-millionth of one-millionth of a farad. A micromicrofarad or picofarad (abbreviation pf). (See *μμF*).

Pigtail Wire: Fine-stranded, extra-flexible, rope- lay lead wire attached to a shield for terminating purposes.

Pitch Diameter: Diameter of a circle passing through the center of the conductors in any layer of a multiconductor cable.

Pitch: In flat cable, the nominal distance between the index edges of two adjacent conductors.

Plain Conductor: A conductor consisting of only one metal.

Plain Weave: A weave used on woven cables. Threads between the wires act as binders and give the cable lateral stiffness and linear flexibility. Also called Standard and Square Weave.

Planetary Cabler: A cabler capable of laying down any number of shielded overbraided or jacketed singles, pairs, called groups, or any combination of them in sequence.

Planetary Twister: A twisting machine whose payoff spools are mounted in rotating cradles that hold the axis of the spool in a fixed direction as the spools are revolved so the wire will not kink as it is twisted.

Plastic Deformation: Change in dimensions under load that is not recovered when the load is removed.

Plasticizer: A chemical agent added to plastics to make them softer and more pliable.

Glossary

Plenum: The air return path of a central air handling system, either ductwork or open space over a suspended ceiling.

Plenum Cable: Cable approved by a recognized agency such as UL for installation in plenums without the need for conduit.

Plug: The part of the two mating halves of a connector which is movable when not fastened to the other mating half.

Ply: The number of individual strands or filaments twisted together to form a single thread.

Point-to-Point Wiring: An interconnecting technique wherein the connections between components are made by wires routed between connecting points.

Polarization: The orientation of a flat cable or a rectangular connector.

Polychloroprene: Chemical name for neoprene.

Polyester: Polyethylene terephthalate extensively as a moisture resistant cable core wrap.

Polyethylene: A thermoplastic material having excellent electrical properties.

Polyhalocarbon: A general name for polymers containing halogen atoms. The halogens are fluorine, chlorine, bromine and iodine.

Polymer: A material of high molecular weight formed by the chemical union of monomers.

Polyolefin: Any of the polymers and copolymers of the ethylene family of hydrocarbons.

Polypropylene: A thermoplastic similar to polyethylene but stiffer and having higher softening point (temperature); excellent electrical properties.

Polyurethane: Class of polymers known for good abrasion and solvent resistance (may be applied in solid or cellular form).

Polyvinyl Chloride: A general-purpose thermoplastic widely used for wire and cable insulations and jackets.

Porosity: Multiple voids in an insulation cross-section.

Potting: The sealing of a cable termination or other component with a liquid which thermosets into an elastomer.

Power Cables: Cables of various sizes construction and insulation, single- or multi-conductor, designed to distribute primary power to various types of equipment.

Power Factor: The ratio of resistance to impedance. The ratio of the actual power of an alternating current to apparent power. Mathematically the cosine of the angle between the voltage applied and the current resulting.

Pre-Bond: Stranded wire which has been fused, topcoat-tinned, or overcoat-tinned.

Primary Insulation: The first layer of non-conductive material applied over a conductor whose prime function is to act as electrical insulation.

Primary: The transformer winding which receives the energy from a supply circuit.

Printed Wiring: A printed circuit intended to provide point-to-point electrical connections.

Programming: Ability to select various circuit patterns by interconnecting appropriate contacts on one side of a connector plug or panel.

Propagation Delay: Time delay between input and output of signal.

Propagation Time: Time required for a wave to travel between two points on a transmission line.

Proximity Effect: Nonuniform current distribution over the cross-section of a conductor caused by the variation of the current in a neighboring conductor.

Pulling Eye: A device used to pull cable into or from a duct.

Pulse: Energy which changes abruptly from an intensity to another. May be light energy or electrical energy.

Pulse Cable: A type of coaxial cable constructed to transmit repeated high- voltage pulses without degradation.

Quad: A series of four separately insulated conductors, generally twisted together in pairs. Also, a series-parallel combination of transistors with increased reliability because failure of one transistor will not disable the entire circuit.

Quadders: Three-bay machines which can twist four wires together and cable braided and shielded wires with varying lay lengths.

Rated Voltage: The maximum voltage at which an electrical component can be operated for extended periods without undue degradation or safety hazard.

R-F: Radio-frequency.

REA: Abbreviation for Rural Electrification Administration.

RG/U: General utility-grade military coaxial cable.

Random Winding: A winding in rotating equipment wherein the wires do not lie in an even pattern.

Reactance: The opposition offered to the flow of alternating current by inductance or capacitance of a compound or circuit.

Red Plaque: A powdery, brown-red growth found on silvercoated copper conductors and shield braids.

Redraw: The consecutive drawing of wire through a series of dies to reach a desired wire size.

Reducing Joint: A joint between two lengths of cable where the conductors are not the same size.

Reel: A revolvable flanged device made of wood metal, used for winding flexible metal wire or cable.

Reflection Loss: The part of a signal which is lost due to reflection of power at a line discontinuity.

Reinforced Sheath: The outermost covering of a cable that has cable sheath constructed in layers with the addition of a reinforcing material, usually a braided fiber, molded in place between layers.

Remanence: The magnetic induction that remains in a magnetic circuit after the removal of an applied magnetomotive force.

Resistance: A measure of the difficulty in moving electrical current through a medium when voltage is applied. It is measured in ohms.

Resistive Conductor: A conductor with high electric resistance.

Restriction on Hazardous Substances (RoHS): The European Commission's Directive 2002/95/EC, adopted January 27, 2003, also known as "RoHS," which restricts the use of certain hazardous substances in electrical and electronic equipment.

Retractile Cord: A cord having specially treated insulation or jacket so that it will retract.

Return Wire: A ground wire or the negative wire in a direct-current circuit.

Glossary

Ribbon Cable: A flat cable of individually insulated conductors lying parallel and held together by means of adhesive or woven textile yarn.

Ridge Marker: One or more ridges running laterally along the outer surface of a plastic-insulated wire for purposes of identification.

Rigid Bay: Cabling equipment that maintains component sequence, and can produce cables with distinct layers.

Rigid Coaxial Cable: Nonflexible coaxial cable, usually a metal tube-armored coaxial cable.

Ring Tongue: A solderless terminal that connects wire to a stud.

Ringing Out: Locating or identifying specific conductive paths by passing current through selected conductors.

Rip-Cord: Two or more insulated conductors in a parallel configuration which may be separated to leave the insulation of each conductor intact.

Rope Concentric: A group of standard conductors assembled in a concentric manner.

Rope Lay Conductor: A conductor composed of a central core surrounded by one or more layers of helically laid groups of wires.

Rope Unilay: A group of stranded conductors assembled in a unilay manner.

Round Wire Shields: Shields constructed from bare, tinned or silver-plated copper wire that include braided, spiral and reverse spiral.

Rubber (Wire Insulation): Term used to describe wire insulations made of thermosetting elastomers, occur naturally or may be made synthetically.

Rulan: DuPont's trade name for their flame-retardant polyethylene insulating material.

S: Heavy-duty, rubber-insulated portable cord. Stranded copper conductors with separator and individual rubber insulation. Two or more color-coded conductors cabled with filler wrapped with separator and rubber jacketed overall. 600V.

SAE: Society of Automotive Engineers.

SANZ: Standards Association of New Zealand.

SBR: Copolymer of styrene and butadiene. Most commonly used type of synthetic rubber.

Secondary Insulation: A nonconductive material that protects the conductor against abrasion and provides a second electrical barrier.

Segmental Conductor: A stranded conductor consisting of three or more stranded conducting elements, each element having approximately the shape of the sector of a circle, assembled to give a substantially circular cross-section.

Selenium Cure: Process used to cure neoprene and rubber-jacketed wires and cables.

Self-Extinguishing: Characteristic of a material whose flame is extinguished after the igniting flame source is removed.

Semi-Conducting Jacket: A jacket having a sufficiently low resistance so that its outer surface can be kept at substantially ground potential.

Semi-Rigid: A cable containing a flexible inner core and a relatively inflexible sheathing.

Semi-Solid: An insulation cross-section having a partially open space between the conductor and the insulation perimeter.

SEMKO: Approval agency for Sweden.

Separator: A layer of insulating material which is placed between a conductor and its dielectric, between a cable jacket and the components it covers or between various components of a multiple-conductor cable.

Serve: A filament or group of filaments such as fibers or wires, wound around a central core.

Serving: A wrapping applied over the core of a cable or over a wire.

Sheath: The outer covering or jacket of a multi-conductor cable.

Shield Coverage: Amount of outer cable covered by the shielding material.

Shield Effectiveness: The ability of a shield to screen out undesirable signals.

Shield: In cables, a metallic layer placed around a conductor or group of conductors to prevent electrostatic or electromagnetic interference between the enclosed wires or external fields.

Shielded Line: A transmission line whose elements confine propagated radio waves to an essentially finite space inside a tabular conducting surface called the sheath, thus preventing the line from radiating radio waves.

Shielded-Type Cable: A cable in which the surface of the insulation is at ground potential.

Shunt Wire: A conductor joining two parts of an electric circuit to divert part of the current.

Signal: A current used to convey information, either digital, analog, audio or video.

Silicone: A material made from silicon and oxygen. Can be in thermosetting elastomer or liquid form. The thermosetting elastomer form is noted for high heat resistance.

Silicone Treating: A silicone liquid treatment applied to insulated conductors to allow for easy jacket stripping.

Single-Faced Tape: Fabric tape finished on one side with a rubber or synthetic compound.

Sizing: Applying a material to a surface to fill pores.

SJ: Junior hard-service, rubber-insulated pendant or portable cord. Same construction as type S, but 300V. Jacket thickness different.

SJO: Same as SJ, but Carolprene®, oil-resistant compound outer jacket. Can also be made "water-resistant." 300V, 60°C.

SJT: Junior hard-service thermoplastic or rubber- insulated conductors with overall thermoplastic jacket. 300V, 60°C to 105°C.

SJTO: Same as SJT but oil-resistant thermoplastic outer jacket. 60°C.

SJOO: Same as SJO with oil-resistant insulation.

SJOOW: Same as SJOO with the added UL + CSA Approval for outdoor use and water resistance.

Skeleton Braid: Widely separated braid of fiber copper, or steel, used to hold core together, for reinforcing jacket or for shielding.

Skin Tape: Filled tape coated on one or both sides with a thin film of uncured rubber or synthetic compound to produce a coating suitable for vulcanization.

Skin Effect: The tendency of alternating current as its frequency increases, to travel only on the surface of a conductor.

Glossary

Sleeve: A braided, knifed or woven tube used over wires or components as insulation tubing. Also called sleeving.

Solid Conductor: A conductor consisting of a single wire.

SO: Hard-service cord, same construction as type S except oil-resistant Carolprene® jacket. 600V, 60˚ to 90˚C

SOO: Same as SO with oil-resistant insulation.

SOOW: Same as SOO with the added UL + CSA Approval for outdoor use and water resistance.

SOW: Same as SO with the added UL and CSA approval for outdoor use and water resistance.

SP-1: All-rubber, parallel-jacketed two-conductor light-duty cord for pendant or portable use in damp locations. 300V.

SP-2: Same as SP-1, but heavier construction, with or without third conductor for grounding purposes. 300V.

SP-3: Same as SP-2 but heavier construction for refrigerators or room air conditioners. 300V.

SPT-1: Same as SP-1, except all-thermoplastic. 300V. With or without third conductor for grounding.

SPT-2: Same as SP-2 except all-thermoplastic. 300V. With or without third conductor for grounding.

SPT-3: Same as SP-3, except all-thermoplastic. 300V. With or without third conductor for grounding.

Span: In flat conductors, distance between the reference edge of the first and the last conductor. In round conductors, distance between centers of the first and last conductors.

Spark Test: A test designed to locate pin-holes in the insulation of a wire or cable by application of a voltage for a very short period of time while the wire is being drawn through the electrode field.

Specific Gravity: The ratio of the density (mass per unit volume) of a material to that of water.

Spiral Shield: A metallic shield of fine-stranded wires applied spirally rather than braided.

Spiral Stripe: A color-coding stripe applied helically to the surface of an insulated wire or cable.

Spiral Wrap: The helical wrap of a tape or thread over a core.

Splice: A connection of two or more conductors or cables to provide good mechanical strength as well as good conductivity.

SRD: Portable range or dryer cable. Three or four rubber-insulated conductors with rubber or neoprene jacket, flat or round construction. 300V, 60°C.

SRDT: Same as SRD, except all-thermoplastic with a maximum temperature of 90°C.

ST: Hard-service cord, jacketed, same as type S except all-plastic construction. 600 V, 60°C to 105°C.

Standing Wave Ratio: In a transmission line, waveguide or analogous system, a figure of merit used to express the efficiency of the system in transmitting power.

Stay Cord: A component of a cable used to anchor the cable ends at their points of termination and to keep any pull of the cable from being transferred to the electrical connections.

STO: Same as ST but with oil-resistant thermoplastic outer jacket. 600 V, 60°C.

Strand: One of the wires of any stranded conductor.

Strand Lay: The distance of advance of one strand of a spirally stranded conductor, in one turn, measured axially.

Stranded Conductor: A conductor composed of groups of wires twisted together.

Strap: Square- or rectangular-section bare conductor manufactured and used in coil form.

Strip: To remove insulation from a cable.

Structural Return Loss: Backward-reflected energies from uneven parts of the cable structure are termed structural return loss.

Surface Resistivity: The resistance of a material between two opposite sides of a unit square of its surface. It is usually expressed in ohms.

SV: Vacuum cleaner cord two- or three-conductor rubber-insulated. Overall rubber jacket. For light duty in damp locations. 300 V, 60°C.

SVO: Same as SV except Carolprene jacket, 300 V, 60°C.

SVT: Same as SV except all-plastic construction. With or without third conductor for grounding purposes only. 300 V, 60°C to 90°C.

Sweep Test: A test given to check attenuation by oscilloscope, as in coaxial cable.

TEW: Canadian Standard Association type appliance wires. Solid or stranded single-conductor, plastic-insulated. 600 V, 105°C.

TF: Fixture wire, thermoplastic-covered solid or 7- strands. 60°C.

TFE: Teflon® (tetrafluoroethylene).

TFF: Same as TF but flexible stranding. 60°C.

THHN: 90°C, 600 V nylon jacketed building wire.

THW: Thermoplastic vinyl-insulated building wire. Flame-retardant, moisture- and heat-resistant. 75°C. Dry and wet locations.

THWN: Same as THW but with nylon jacket overall. 75°C.

TW: Thermoplastic vinyl-jacketed building wire, moisture-resistant 60°C.

Take-Up: The process of accumulating wire or cable onto a reel, bobbin or some other type of pack. Also, the device for pulling wire or cable through a piece of equipment or machine.

Tank Test: A voltage dielectric test in which the test sample is submerged in water and voltage is applied between the conductor and water as ground.

Tape: A relatively narrow woven or cut strip of fabric, paper or film material.

Tape Cable: A form of multiple-conductor consisting of parallel metal strips imbedded in insulating material.

Tape Wrap: A spirally applied tape over an insulated or uninsulated wire.

Taped Insulation: Insulation of helically wound tapes applied over a conductor or over an assembled group of insulated conductors.

Taping: Process of insulating continuous-length, large-diameter wires with tape of nonextrudable materials.

Tear Strength: The force required to initiate or continue a tear in a material under specified conditions.

Glossary

Teflon®: DuPont's trade name for fluorocarbon resins. FEP, PFA and TFE are typical materials.

Tefzel: DuPont's trade name for a fluorocarbon material typically used as a wire wrap insulation.

Telemetry Cable: Cable used for transmission of information from instruments to the peripheral recording equipment.

Temperature Rating: The maximum temperature at which an insulating material may be used in continuous operation without loss of its basic properties.

Tensile Strength: The pull stress required to break a given specimen.

Tension Member: A member included in a fiber cable to add tensile strength.

Terminals: Metal wire termination devices designed to handle one or more conductors, and to be attached to a board bus or block with mechanical fasteners or clipped on.

Test Lead: A flexible, insulated lead wire used for making tests, connecting instruments to a circuit temporarily or for making temporary electrical connections.

Textile Braid: Any braid made from threads of cotton, silk or synthetic fibers.

Thermal Aging: Exposure to a thermal condition or programmed series of conditions for predescribed periods of time.

Thermocouple Lead Wire: An insulated pair of wires used from the couple to a junction box.

Thermoplastic: A material which softens when heated and becomes firm on cooling.

Thermoset: A material which hardens or sets when heat is applied, and which, once set cannot be resoftened by heating. The application of heat is called "curing."

Three-Phase Current: Current delivered through three wires, with each wire serving as a return for the other two.

Three-Phase Three-Wire System: An alternating current supply system comprising three conductors over which three-phase power is sent.

Three-Wire System: A d-c or single-phase a-c system comprising three conductors, one of which is maintained at a potential midway between the potential of the other two.

Tin Overcoat (TOC): Tinned copper wire stranded, then coated with pure tin.

Tinsel Wire: A low-voltage stranded wire with each strand a very thin conductor ribbon spirally wrapped around a textile yarn.

Topcoat: Bare (untinned) copper wire, stranded then coated with pure tin.

Tracer: A means of identifying polarity.

Transmission: Transfer of electric energy from one location to another through conductors or by radiation or induction fields.

Transmission Cable: Two or more transmission lines. See *Transmission Line.*

Transmission Line: A signal-carrying circuit with controlled electrical characteristics used to transmit high-frequency or narrow-pulse signals.

Transmission Loss: The decrease or loss in power during transmission of energy from one point to another. Usually expressed in decibels.

Transposition: Interchanging the relative positions of wires to neutralize the effects of induction to or from other circuits or, to minimize interference pickup by the lead-in during reception.

Tray: A cable tray system is an assembly of units or sections, and ancillary filings, made of noncombustible materials used to support cables. Cable tray systems include ladders troughs channels, solid bosom trays and similar structures.

Tray Cable: A factory-assembled multi-conductor or multipair control cable approved under the National Electrical Code for installation in trays.

Triaxial: A three-conductor cable with one conductor in the center, a second circular conductor shield concentric with the first, and third circular conductor shield insulated from and concentric with the first and second, usually with insulation, and over a braid or impervious sheath overall.

Triboelectric Noise: Noise generated in a shielded cable due to variations in capacitance between shielding and conductor as the cable is flexed.

Triple Cable: A cable composed of three insulated single conductors and one bare conductor all twisted together. It may or may not have a common covering of binding.

True Concentric: A cable in which each successive layer has a reversed direction of lay from the preceding layer.

Tubing: A tube of extruded nonsupported plastic material.

Twin Cable: A pair of insulated conductors twisted, sheathed or held together mechanically and not identifiable from each other in a common covering.

Twin Coaxial: A configuration containing two separate complete coaxial cables laid parallel or twisted around each other in one complex.

Twin Line: A transmission line which has a solid insulating material, in which the two conductors are placed in parallel to each other.

Twinner: A device for twisting together two conductors.

Twisted Pairs: A cable composed of two small insulated conductors twisted together without a common covering.

UF: Thermoplastic underground feeder and branch circuit cable.

UHF: Abbreviation for ultra high frequency, 300 to 3,000 MHz.

UL: Underwriters Laboratories, Inc.

UTE: Approval agency for France; Union Technique de l'Electricite.

Unbalanced Line: A transmission line in which voltages on the two conductors are unequal with respect to ground.

Unidirectional Concentric Stranding: A stranding where each successive layer has a different lay length, thereby retaining a circular form without migration of strands from one layer to another.

Unidirectional Stranding: A term denoting that in a stranded conductor, all layers have the same direction of lay.

Unilay Strand: A conductor constructed with a central core surrounded by more than one layer of helically-laid wires, with all layers having a common length and direction of lay.

VDE: German approval agency.

VHF: Abbreviation for very high frequency, 30 to 300 MHz.

VSWR: Abbreviation for volume standing wave ratio.

Glossary

VW-1: A flammability rating established by Underwriters Laboratories for wires and cables that pass a specially designed vertical flame test (formerly designated FR-1-).

Velocity of Propagation: The speed of an electrical signal down a length of cable compared to speed in free space expressed as a percent. It is the reciprocal of the square root of the dielectric constant of the cable insulation.

Volt: A unit of electromotive force.

Voltage: The term most often used in place of electromotive force, potential difference or voltage drop to designate the electric pressure that exists between two points and is capable of producing a current when a closed circuit is connected between two points.

Voltage Drop: A term used to express the amount of voltage loss in a conductor of given size and length drawing a given current.

Voltage Rating: The highest voltage that may be continuously applied to a wire in conformance with standards or specifications.

Voltage Standing Wave Ration (VSWR): The ratio of the maximum effective voltage to the minimum effective voltage measured along the length of a mis-matched radio frequency transmission line.

Volume Resistivity (Specific Insulation Resistance): The electrical resistance between opposite faces of a 1 cm cube of insulating material commonly expressed in ohms/centimeter.

Vulcanization: A chemical reaction in which the physical properties of an elastomer are changed by reacting it with sulfur or other cross-linking agents.

Wall Thickness: The thickness of the applied insulation or jacket.

Water Absorption: A test to determine the water absorbed by a material after a given immersion period.

Waterblocked Cable: A cable constructed with no internal voids in order to allow no longitudinal water passage under a given pressure.

Watt: A unit of electric power.

Wave Length: The distance, measured in the direction of propagation, of a repetitive electrical pulse or waveform between two successive points that are characterized by the same phase of vibration.

Wicking: The longitudinal flow of a liquid in a wire or cable due to capillary action.

Wire: A conductor, either bare or insulated.

Wire Gauge: A system of numerical designation of wire sizes.

Wire Nut: A closed-end splice that is screwed on instead of crimped.

Wire Wrapped Connection: A solderless connection made by wrapping bare wire around a square or rectangular terminal with a power or hand tool.

Wire Wrapping Tools: Portable electric tools and automatic stationary machines used to make solderless wrapped connections of wires to terminals.

Wire and Cable Marker: Device for identification marking of wire and cable.

Wire and Cable Tying, Clamping and Harnessing Devices: Tying faces lacing cords and flexible sleevings which are use for wire and cable bundling, harnessing and holding. Other devices include plastic ties or clamps, spiral-cut plastic tubing and plastic U-shaped trays or ducts.

Wire and Lead Cutters: Tools for cutting range from plier-type cutters to semiautomatic or fully automatic machines integrated with other wire processing operations such as stripping, forming and terminating.

Wrapper: An insulating barrier applied as a sheet or tape wrapped around a co~l periphery.

XLPE: Crosslinked polyethylene.

Yield Strength: The minimum stress at which a material will start to physically deform without increase in load.

Zytel: DuPont's trade name for nylon resins.

Sections of this glossary are reprinted with permission from December, 1985 issue of **ELECTRI•ONICS** copyright 1985. Lake Publishing Corporation, 17730 W. Peterson Rd., Libertyville, Illinois 60048-0159 U.S.A. Permission to reprint granted to the General Cable Technologies Corporation, no additional reproduction of this Wire and Cable Glossary allowed without permission.

Unit Conversion Factors

Unit Conversion Factors

UNIT	X CONSTANT	= UNIT	UNIT	X CONSTANT	= UNIT
BTU	778.0	foot-pound (ft-lb)	gallons	3.785332	liters (l)
BTU	1054.8	joules	gallons	0.13368	cubic foot (ft^3)
BTU	0.293	watt-hours (w-hr)	gallons	231.0	cubic inch (in^3)
centimeters (cm)	0.032808	feet (ft)	gallons	3785.332	cubic centimeter (cm^3)
centimeters (cm)	0.3937	inches (in)	grams (g)	15.432	grains
centimeters (cm)	0.00001	kilometers (km)	gram/centimeter^3 (gm/cm^3)	0.0361275	pounds/in^3 (lb/in^3)
centimeters (cm)	0.010	meters (m)	horsepower (hp)	33000.0	ft-lb/min
centimeters (cm)	10.0	millimeters (mm)	horsepower (hp)	550.0	ft-lb/sec
circular mils	0.00064516	circular millimeters	horsepower (hp)	745.7	watts (w)
circular mils	0.0000007854	inches^2 (in^2)	inch (in)	0.027178	yards (yd)
circular mils	0.00050671	square millimeters (mm^2)	inch (in)	0.083333	feet (ft)
circular mils	0.7854	$mils^2$	inch (in)	0.00002540	kilometer (km)
cubic centimeter (cm^3)	0.000035314	cubic foot (ft^3)	inch (in)	0.025400	meter (m)
cubic centimeter (cm^3)	0.061023	cubic inch (in^3)	inch (in)	2.54000514	centimeter (cm)
cubic centimeter (cm^3)	0.000001	cubic meter (m^3)	inch (in)	25.4000514	millimeter (mm)
cubic centimeter (cm^3)	0.0026417	gallons	inch (in)	1000.0	mils
cubic foot (ft^3)	1728.0	cubic inch (in^3)	joules	0.000948	BTU
cubic foot (ft^3)	28317.016	cubic centimeter (cm^3)	joules	10^7	ergs
cubic inch (in^3)	0.00057870	cubic feet (ft^3)	liters (l)	61.0250	cubic inch (in^3)
cubic inch (in^3)	0.000016387	cubic meter (m^3)	meters (m)	1.093611	yards (yd)
cubic inch (in^3)	16.387162	cubic centimeter (cm^3)	meters (m)	3.2808333	feet (ft)
cubic meter (m^3)	1000000.0	centimeter (cm)	meters (m)	39.37	inch (in)
cubic meter (m^3)	35.314456	cubic foot (ft^3)	meters (m)	100.0	centimeter (cm)
cubic meter (m^3)	264.17	gallons	miles	1760.0	yards (yd)
feet (ft)	0.00018939	miles	miles	5280.0	feet (ft)
feet (ft)	0.33333	yards (yd)	miles	1.6093	kilometer (km)
feet (ft)	12	inches (in)	millimeters (mm)	0.0032808	feet (ft)
feet (ft)	0.00030480	kilometers (km)	millimeters (mm)	0.03937	inch (in)
feet (ft)	0.30480	meters (m)	millimeters (mm)	0.001	meters (m)
feet (ft)	30.480	centimeters (cm)	millimeters (mm)	0.01	centimeters (cm)
feet (ft)	304.80	millimeters (mm)	millimeters (mm)	39.3701	mils
feet/pound (ft/lb)	0.00067197	meters/grams (m/g)	millimeters (mm)	1000.0	microns (u)
foot-pound (ft-lb)	0.001285	BTU	watts (w)	44.25	ft-lb/minute
foot-pound (ft-lb)	1.356	joules	watts (w)	0.737562	ft-lb/sec
foot-pound (ft-lb)	0.1383	kilogram/meter (kg/m)	watts (w)	0.001341	horsepower (hp)
			watt-hours (w-hr)	3.41266	BTU

Temperature Conversion Chart

To use this chart, find your known temperature (˚F or ˚C) in the shaded column. If the known temperature is in ˚C and you wish to know its value in ˚F, move to the adjacent right-hand column. If the known temperature is in ˚F and you wish to know its value in ˚C, move to the adjacent left-hand column.

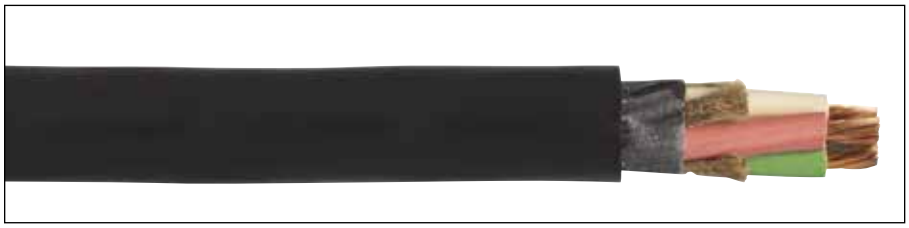
Temperature Conversion Formulas	
°C =	$\frac{5}{9}$ (°F - 32)
°F =	($\frac{9}{5}$ x °C) + 32

°C	KNOWN TEMP	°F	°C	KNOWN TEMP	°F	°C	KNOWN TEMP	°F	°C	KNOWN TEMP	°F	°C	KNOWN TEMP	°F
-45.0	**-49.0**	-56.2	-17.2	**1.0**	33.8	10.6	**51.0**	123.8	38.3	**101.0**	213.8	66.1	**151.0**	303.8
-44.4	**-48.0**	-54.4	-16.7	**2.0**	35.6	11.1	**52.0**	125.6	38.9	**102.0**	215.6	66.7	**152.0**	305.6
-43.9	**-47.0**	-52.6	-16.1	**3.0**	37.4	11.7	**53.0**	127.4	39.4	**103.0**	217.4	67.2	**153.0**	307.4
-43.3	**-46.0**	-50.8	-15.6	**4.0**	39.2	12.2	**54.0**	129.2	40.0	**104.0**	219.2	67.8	**154.0**	309.2
-42.8	**-45.0**	-49.0	-15.0	**5.0**	41.0	12.8	**55.0**	131.0	40.6	**105.0**	221.0	68.3	**155.0**	311.0
-42.2	**-44.0**	-47.2	-14.4	**6.0**	42.8	13.3	**56.0**	132.8	41.1	**106.0**	222.8	68.9	**156.0**	312.8
-41.7	**-43.0**	-45.4	-13.9	**7.0**	44.6	13.9	**57.0**	134.6	41.7	**107.0**	224.6	69.4	**157.0**	314.6
-41.1	**-42.0**	-43.6	-13.3	**8.0**	46.4	14.4	**58.0**	136.4	42.2	**108.0**	226.4	70.0	**158.0**	316.4
-40.6	**-41.0**	-41.8	-12.8	**9.0**	48.2	15.0	**59.0**	138.2	42.8	**109.0**	228.2	70.6	**159.0**	318.2
-40.0	**-40.0**	-40.0	-12.2	**10.0**	50.0	15.6	**60.0**	140.0	43.3	**110.0**	230.0	71.1	**160.0**	320.0
-39.4	**-39.0**	-38.2	-11.7	**11.0**	51.8	16.1	**61.0**	141.8	43.9	**111.0**	231.8	71.7	**161.0**	321.8
-38.9	**-38.0**	-36.4	-11.1	**12.0**	53.6	16.7	**62.0**	143.6	44.4	**112.0**	233.6	72.2	**162.0**	323.6
-38.3	**-37.0**	-34.6	-10.6	**13.0**	55.4	17.2	**63.0**	145.4	45.0	**113.0**	235.4	72.8	**163.0**	325.4
-37.8	**-36.0**	-32.8	-10.0	**14.0**	57.2	17.8	**64.0**	147.2	45.6	**114.0**	237.2	73.3	**164.0**	327.2
-37.2	**-35.0**	-31.0	-9.4	**15.0**	59.0	18.3	**65.0**	149.0	46.1	**115.0**	239.0	73.9	**165.0**	329.0
-36.7	**-34.0**	-29.2	-8.9	**16.0**	60.8	18.9	**66.0**	150.8	46.7	**116.0**	240.8	74.4	**166.0**	330.8
-36.1	**-33.0**	-27.4	-8.3	**17.0**	62.6	19.4	**67.0**	152.6	47.2	**117.0**	242.6	75.0	**167.0**	332.6
-35.6	**-32.0**	-25.6	-7.8	**18.0**	64.4	20.0	**68.0**	154.4	47.8	**118.0**	244.4	75.6	**168.0**	334.4
-35.0	**-31.0**	-23.8	-7.2	**19.0**	66.2	20.6	**69.0**	156.2	48.3	**119.0**	246.2	76.1	**169.0**	336.2
-34.4	**-30.0**	-22.0	-6.7	**20.0**	68.0	21.1	**70.0**	158.0	48.9	**120.0**	248.0	76.7	**170.0**	338.0
-33.9	**-29.0**	-20.2	-6.1	**21.0**	69.8	21.7	**71.0**	159.8	49.4	**121.0**	249.8	77.2	**171.0**	339.8
-33.3	**-28.0**	-18.4	-5.6	**22.0**	71.6	22.2	**72.0**	161.6	50.0	**122.0**	251.6	77.8	**172.0**	341.6
-32.8	**-27.0**	-16.6	-5.0	**23.0**	73.4	22.8	**73.0**	163.4	50.6	**123.0**	253.4	78.3	**173.0**	343.4
-32.2	**-26.0**	-14.8	-4.4	**24.0**	75.2	23.3	**74.0**	165.2	51.1	**124.0**	255.2	78.9	**174.0**	345.2
-31.7	**-25.0**	-13.0	-3.9	**25.0**	77.0	23.9	**75.0**	167.0	51.7	**125.0**	257.0	79.4	**175.0**	347.0
-31.1	**-24.0**	-11.2	-3.3	**26.0**	78.8	24.4	**76.0**	168.8	52.2	**126.0**	258.8	80.0	**176.0**	348.8
-30.6	**-23.0**	-9.4	-2.8	**27.0**	80.6	25.0	**77.0**	170.6	52.8	**127.0**	260.6	80.6	**177.0**	350.6
-30.0	**-22.0**	-7.6	-2.2	**28.0**	82.4	25.6	**78.0**	172.4	53.3	**128.0**	262.4	81.1	**178.0**	352.4
-29.4	**-21.0**	-5.8	-1.7	**29.0**	84.2	26.1	**79.0**	174.2	53.9	**129.0**	264.2	81.7	**179.0**	354.2
-28.9	**-20.0**	-4.0	-1.1	**30.0**	86.0	26.7	**80.0**	176.0	54.4	**130.0**	266.0	82.2	**180.0**	356.0
-28.3	**-19.0**	-2.2	-0.6	**31.0**	87.8	27.2	**81.0**	177.8	55.0	**131.0**	256.8	82.8	**181.0**	357.8
-27.8	**-18.0**	-0.4	0.0	**32.0**	89.6	27.8	**82.0**	179.6	55.6	**132.0**	269.6	83.3	**182.0**	359.6
-27.2	**-17.0**	1.4	0.6	**33.0**	91.4	28.3	**83.0**	181.4	56.1	**133.0**	271.4	83.9	**183.0**	361.4
-26.7	**-16.0**	3.2	1.1	**34.0**	93.2	28.9	**84.0**	183.2	56.7	**134.0**	273.2	84.4	**184.0**	363.2
-26.1	**-15.0**	5.0	1.7	**35.0**	95.0	29.4	**85.0**	185.0	57.2	**135.0**	275.0	85.0	**185.0**	365.0
-25.6	**-14.0**	6.8	2.2	**36.0**	96.8	30.0	**86.0**	186.8	57.8	**136.0**	276.8	85.6	**186.0**	366.8
-25.0	**-13.0**	8.6	2.8	**37.0**	98.6	30.6	**87.0**	188.6	58.3	**137.0**	278.6	86.1	**187.0**	368.6
-24.4	**-12.0**	10.4	3.3	**38.0**	100.4	31.1	**88.0**	190.4	58.9	**138.0**	280.4	86.7	**188.0**	370.4
-23.9	**-11.0**	12.2	3.9	**39.0**	102.2	31.7	**89.0**	192.2	59.4	**139.0**	282.2	87.2	**189.0**	372.2
-23.3	**-10.0**	14.0	4.4	**40.0**	104.0	32.2	**90.0**	194.0	60.0	**140.0**	284.0	87.8	**190.0**	374.0
-22.8	**-9.0**	15.8	5.0	**41.0**	105.8	32.8	**91.0**	195.8	60.6	**141.0**	285.8	88.3	**191.0**	375.8
-22.2	**-8.0**	17.6	5.6	**42.0**	107.6	33.3	**92.0**	197.6	61.1	**142.0**	287.6	88.9	**192.0**	377.6
-21.7	**-7.0**	19.4	6.1	**43.0**	109.4	33.9	**93.0**	199.4	61.7	**143.0**	289.4	89.4	**193.0**	379.4
-21.1	**-6.0**	21.2	6.7	**44.0**	111.2	34.4	**94.0**	201.2	62.2	**144.0**	291.2	90.0	**194.0**	381.2
-20.6	**-5.0**	23.0	7.2	**45.0**	113.0	35.0	**95.0**	203.0	62.8	**145.0**	293.0	90.6	**195.0**	383.0
-20.0	**-4.0**	24.8	7.8	**46.0**	114.8	35.6	**96.0**	204.8	63.3	**146.0**	294.8	91.1	**196.0**	384.8
-19.4	**-3.0**	26.6	8.3	**47.0**	116.6	36.1	**97.0**	206.6	63.9	**147.0**	296.6	91.7	**197.0**	386.6
-18.9	**-2.0**	28.4	8.9	**48.0**	118.4	36.7	**98.0**	208.4	64.4	**148.0**	289.4	92.2	**198.0**	388.4
-18.3	**-1.0**	30.2	9.4	**49.0**	120.2	37.2	**99.0**	210.2	65.0	**149.0**	300.2	92.8	**199.0**	390.2
-17.8	**0.0**	32.0	10.0	**50.0**	122.0	37.8	**100.0**	212.0	65.6	**150.0**	302.0	93.3	**200.0**	392.0

General Cable

CAROL BRAND

Cord Technical Information 11



As applications become more intricate, specifying wire and cable products to meet commercial, industrial and specialty requirements has become more time-consuming and complex.

Today's designers, installers and contractors must be aware not only of general power transmission types but also of the myriad of materials available to meet specific environmental and electrical performance criteria.

This technical section is presented to aid in the selection of cord products to best suit specific designs and applications.

For technical issues and questions, please contact your local General Cable distributor, your retailer or your Inside Sales Representative.

Index **Page**

AWG to Metric Conversion Chart	93
Common Wire Conductor Stranding	93
Bend Radius Calculation per ICEA	93
Class K Copper Stranding	94
Class M Copper Stranding	95
Installation — Training and Bending Limitations	96
Cord Product Coding System	96
Voltage Drop Calculations	97
Insulation and Jacket Properties	98
Government and Military Wire and Cable Specifications	99

AWG to Metric Conversion Chart

SIZE (AWG)	mm^2	SIZE (AWG)	mm^2
18	0.82	1/0	53.5
16	1.31	2/0	64.4
14	2.08	3/0	85.0
12	3.31	4/0	107.0
10	5.26	250	127.0
9	6.63	300	152.0
8	8.37	350	177.0
6	13.30	500	253.0
4	21.15	600	304.0
2	33.62	750	380.0
1	42.40	1000	507.0

Common Wire Conductor Stranding

STRANDING CLASS	14–2 AWG	1–4/0 AWG	250 MCM – 500 MCM
B	7 STR	19 STR	37 STR
C	19 STR	37 STR	61 STR
D	37 STR	61 STR	91 STR
G	49 STR	133 STR	259 STR
H	133 STR	259 STR	427 STR
I	All sizes use 24 AWG wires		
K	All sizes use 30 AWG wires		
M	All sizes use 34 AWG wires		

Bend Radius Calculation per ICEA

Bend Radius = 6 x nominal OD (typically in inches)

Applies to the following cable types:

SJ	G-GC
SO	Welding
W	Stage Lighting & Entertainment
G	

Class K Copper Stranding

Size	Rope-Lay with Bunch Stranding		Bunch Stranding		Weight
AWG or kcmil	Nominal Number of 30 AWG Wires	Strand Construction	Nominal Number of 30 AWG Wires	Approx. O.D. (inches)	lbs./1000 ft.
1,000	10,101	37 x 7 x 39	10,101	1.419	3,270
900	9,065	37 x 7 x 35	9,065	1.323	2,935
800	7,980	19 x 7 x 60	7,980	1.305	2,585
750	7,581	19 x 7 x 57	7,581	1.276	2,455
700	6,916	19 x 7 x 52	6,916	1.207	2,240
650	6,517	19 x 7 x 49	6,517	1.166	2,110
600	5,985	19 x 7 x 45	5,985	1.125	1,940
550	5,453	19 x 7 x 41	5,453	1.056	1,765
500	5,054	19 x 7 x 38	5,054	0.988	1,635
450	4,522	19 x 7 x 34	4,522	0.933	1,465
400	3,990	19 x 7 x 30	3,990	0.878	1,290
350	3,458	19 x 7 x 26	3,458	0.809	1,120
300	2,989	7 x 7 x 61	2,989	0.768	960
250	2,499	7 x 7 x 51	2,499	0.682	802
4/0	2,107	7 x 7 x 43	2,107	0.627	676
3/0	1,666	7 x 7 x 34	1,666	0.533	535
2/0	1,323	7 x 7 x 27	1,323	0.470	425
1/0	1,064	19 x 56	1,064	0.451	338
1	836	19 x 44	836	0.397	266
2	665	19 x 35	665	0.338	211
3	532	19 x 28	532	0.304	169
4	420	7 x 60	420	0.272	132
5	336	7 x 48	336	0.235	106
6	266	7 x 38	266	0.202	84
7	210	7 x 30	210	0.179	66
8	168	7 x 24	168	0.157	53
9	133	7 x 19	133	0.146	42
10	–	–	104	0.126	32.5
12	–	–	65	0.101	20.3
14	–	–	41	0.078	12.8
16	–	–	26	0.060	8.0
18	–	–	16	0.048	5.0
20	–	–	10	0.038	3.2

Sources: ASTM B172 Specification for Rope-Lay-Stranded Copper Conductors Having Bunch-Stranded Members and ICEA S-68-516 (NEMA WC8).

Class M Copper Stranding

Size	Rope-Lay with Bunch Stranding		Bunch Stranding		Weight
AWG or kcmil	Nominal Number of 34 AWG Wires	Strand Construction	Nominal Number of 34 AWG Wires	Approx. O.D. (inches)	lbs./1000 ft.
1,000	25,193	61 x 7 x 59	25,193	1.404	3,240
900	22,631	61 x 7 x 53	22,631	1.331	2,910
800	20,069	61 x 7 x 47	20,069	1.256	2,580
750	18,788	61 x 7 x 44	18,788	1.207	2,415
700	17,507	61 x 7 x 41	17,507	1.183	2,250
650	16,226	61 x 7 x 38	16,226	1.133	2,085
600	14,945	61 x 7 x 35	14,945	1.084	1,920
550	13,664	61 x 7 x 32	13,664	1.035	1,755
500	12,691	37 x 7 x 49	12,691	0.997	1,630
450	11,396	37 x 7 x 44	11,396	0.940	1,465
400	10,101	37 x 7 x 39	10,101	0.901	1,300
350	8,806	37 x 7 x 34	8,806	0.825	1,130
300	7,581	19 x 7 x 57	7,581	0.768	975
250	6,384	19 x 7 x 48	6,384	0.713	821
4/0	5,320	19 x 7 x 40	5,320	0.645	684
3/0	4,256	19 x 7 x 32	4,256	0.576	547
2/0	3,325	19 x 7 x 25	3,325	0.508	427
1/0	2,646	7 x 7 x 54	2,646	0.423	337
1	2,107	7 x 7 x 43	2,107	0.376	268
2	1,666	7 x 7 x 34	1,666	0.337	212
3	1,323	7 x 7 x 27	1,323	0.305	169
4	1,064	19 x 56	1,064	0.269	134
5	836	19 x 44	836	0.240	105
6	665	19 x 35	665	0.215	84
7	532	19 x 28	532	0.196	67
8	420	7 x 60	420	0.162	53
9	336	7 x 48	336	0.146	42
10	259	7 x 37	259	0.126	32.5
12	168	7 x 24	168	0.101	21.0
14	–	–	104	0.078	12.8
16	–	–	65	0.060	8.0
18	–	–	41	0.048	5.0
20	–	–	26	0.038	3.2

Sources: ASTM B172 Specification for Rope-Lay-Stranded Copper Conductors Having Bunch-Stranded Members and ICEA S-68-516 (NEMA WC8).

Installation — Training and Bending Limitations

Physical Limitations Training and Bending

Overview

Training is the positioning of cable when it is not under tension. Bending is the positioning of cable when it is under tension. When installing cable, the object is to limit the mechanical forces so that the cable's physical and electrical characteristics are maintained for the expected service life. Bends in conductors, multiconductor cables or assemblies of conductors shall be made so that the cable will not be damaged.

A nonshielded cable can tolerate a sharper bend than a shielded cable. This is especially true for cables having helically applied metallic shielding tapes which, when bent too sharply, can separate or buckle and cut into the insulation. Remember that offsets are bends.

The problem is compounded by the fact that most tapes are under jackets that conceal such damage. The extruded polymers used for insulation shields have sufficient conductivity and coverage initially to pass acceptance testing, then fail prematurely due to corona at the shield/insulation interface.

Minimum Bending Radius in Accordance with National Electric Code

Voltage	Conductors	Shielding	Cable Types	Minimum Bending Radius as a Multiple of Conductor/Assembly Diameter		
600 V	Single	Nonshielded	All	5X		
601-2000 V			All	8X		
600 V or 2000 V	Multiconductor or Multiplexed	Nonshielded	TC or TC-ER	1 in. (25 mm) or less	Over 1 in. to 2 in. (>25 mm to 50 mm)	Over 2 in. (>50 mm)
				4X	5X	6X
			MC[1]	7X		
		Shielded	All	12X		
			TC or TC-ER	12X		
			MC	12X/7X[1]		

[1] Per 330.24B Interlocked-Type Armor or Corrugated Sheath.

Cord Product Coding System

Cord Packaging and Color Codes

Example: 02725.41.01

Product Number

Packaging Code Identification Numbers

CODE	PACKAGING	CODE	PACKAGING
15/R5	250' Spool	41	1000' Reel
18/R8	500' Spool	43	2000' Reel
21	1000' Spool	44	2500' Reel
24	2500' Spool	46	5000' Reel
35	250' Reel	85	250' Coil
38	500' Reel	99	LL Reel
40	LL Reel	XX	Shorts

Jacket Color Code Identification Numbers

CODE	COLOR	CODE	COLOR
01	Black	07	Blue
02	White	08	Brown
03	Red	10	Gray
04	Orange	13	Pink
05	Yellow	19	Purple
06	Green	77	Light Blue

Voltage Drop Calculations

To Find Volts Lost:

1. Multiply current (amperes) by the distance (feet in one conductor) by the figure in the table below for the type of system and wire used.
2. Place a decimal in front of the last six figures.
3. The result is number of volts lost.

Note: For AC 3 Phase Current Voltage Drop obtained is phase-to-phase.

WIRE SIZE	POWER FACTOR %	AC SINGLE PHASE	AC THREE PHASE	DC	WIRE SIZE	POWER FACTOR %	AC SINGLE PHASE	AC THREE PHASE	DC
14 AWG	100	5880	5090	5880	**3/0 AWG**	100	149	129	144
	90	5360	4640			90	179	155	
	80	4790	4150			80	181	156	
	70	4230	3660			70	177	153	
	60	3650	3160			60	171	148	
12 AWG	100	3690	3190	3690	**4/0 AWG**	100	121	104	114
	90	3380	2930			90	152	131	
	80	3030	2620			80	156	135	
	70	2680	2320			70	155	134	
	60	2320	2010			60	151	131	
10 AWG	100	2320	2010	2820	**250 kcmil**	100	102	89	97
	90	2150	1861			90	136	117	
	80	1935	1675			80	143	123	
	70	1718	1487			70	143	124	
	60	1497	1296			60	141	122	
8 AWG	100	1462	1265	1462	**300 kcmil**	100	86	75	81
	90	1373	1189			90	121	104	
	80	1248	1081			80	128	111	
	70	1117	969			70	131	113	
	60	981	849			60	130	113	
6 AWG	100	918	795	918	**350 kcmil**	100	74	64	69
	90	882	764			90	109	95	
	80	812	703			80	118	102	
	70	734	636			70	122	105	
	60	653	565			60	122	106	
4 AWG	100	578	501	578	**400 kcmil**	100	66	57	60
	90	571	494			90	101	88	
	80	533	462			80	111	96	
	70	489	423			70	115	99	
	60	440	381			60	116	101	
2 AWG	100	367	318	363	**500 kcmil**	100	54	47	48
	90	379	328			90	89	78	
	80	361	313			80	99	86	
	70	337	292			70	105	91	
	60	309	268			60	108	93	
1 AWG	100	291	252	288	**600 kcmil**	100	47	41	40
	90	311	269			90	83	72	
	80	299	259			80	93	81	
	70	284	246			70	99	86	
	60	264	229			60	103	89	
1/0 AWG	100	233	202	229	**750 kcmil**	100	39	34	32
	90	257	222			90	75	65	
	80	252	218			80	86	75	
	70	241	209			70	93	81	
	60	227	106			60	97	84	
2/0 AWG	100	187	162	181	**1000 kcmil**	100	31	27	24
	90	213	184			90	67	58	
	80	212	183			80	79	68	
	70	206	178			70	86	75	
	60	196	169			60	91	78	

Insulation and Jacket Properties

TYPICAL PROPERTIES OF COMMON INSULATING MATERIALS

PARAMETER	PVC	PE	PP	XLPE	NYLON	EPDM	TFE	BUTYL RUBBER	SILICONE RUBBER	TPR
Specific Gravity	1.37	0.92	0.89	0.93-1.18	1.09	1.43	2.17	1.40	1.60	1.16-1.20
Dielectric Constant										
(a) 60 Hz	6.0	2.26	2.6	3.0	4.6	3.4	2.1	4.1	3.3	2.8
(b) 1000 Hz	5.0	2.25		3.0	4.5	3.4	2.1	4.0	3.1	2.8
Dielectric Strength, v/mil										
(a) 0.010" wall	1800	2100	850	-	1000	700	2000	700	600	625
(b) 0.040" wall	800	1050	450	700	470	500	950	500	400	
Tensile Strength, PSI x 1000	1.5-3.8	1.4-2.4	2.9-4.5	1.8-2.5	8.8-11.9	0.8-1.2	2.0-6.0	0.5-1.5	0.6-1.2	2.3
Service Temp. Range, °C	-55/+105	-90/+90	-40/+105	-55/+105	-55/+105	-55/+105	-90/+260	-40/+90	-80/+200	-55/+90
Elongation, %	200-375	350-550	700	250-400	150-380	250-450	200-500	200-400	125-400	500
Water Absorption, % in 24 hr	<0.75	<0.02	<0.02	<0.01	2.5	<0.1	<0.01	<1.0	<1.0	<0.6
Flame Resistance	Self-Extinguishing	Support Flame	Support Flame	Slow Flame	Self-Extinguishing	Supports Flame	Non-Flammable	Slow Burning	Slow (Non-Cond. Ash)	Flammable
Ozone Resistance	Excellent	Good	Excellent	Good	Good	Excellent	Excellent	Excellent	Excellent	Excellent
Flexibility	Good	Good	Good	Good-Fair	Good-Fair	Excellent	Good	Excellent	Excellent	Excellent
Abrasion Resistance	Good	Good	Fair	Excellent	Excellent	Fair	Excellent	Poor	Poor	Good-Fair
Acid Resistance	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Good	Excellent
Base Resistance	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Good	Good	Excellent
Hydraulic Fluid Resistance	Good-Fair	Fair-Poor	Fair	Good-Fair	Good-Fair	Good-Fair	Excellent	Poor	Fair-Poor	Poor
Organic Solvent Resistance	Fair-Poor	Poor	Fair	Fair	Good-Fair	Fair-Poor	Excellent	Good-Fair	Poor	Poor

NOTE: The above is representative of performance. For specific compound performance, consult factory.

TYPICAL PROPERTIES OF COMMON JACKETING MATERIALS

PARAMETER	PVC	PE	NYLON	CPE	TFE	SILICONE RUBBER	NEOPRENE	POLY-URETHANE	TPR
Specific Gravity	1.37	0.92	1.09	1.46	2.17	1.24	1.52	1.3	1.16-1.20
Tensile Strength, PSI x 1000	1.5-3.8	1.4-2.4	8.8-119	1.2-2.0	2.0-6.0	0.6-1.2	1.5-2.5	>3.5	2.3
Elongation, %	200-375	350-550	150-380	300-500	200-500	125-400	300-500	540-700	500
Service Temp. Range,°C	-55/+105	-80/+75	-55/+105	-50/+105	-90/+200	-80/+200	-65/+90	-65/+75	-55/+90
Ozone Resistance	Excellent	Good	Good	Excellent	Excellent	Excellent	Excellent	Good	Excellent
Weatherability	Good-Fair	Excellent-Good	Fair-Poor	Excellent	Excellent	Excellent	Good	Good	Excellent
Flame Resistance	Self-Extinguishing	Supports Flame	Flammable	Self-Extinguishing	Non-Flammable	Slow-Burn (Non-Cond. Ash)	Self-Extinguishing	Slow-Burn	Flammable
Flexibility	Good	Good	Good-Fair	Excellent	Good	Excellent	Excellent	Excellent	Excellent
Abrasion Resistance	Good	Good	Excellent	Good	Excellent	Poor	Excellent	Excellent	Good-Fair
Acid Resistance	Excellent	Excellent	Poor	Good	Excellent	Poor	Good	Fair	Excellent
Base Resistance	Excellent	Excellent	Excellent	Excellent	Excellent	Good	Good	Fair	Excellent
Hydraulic Fluid Resistance	Good-Fair	Fair-Poor	Good-Fair	Good	Excellent	Fair-Poor	Good	Poor	Good
Organic Solvent Resistance	Fair-Poor	Poor	Good-Fair	Good	Excellent	Poor	Good	Poor	Poor
Resistance to Tearing	Good	Good	Excellent	Good	Good	Fair	Good	Excellent	Good-Fair

NOTE: The above is representative of performance. For specific compound performance, consult factory.

Government and Military Wire and Cable Specifications

J-C-90: Flexible cord and fixture wire.
J-C-96: Neoprene jacketed telephone wire.
J-C-580: Flexible cord and fixture wire.
J-C-0741: Rubber and/or neoprene welding cable.
MIL-C-17: Coaxial cable – polyethylene and Teflon dielectric.
MIL-C-915, MIL-C-2194: Shipboard cable.
MIL-C-1486: 10 conductor WM-46/U only.
MIL-C-3078: Cable, electric, insulated low tension single conductor.
MIL-C-3432: 300 volt and 600 volt rubber insulated power and control cable.
MIL-C-3458: Cables, telephone.
MIL-C-3702: Cable, power electrical, ignition, high tension.
MIL-C-3849: Tinsel cord. Light duty low voltage flexible cord for switchboards, microphones, telephones, etc.
MIL-C-3883: Cord electrical (audio frequency).
MIL-C-3884: Conductor electrical (short lay).
MIL-C-4839: KEL-F insulated cable, WF-15/U.
MIL-C-4866: RG-62 B/U cable.
MIL-C-4921A (ASG): Single conductor 8 AWG 5,000 volt cable with butyl compound insulation and polychloroprene. For airport lighting.
MIL-C-5136: Cable, power, electric, polychloroprene sheathed, buna compound insulated.
MIL-C-5767: Low temperature rubber portable cords.
MIL-C-6166: Cord, headset-microphone CX1301/AR.
MIL-C-7078: 600 volt aircraft cable.
MIL-C-8721 (ASG): Cable, ignition high tension, aircraft quality.
MIL-C-8721: Miniature coaxial cables with Teflon TFE cores.
MIL-C-8817 (ASG): Cable ignition, high tension, aircraft quality.
MIL-C-9360: RG 134/U cable
MIL-C-10065: Cables, special purpose electrical (multi-pair) audio frequency.
MIL-C-10369: Cable, telephone field, for rapid payout.
MIL-C-10392: Cables, special purpose, electric (miniature).
MIL-C-10581: Cables telephone, cable assemblies, telephone, coil assembly, telephone loading
MIL-C-11060: Cables, twisted pair, internal hook-up, unshielded and shielded.
MIL-C-11097: Cable, telephone (Wire W-50-A).
MIL-C-11311: Telephone cable types WD-31/U and WT-24/U.
MIL-C-11440: Cable, power electrical.
MIL-C-12064: Low temperature power cable and cords for Arctic service.
MIL-C-12423: Cable, telephone WD-33 U.
MIL-C-12881: Cables, telephone, switchboard (cable and cable assemblies).
MIL-C-12992: Cable assembly, power, electrical (Cord CX-227 TVQ- 1).
MIL-C-13066: Cable, telephone (submarine No. 19 AWG and No. 22 AWG).
MIL-C-13077: Cable, special purpose, electrical.
MIL-C-13486: Cables, special purpose electrical: low tension, heavy duty, single CDR & multiconductor shielded arid unshielded
MIL-C-13777: Multi-conductor missile ground support cable.
MIL-C-13892: Cable, telephone (flexible).
MIL-C-14189: Cable, power electrical, 3000 volt, for field use.
MIL-C-15325: Cable, tow, electric (three conductor).
MIL-C-15479: Cables, power, electrical, submarine, Navy Standard Harbor Defense.
MIL-C-18959: Cable power, electrical, portable neoprene jacketed 600 volt.
MIL-C-18961: Cable, special purpose, electrical and wire, electrical, shot
MIL-C-18962: Cable, power, electrical, direct burial, neoprene jacketed 600 volt.
MIL-C-19381 (Ships): Cables, special purpose, electrical nuclear plant.
MIL-C-19547: Cables, electrical, special purpose, shore use.
MIL-C-19638: Cables, power electric, submarine, Navy Harbor Defense.
MIL-C-19654: Cable, telephone, submarine.
MIL-C-19787: Cable, electric, torpedo, 65 conductor (torpedo control, electric setting).
MIL-C-19883: Cables, special purpose, electric, for remote control radar set AN/FPN-28.
MIL-C-21069: Cable, electrical, shield, 600 volt (non-flexing service).
MIL-C-22667: Cable, special purpose, buoyant, electrical (submarine use).
MIL-C-23020: Coaxial cable for use inside submarines (water blocked).
MIL-C-23206: Cable, special purpose, electrical. Silicone rubber, water blocked.
MIL-C-23437: Cable, electrical, shielded pairs.
MIL-C-24145 (Ships): Cable, electrical special purpose for shipboard use (water blocked and non-water blocked). Formerly BuShip 660 L.
MIL-C-24640: Cable, electrical, lightweight for shipboard use.
MIL-C-24643: Cable and cord, electrical, low-smoke for shipboard use.
MIL-C-25115: RG-62 C/U.
MIL-C-25509: RG-115 A U
MIL-C-26468 (USAF): Cables, guided missile, ground installation, general requirements for.
MIL-C-27072: Multi-conductor ground support cable.
MIL-C-27212: Cable, power, electrical, airport lighting control.
MIL-C-27500: Shielded and unshielded aircraft and missile cables.
MIL-C-36359 (USAF): Power cable of two voltage range for airport lighting 8 AWG (3,000-5,OOOV) CCLP insulated.
MIL-C-55021: Cables, twisted pairs and triples, internal hook-up, shielded and unshielded.
MIL-C-55036: Cable, telephone, WM130##/6.
MIL-E-9085 (USAF): Electrical cord, WM-85/u.
MIL-E-9088 (USAF): Electrical cord, WF-15/u.
MIL-R-833 (USAF): RF cable, RG12/u.
MIL-STD-122: Color code for chassis wiring for electronic equipment.
MIL-STD-681: Identification coding and application of hook-up wire.
MIL-W-76: General purpose hook-up wire. Vinyl insulated types LW, MW and HW.
MIL-W-438: Wire ignition electric power.
MIL-C-442: Thermoplastic or rubber jacketed two conductor parallel rip cord.
MIL-W-583: Wire, magnet, electrical.
MIL-W-3093: Wire, insulated, W-121, W-122, W-123, WD15/u, WD-16, WF-9/u, WT-3/u (distributing, frame wires).
MIL-W-3104: Wire, insulated No. 20 AWG, extra flexible.
MIL-W-3975: Wire, electrical (tinsel).
MIL-W-3861: Wire, electrical (bare copper).
MIL-W-5086: 600 volt aircraft wire (copper conductors).
MIL-W-5088: Installation of wiring and wiring devices in aircraft.
MIL-W-5274: Spec for aircraft wire, Type I 600V, Type II 600V, Type 111 300 rating
MIL-W-5845: Wire, electrical, iron and constantan, thermocouple.
MIL-W-5846: Wire, electrical, chromel and alumel, thermocouple.
MIL-W-5908: Wire, electrical, copper and constantan, thermocouple.
MIL-W-6370: Wire, electrical, insulated antenna.
MIL-W-7072: 600 volt aircraft wiring (aluminum conductors).
MIL-W-7500: Wire, electrical, WS-31-U.
MIL-W-8160: Installation of wire in guided missiles.
MIL-W-877: 600 volt silicone rubber insulated aircraft wire.
MIL-W-12349: KEL-F insulated hook-up wire.
MIL-W-12410: General purpose hook-up wire similar to MIL-W-76.
MIL-W-12995: Wire, electrical (W-29 and W-120).
MIL-W-13075: Wire, electrical
MIL-W-13169: Wire, electrical (for instrument test leads).
MIL-W-13241: Wire, electrical.
MIL-W-16400: General specification for electronic equipment, Naval ship and shore.
MIL-W-16878: Electronic hook-up wire. Includes vinyl (Types B, C, and D), Teflon (Types ET, E, EE, KT, K and KK) and polyethylene (Type J).
MIL-W-17211 (Ships): Wire, electrical, radio antenna 7/12, 7/14, 7/16, 7/18, 7/20, 7/22.
MIL-W-19150: Wire, insulated, hard drawn copper.
MIL-W-19583 (Navy): Wire, electrical, magnet, high temperature, film insulated.
MIL-W-21306: Wire, electrical twisted pair, color coded switchboard.
MIL-W-22759: Teflon and Tefzel insulated airframe wire.
MIL-W-25038: Wire, electrical, high temperature and fire-resistant aircraft.
MIL-W-27300: Teflon insulated 600 volt aircraft wire.
MIL-W-81044: Irradiated wire for aircraft and hook-up.
MIL-W-81381: Wire, electric polyamide insulated copper and copper alloy (Kapton H-film).
MIL-W-81822: Solid conductor, wire wrap insulated and uninsulated.
NAS-702: General purpose PVC insulated hook-up wire.
NAS-703: High temperature general purpose Teflon TFE insulated wire. Similar to Types E and EE of MIL-W-16878.

Cordset Technical Information 12



General Cable takes pride in offering high-quality cordsets to our customers that provide reliable service year after year in the most rugged uses and application conditions. From our innovative **Plug-it®** line of cordset products and extension cord accessories to the ultimate extension cord in the industry – **FrogHide®** – we sell the products that power you forward.

Handy information and technical data in this section will help in the correct selection and matching of our cordset products to your application. For difficult applications or more detailed technical questions, please contact your local General Cable distributor, your retailer, or your Inside Sales Representative.

Index	Page
Extension Cord Facts	101
Cordset Product Coding System	102
Understanding Wire Gauge	103
How to Select the Right Extension Cord	103
Ground Fault Circuit Interrupters (GFCI)	104
NEMA Receptacle and Plug Chart	105-106

Extension Cord Facts

What does AWG mean?

AWG means American Wire Gauge. It designates the size of the copper wire. The standard sizes for extension cords are 16 AWG, 14 AWG, 12 AWG and 10 AWG. The smaller the AWG number, the larger the size of the copper wire and wattage rating.

What do the amp and watt ratings mean?

Never plug more than the specific number of watts into a cord. For example, could you plug a 150-watt lamp, a 60-watt lamp and a 10-amp appliance into an extension cord rated 13 amps/1625 watts?

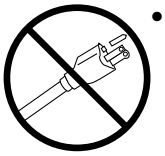
Use the Amp to Watt Conversion Table to determine the total number of watts to be used (150 watts + 60 watts + 1250 watts = 1460 watts). Therefore, it is safe to use the 13-amp/1625-watt extension cord.

Always look for the Underwriters Laboratory label which is permanently attached or molded into the cord. Read the label for instructions and electrical ratings.

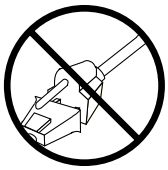
Amps To Watts (@ 125 V) Conversion Table		
0	=	0
1	=	125
2	=	250
3	=	375
4	=	500
5	=	625
6	=	750
7	=	875
8	=	1000
9	=	1125
10	=	1250
11	=	1375
12	=	1500
13	=	1625
14	=	1750
15	=	1875

How to use an extension cord properly.

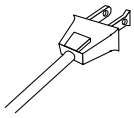
- Be sure the cord you have selected meets the intended use. Never use a cord outdoors that is not marked for outdoors.
- Inspect cord thoroughly before each use. Do not use if damaged.



- Do not remove, bend or modify any metal prongs or pins of plug.
- Look for the number of watts on appliances to be plugged into cord.
- Refer to UL Label on cord for specific wattage.
- Do not connect a three-prong plug into a two-hole cord.



- Do not plug more than the specified number of watts into a cord.
- Make sure appliance is off before connecting cord to outlet.



- A polarized plug has one blade wider than the other.
- Fully insert plug into outlet.
- Do not use excessive force to make connections.
- Do not run cords through doorways, holes in ceilings, walls or floors.
- Do not use an extension cord when wet.



- Keep extension cords away from water.
- Keep children and pets away from extension cords.



- Avoid overheating. Uncoil cord and do not cover it with any other material.
- Do not plug one extension cord into another.
- Do not drive, drag or place objects over extension cord.
- Always grasp plug when removing it from cord or outlet.
- Do not unplug by pulling on cord.



- Always store extension cords indoors.

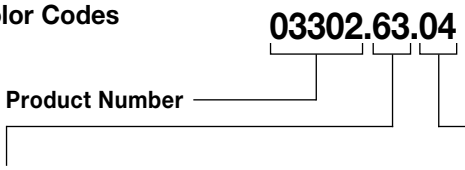


- Do not walk on cord.
- Always unplug cord when not in use.
- Always look for the Underwriters Laboratory (UL) label which is permanently attached or molded into the cord. Read the label for instructions and electrical ratings.

Cordset Product Coding System

Cordset Packaging and Color Codes

Example:



Packaging Code Identification Numbers

CODE	PACKAGING	CODE	PACKAGING
13	Clamshell	70	Bulk (with tie)
60	Cuff	73	Bulk (without tie)
61	Box	96	Card
63	Sleeve		

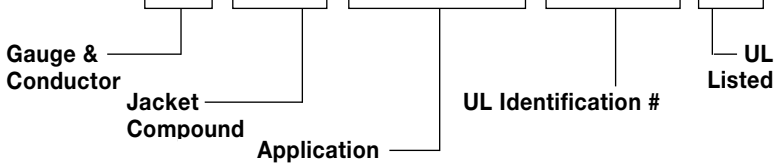
Jacket Color Code Identification Numbers

CODE	COLOR	CODE	COLOR
00	No color	06	Green
01	Black	07	Blue
02	White	08	Brown
03	Red	10	Gray
04	Orange	17	Beige
05	Yellow		

Surface Printed Legend

Our extension cords have surface-printed jackets to provide a means of identifying and distinguishing between different types of extension cords.

Example: 16/3 SJTW OUTDOOR E-XXXXX (UL)



Inner Wire Color Code Chart

NO. OF CONDUCTORS	COLOR
2	Black, White
3	Black, White, Green
4	Black, White, Green, Red

Understanding Wire Gauge

- Gauge refers to the size of the wire
- The thinner the wire, the higher the gauge number
- The thicker the wire, the lower the gauge number



- The lower the gauge, the more electrical current (amps) the wire can carry
- The lower the gauge, the longer distance the wire can be run from an electrical source

How to Select the Right Extension Cord

1. Look up the amp rating on the power tool or appliance.
2. Determine the maximum distance the tool or appliance will be from the electrical outlet.
3. Use the Extension Cord Selector chart below to identify the proper gauge.

Extension Cord Selector

EQUIPMENT	AMP RATING
Circular Saw	12-15
Power Drill	3-7
Hedge Trimmer	2-3
Weed Trimmer	2-4
Chain Saw	7-12
Leaf Blower	6-12
Bug Killer	1-2
Lawn Mower	6-12

Extension Cord Selector

MAXIMUM DISTANCES	UP TO 10 AMPS	UP TO 15 AMPS
0' to 25'	16 Gauge	14 Gauge
25' to 50'	16 Gauge	14 Gauge
50' to 75'	16 Gauge	12 Gauge
75' to 100'	16 Gauge	12 Gauge

Extension Cord Performance Guide

	FROGHIDE® ULTRA FLEX® RUBBER	LIFETIME PLUS® SUPER FLEX®	ALL WEATHER BLUE	SAFETY ORANGE®
Low-Temp Flex	Excellent	Good	Good	Fair
Room-Temp Flex	Excellent	Very Good	Very Good	Good
Oil Resistance	Excellent	Very Good	Very Good	Fair
Cap/Cord Bonding	Excellent	Very Good	Very Good	Good
Abrasion Resistance	Excellent	Very Good	Very Good	Very Good
Chemical Resistance	Excellent	Very Good	Very Good	Very Good
Heat Softening	Excellent	Fair	Fair	Fair
Water Resistance	Excellent	Excellent	Excellent	Excellent
Flame Resistance	Excellent	Very Good	Very Good	Very Good

Ground Fault Circuit Interrupters (GFCI)

What is the GFCI?

The GFCI is a fast-acting circuit interrupter that senses small current imbalances.

These small imbalances in the circuit are caused by current leakage to ground and, in a fraction of a second, the GFCI shuts off the electricity. The GFCI continually matches the amount of current going to an electrical device against the amount of current returning from the device along the normal path. Whenever the amount "going" differs from the amount "returning" by approximately 5 milliamps, the GFCI interrupts the electrical power within as little as 1/40 of a second.

What are OSHA's Electrical Standards for Construction?

GFCIs can be used successfully to reduce electrical hazards on construction sites...

Tripping of GFCIs - interruption of current flow - is sometimes caused by wet connectors and tools. It is a good practice to limit exposure of connectors and tools to excessive moisture by using watertight or sealable connectors. Providing more GFCIs or shorter circuits can prevent tripping caused by the cumulative leakage from several tools or by leakages from extremely long circuits.

To help cope with the electrical hazards at construction sites...

The Occupational Safety and Health Administration (OSHA) issued a revision of OSHA safety and health regulation, 29 Code of Federal Regulations Part 1926, Subpart K (Electrical Standards of Construction). This revision was published in the federal Register and contains the requirements for the GFCI and the assured equipment grounding conductor program.

What are the Employer's Responsibilities on a Construction Site?

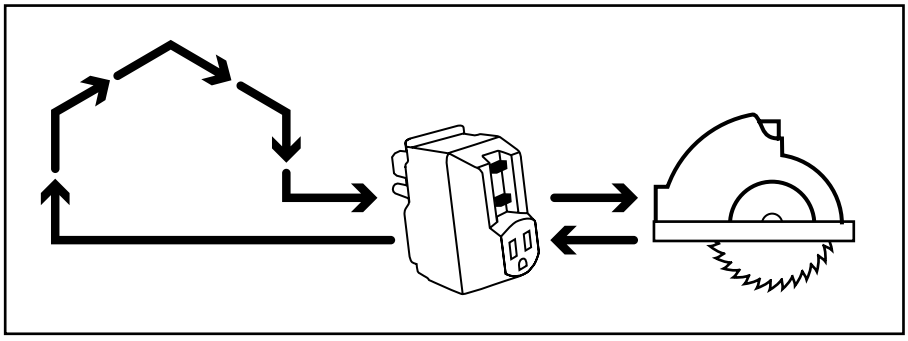
OSHA ground-fault protection rules and regulations have been determined necessary and appropriate for employee safety and health.

Therefore, it is the employer's responsibility to provide either...

- Ground-fault circuit interrupters on construction sites for receptacle outlets in use and not a part of the permanent wiring of the building or structure.
- A scheduled and recorded assured equipment grounding conductor program on construction sites, covering all cordsets, receptacles that are not part of the permanent wiring of the building or structure, and equipment connected by cord and plug that are for use or used by employees.

It is also the employer's responsibility to provide approved ground fault circuit interrupters for a 120-volt, single-phase, 15- and 20-ampere receptacle outlets on construction sites that are not part of the permanent wiring of the building or structure, and that are in use by employees. Receptacles on the ends of extension cords are not part of the permanent wiring and, therefore must be protected by GFCIs whether or not the extension cord is plugged into permanent wiring.

Effective management of worker safety and health protection is a decisive factor in reducing the extent and severity of work-related injuries and illnesses and their related costs. An effective program includes provisions for the systematic identification, evaluation and prevention or control of general workplace hazards, specific job hazards and potential hazards that may arise from foreseeable conditions. An effective program will include management commitment and employee involvement, work site analysis, hazard prevention and control, training and the proper equipment.



NEMA Receptacle and Plug Chart

	VOLTAGE	LINE NO.	15 AMPERE RECEPTACLE	15 AMPERE PLUG	20 AMPERE RECEPTACLE	20 AMPERE PLUG
2 Pole 2 Wire	125 V	1	1-15R 	1-15P 		
	250 V	2	2-15R 	2-15P 	2-20R 	2-20P 
2 Pole 3 Wire Grounding	125 V	5	5-15R 	5-15P 	5-20R 	5-20P 
	250 V	6	6-15R 	6-15P 	6-20R 	6-20P 
	277 V	7	7-15R 	7-15P 	7-20R 	7-20P 
3 Pole 3 Wire	125/250 V	10			10-20R 	10-20P 
	3 ϕ Δ 250 V	11	11-15R 	11-15P 	11-20R 	11-20P 
3 Pole 4 Wire Grounding	125/250 V	14	14-15R 	14-15P 	14-20R 	14-20P 
	3 ϕ Δ 250 V	15	15-15R 	15-15P 	15-20P 	15-20P 
4 Pole 4 Wire	3 ϕ Y 120/208 V	18	18-15R 	18-15P 	18-20R 	18-20P 

NEMA Receptacle and Plug Chart

	VOLTAGE	LINE NO.	30 AMPERE RECEPTACLE	30 AMPERE PLUG	50 AMPERE RECEPTACLE	50 AMPERE PLUG	60 AMPERE RECEPTACLE	60 AMPERE PLUG
2 Pole 2 Wire	125 V	1						
	250 V	2	2-30R 	2-30P 				
2 Pole 3 Wire Grounding	125 V	5	5-20R 	5-30P 	5-50R 	5-50P 		
	250 V	6	6-30R 	6-30P 	6-50R 	6-50P 		
	277 V	7	7-30R 	7-30P 	7-50R 	7-50P 		
3 Pole 3 Wire	125/250 V	10	10-30R 	10-30P 	10-50R 	10-50P 		
	3 ϕ Δ 250 V	11	11-30R 	11-30P 	11-50R 	11-50P 		
3 Pole 4 Wire Grounding	125/250 V	14	14-30R 	14-30P 	14-50R 	14-50P 	14-60R 	14-60P 
	3 ϕ Δ 250 V	15	15-30R 	15-30P 	15-50R 	15-50P 	15-60R 	15-60P 
4 Pole 4 Wire	3 ϕ Y 120/208 V	18	18-30R 	18-30P 	18-50R 	18-50P 	18-60R 	18-60P 

LOCKING-TYPE PLUGS AND RECEPTACLES

VOLTAGE	LINE NO.	15 AMPERE RECEPTACLE	15 AMPERE PLUG	20 AMPERE RECEPTACLE	20 AMPERE PLUG	30 AMPERE RECEPTACLE	30 AMPERE PLUG
125 V	L-1	L1-15R 	L1-15P 				
250 V	L-2			L2-20R 	L2-20P 		
125 V	L-5	L5-15R 	L5-15P 	L5-20R 	L5-20P 	L5-30R 	L5-30P 
250 V	L-6	L6-15R 	L6-15P 	L6-20R 	L6-20P 	L6-30R 	L6-30P 
277 V, A.C.	L-7	L7-15R 	L7-15P 	L7-20R 	L7-20P 	L7-30R 	L7-30P 
480 V	L-8			L8-20R 	L8-20P 	L8-30R 	L8-30P 
600 V	L-9			L9-20R 	L9-20P 	L9-30R 	L9-30P 

CAROL BRAND

General Cable

Catalog Number Index

13

CATALOG NUMBER	PAGE
00436.63.17	66
00439.63.17	66
00442.63.17	66
00565.63.17	71
00594.63.04	60
00596.61.04	60
00597.61.04	60
00604.63.01	65
00606.63.01	65
00655.63.04	71
00690.63.04	60
00691.63.04	60
00692.63.04	60
00694.63.04	60
00696.63.04	60
00697.63.04	60
00762.63.17	66
00772.63.17	66
00787.63.05	60
00788.63.05	60
00790.63.07	60
00791.63.07	60
00792.63.07	60
00793.63.07	60
01004.63.01	65
01006.63.01	65
01101	43
01102	43
01103	43
01104	43
01105	43
01106	43
01107	43
01108	43
01109	43
01278.70.01	64
01302	19
01303	19
01304	19
01305	19
01306	19
01307	19
01310	15
01311	15
01312	15
01342	15
01343	15
01344	15
01358	15
01360	15
01361	19
01362	19
01364	15
01364.70.01	64
01366	19
01368	19
01369	19
01370	19
01376	19
01377	19
01378	19
01379	15
01380	15
01381	15
01382	15
01383	15
01384	15
01411	12
01442	12
01443	12
01444	12
01460	12
01464	12
01480	12
01481	12
01483	12
01484	12
01513.70.01	64
01614.70.01	64
01732.70.01	64
01751	40
01752	40
01753	40
01754	40
01755	40
01756	40
01757	40
01758	40
01761	42
01762	42
01763	42
01764	42
01765	42
01766	42
01767	42
01768	42
01771	41
01772	41
01773	41
01774	41
01775	41
01776	41
01777	41
01778	41
01811	17
01812	17
01818	17
01819	17
01821	17
01822	17
01823	17
01824	17
01825	17
01827	17
01950.70.01	64
01951.70.01	64
02001	11
02002	11
02003	11
02004	11
02005	11
02006	11
02007	11
02008	11
02009	11
02021	11
02022	11
02023	11
02024	11
02031	11
02032	11
02033	11
02034	11
02035	11
02036	11
02037	11
02038	11
02039	11
02041	11
02042	11
02043	11
02045	11
02046	11
02050.70.10	66
02052.70.01	64
02053.70.01	64
02301	53
02303	53
02304	53
02305	53
02306	53
02309	54
02310	54
02311	54
02312	54
02313	54
02332.70.01	63
02333.70.01	63
02425	12
02426	12
02427	12
02428	12
02462	12
02465	12
02466	12
02468	12
02469	12
02470	12
02522.73.01	66
02523.73.01	64
02524.73.01	64
02547.70.01	64
02548.70.01	64
02551.70.01	63
02601	10
02602	10
02603	10
02604	10
02605	10
02606	10
02607	10
02608	10
02609	10
02621	10
02622	10
02623	10
02624	10
02631	10
02632	10
02633	10
02634	10
02635	10
02636	10
02637	10
02638	10
02639	10
02641	10
02642	10
02643	10
02645	10
02646	10
02685.70.01	64
02686.70.01	64
02722	13
02723	13
02724	13
02725	13
02726	13
02727	13
02728	13
02762	13
02763	13
02765	13
02766	13
02767	13
02768	13
02769	13
02770	13
02806	39
02835	39
02845	39
02855	39
02861	39
02862	39
02868	39
02906	39
02935	39
02945	39
02955	39
02961	39
02962	39
02968	39
03302.63.04	59
03304.63.04	59
03318.63.04	59
03327.63.04	59
03328.63.04	59
03350.63.05	58
03351.61.05	58
03352.61.05	58
03353.61.05	58
03354.63.04	59
03356.63.04	59
03387.63.05	58
03390.63.05	58
03391.63.05	58
03392.63.05	58
03397.61.05	58
03398.61.05	58
03399.61.05	58
03654.63.07	61
03655.63.07	61

Catalog Number Index

CATALOG NUMBER	PAGE	CATALOG NUMBER	PAGE	CATALOG NUMBER	PAGE	CATALOG NUMBER	PAGE
03660.63.07	61	05482	31	09230	22	44623.61.05	69
03661.63.07	61	05483	31	09405	22	76502	51
03662.63.07	61	05484	31	09406	22	76512	51
03667.63.07	61	05485	31	09407	22	76812	51
03668.63.07	61	05486	31	09408	22	76822	51
03685.61.05	61	05487	31	09409	22	76832	51
03686.61.05	61	05488	31	09410	22	76843	51
03702	30	05489	31	09412	22	76954	52
03704	30	05581	31	09414	22	76994	52
03706	30	05582	31	09416	22	77453	18
03708	30	05583	31	09418	22	77463	18
03710	30	05584	31	09420	22	77473	18
03712	30	05585	31	09424	22	77483	18
03714	30	05586	31	09428	22	77493	18
04000.63.05	71	05587	31	09430	22	80611	44
04103.73.10	66	05588	31	09605	21	80621	44
04106.73.10	66	05589	31	09606	21	80631	44
04127.60.01	73	05604.63.10	65	09607	21	80641	44
04170.60.02	73	05606.63.10	65	09608	21	80651	44
04194.60.17	65	05654.63.10	65	09609	21	80661	44
04195.60.17	65	05656.63.10	65	09610	21	80671	44
04199.60.17	65	05782	33	09612	21	80681	44
04455.60.05	72	05783	33	09614	21	80691	44
04457.60.05	72	05784	33	09616	21	80701	44
04497.60.05	72	05785	33	09618	21	81312	36
04530.73.01	64	05786	33	09620	21	81313	36
04781.96.17	68	05788	33	09622	21	81314	36
04803.73.10	66	06014.60.04	63	09624	21	81315	36
04806.73.10	66	06200.61.06	57	09626	21	81372	36
04926.70.01	64	06225.61.06	57	09630	21	81373	36
04929.70.01	64	06250.61.06	57	09805	21	81374	36
04932.70.01	64	06400.63.06	57	09806	21	81375	36
04949.60.10	64	06425.63.06	57	09807	21	81382	36
05091	32	06450.63.06	57	09808	21	81383	36
05092	32	06610.63.01	63	09810	21	81384	36
05093	32	06625.63.01	63	09812	21	81385	36
05094	32	06801.63.04	59	09814	21	81392	36
05095	32	06826.63.04	59	09816	21	81393	36
05096	32	06853.63.04	59	09818	21	81394	36
05097	32	06911.63.01	63	09820	21	81395	36
05098	32	07505.73.05	68	09822	21	81402	36
05099	32	09005	22	09824	21	81403	36
5310.01001	45	09006	22	09827	21	81404	36
5310.01002	45	09007	22	09830	21	81405	36
5310.01004	45	09008	22	13002	20	81412	36
5310.01006	45	09010	22	13003	20	81413	36
5310.01008	45	09012	22	16063	13	81414	36
5310.01010	45	09016	22	16064	13	81415	36
5310.01012	45	09020	22	16065	13	81423	36
5310.01014	45	09205	22	16073	13	81443	36
5310.01110	45	09206	22	16074	13	81473	36
5310.01111	45	09207	22	16075	13	81622	36
5310.01210	45	09208	22	16083	13	81623	36
5310.01262	45	09209	22	16084	13	81624	36
5310.01310	45	09210	22	16085	13	81625	36
5310.01313	45	09212	22	16093	13	81642	36
5310.01373	45	09214	22	16094	13	81643	36
5310.01410	45	09216	22	16095	13	81644	36
5310.01444	45	09218	22	23804	55	81645	36
5310.01535	45	09220	22	23805	55	81662	36
5310.01646	45	09224	22	23807	55	81663	36
5310.01777	45	09226	22	23810	55	81664	36
5310.01929	45	09227	22	25202	50	81665	36
05481	31	09228	22	25212	50	82313	37

Catalog Number Index

CATALOG NUMBER	PAGE
82314	37
82373	37
82374	37
82383	37
82384	37
82393	37
82394	37
82403	37
82404	37
82413	37
82414	37
82423	37
82443	37
82473	37
82623	37
82624	37
82643	37
82644	37
82663	37
82664	37
83001	35
83002	35
83004	35
83006	35
83008	35
83010	35
83020	35
83030	35
83040	35
83103	38
83113	38
83123	38
83133	38
83143	38
83153	38
83163	38
83183	38
83250	35
83350	35
83500	35
86002	27
86003	27
86012	28
86013	28
86022	28
86023	28
86112	29
86113	29
86333	28
86343	28
86902	26
86903	26
86904	26
86912	26
86913	26
86914	26
86922	26
86923	26
86924	26
86932	26
86933	26
86934	26
86952	26
86953	26
86954	26
86962	26
86963	26
86964	26
86972	26
86973	26
86974	26
86982	26
86983	26
86984	26
89002	24
89003	24
89004	24
89012	24
89013	24
89014	24
89022	24
89023	24
89024	24
89032	24
89033	24
89034	24
89042	24
89043	24
89044	24
89052	24
89053	24
89054	24
89062	24
89063	24
89064	24
89065	24
89072	24
89073	24
89074	24
89075	24
89082	24
89083	24
89084	24
89085	24
89092	24
89093	24
89094	24
89095	24
89203	25
89204	25
89403	25
89404	25
89603	25
89604	25
89663	24
89664	24
89803	25
89804	25
89883	24
89884	24
91811	46
91911	46
91920	46
91926	46
91929	46
91930	46
91931	46
91937	46
91940	46
91944	46
91953	46
91964	46
91977	46
98187	17
98267	17
98270	17
98463	17
99142	41
99202	41
99432	41
D7524.13.05	69
EV0406	49
EV0608	49
EV0803	49
EV1003	49
EV1203	49
EV1403	49
EVE0608	48
EVE0803	48
EVE1003	48
EVE1203	48
EVE1403	48
EVE1603	48
EVJ123	49
EVJ143	49
EVJ163	49
EVJE123	48
EVJE143	48
EVJE163	48
EVJT123	48
EVJT143	48
EVT1203	48
EVT1403	48
GC601	9
GC602	9
GC603	9
GC604	9
GC605	9
GC606	9
GC607	9
GC608	9
GC609	9
GC621	9
GC622	9
GC623	9
GC624	9
GC631	9
GC632	9
GC633	9
GC634	9
GC635	9
GC636	9
GC637	9
GC638	9
GC639	9
GC641	9
GC642	9
GC643	9
GC645	9
GC646	9
HF063	14
HF064	14
HF065	14
HF073	14
HF074	14
HF075	14
HF083	14
HF084	14
HF085	14
HF093	14
HF094	14
HF095	14
HF310	16
HF311	16
HF312	16
HF342	16
HF343	16
HF344	16
HF358	16
HF360	16
HF364	16
HF379	16
HF380	16
HF381	16
HF382	16
HF383	16
HF384	16
HF722	14
HF723	14
HF724	14
HF725	14
HF726	14
HF727	14
HF728	14
HF762	14
HF763	14
HF765	14
HF766	14
HF767	14
HF768	14
HF769	14
HF770	14

General Cable

Who says you can't have it all?



At General Cable, we are dedicated to providing you with a full range of in-stock quality wire and cable at competitive prices, expert service and support, and innovative programs that provide hassle-free delivery—whenever and wherever it's needed. We are your all-in supplier for:

- **Carol® Brand Portable Cord, Industrial Cord & Cordset Products (Super Vu-Tron® Supreme featuring GenClean™)**
- **Carol® Brand Electronics Products (EXZEL® & Electronic Classics)**
- **General Cable Armored, Instrumentation Power & Control and Automation Cables (CCW®, FREP®, GenFree®, SunGen®, TC Flex™, VNTC®)**
- **Gen*SPEED*® Brand, Carol® Brand and Helix/Hi-Temp® Cat 6 and Cat 5e Products**
- **General Cable Copper Building Wire & PV Wire**
- **STABILOY® Brand and PDIC® Brand Aluminum Alloy Feeder, Service Entrance & Armored Cables**
- **General Cable Military, Mining, Nuclear, OGP and Rail & Transit Cables**

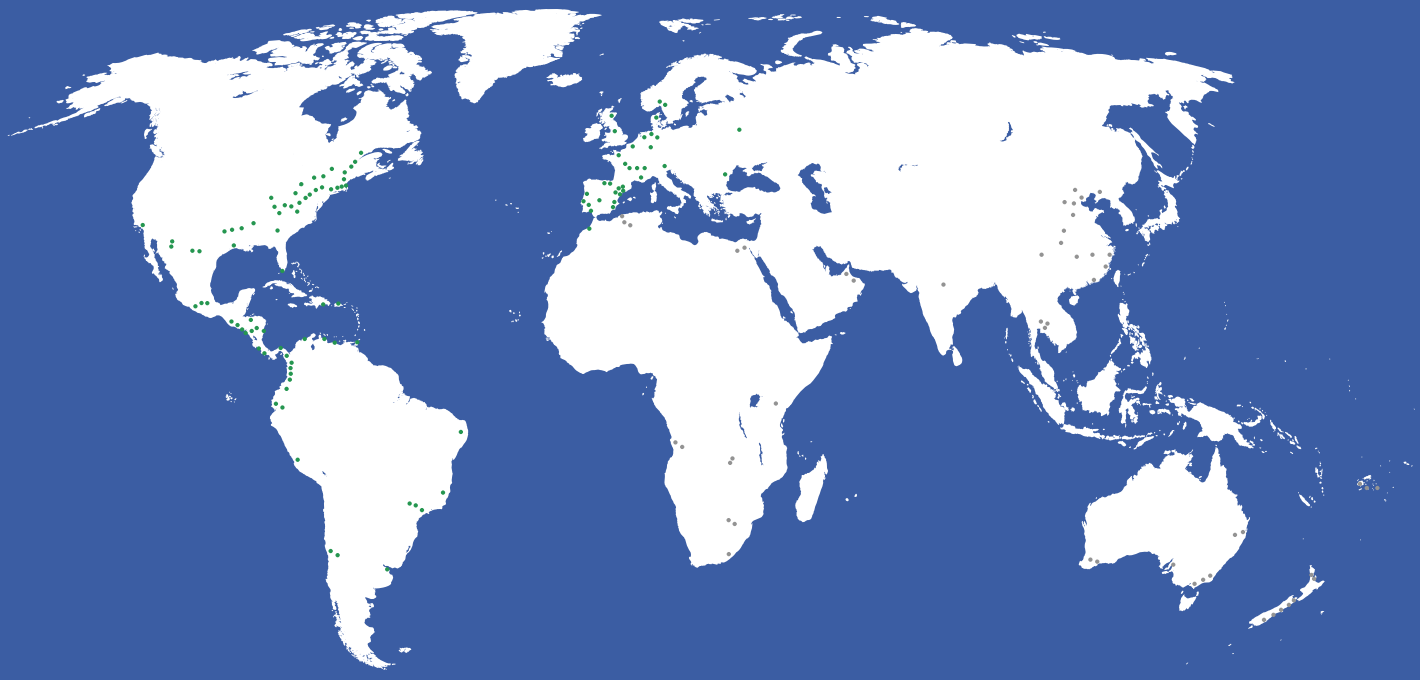
Call us today for all your commercial, industrial and residential cabling needs. Let General Cable put its people, products and programs to work for you.

Check out General Cable's Calculation & Catalogs Apps and other mobile tools

1.800.243.8020 www.generalcable.com info@generalcable.com

General Cable | ONE COMPANY
CONNECTING THE WORLD

Global Reach



General Cable, a leading wire and cable innovator for over 170 years, serves customers through a network of 38 manufacturing facilities in our core markets and has worldwide sales representation and distribution. The Company is dedicated to the production of high-quality aluminum, copper and fiber optic wire and cable and systems solutions for the energy, construction, industrial, specialty and communications sectors. In addition to our strong brand recognition and strengths in technology and manufacturing, General Cable is also competitive in such areas as distribution and logistics, marketing, sales and customer service. This combination enables General Cable to better serve its customers as they expand into new geographic markets.

General Cable
4 Tesseneer Drive
Highland Heights, Kentucky 41076-9753
Telephone: 800.243.8020
859.572.8000
Email: info@generalcable.com
www.generalcable.com

156 Parkshore Drive
Brampton, Ontario L6T 5M1
Telephone: 800.561.0649
905.494.5300
Fax: 800.565.2529
Email: infoca@generalcable.com

Form No. CAR-0084-R0115
46207

Combination short-circuit current ratings for non-fusible safety switches



Safety First: protecting people and equipment

The recent changes in Electrical Workplace Safety Standard NFPA® 70E recommend that industrial users and building owners conduct an arc-flash hazard analysis for their facilities. This analysis includes a short-circuit, coordination and arc-flash system study conducted by a professional engineer, which identifies the available arc-flash energy measured in calories per centimeter-squared (cal/cm^2) for electrical equipment throughout the facility. Then, a special label is affixed to the equipment warning persons working on it while energized of both the arc-flash energy and the personal protective equipment needed to ensure that the worker is adequately protected.

The UL® 98 Standard (Enclosed and Deadfront Switches) allows non-fusible switches to have a maximum short-circuit interrupting rating of 10 kA. This is because as a stand-alone device without integral overcurrent protection, the system designer may not know the upstream overcurrent protection. UL permits higher series connected fault current ratings if specific products are tested together. UL Listed combination ratings must be printed on the safety switch pub on the door, and must specify which upstream devices may be used to protect at higher fault current levels. Additionally, UL does not permit series combination ratings with motor circuit protectors.

Recent system studies have shown that many non-fusible safety switches used in industrial facilities are being applied in systems where the available fault current exceeds the product listing. A study for the system shown in the one-line diagram, **Figure 1**, proved that the available short-circuit current at the safety switch applied as a local motor disconnect was 13.5 kA.

Eaton has completed testing as defined by the UL 98 standard for heavy-duty non-fusible safety switches to achieve a higher level of series combination ratings with upstream Eaton molded-case circuit breakers and various fuse types.

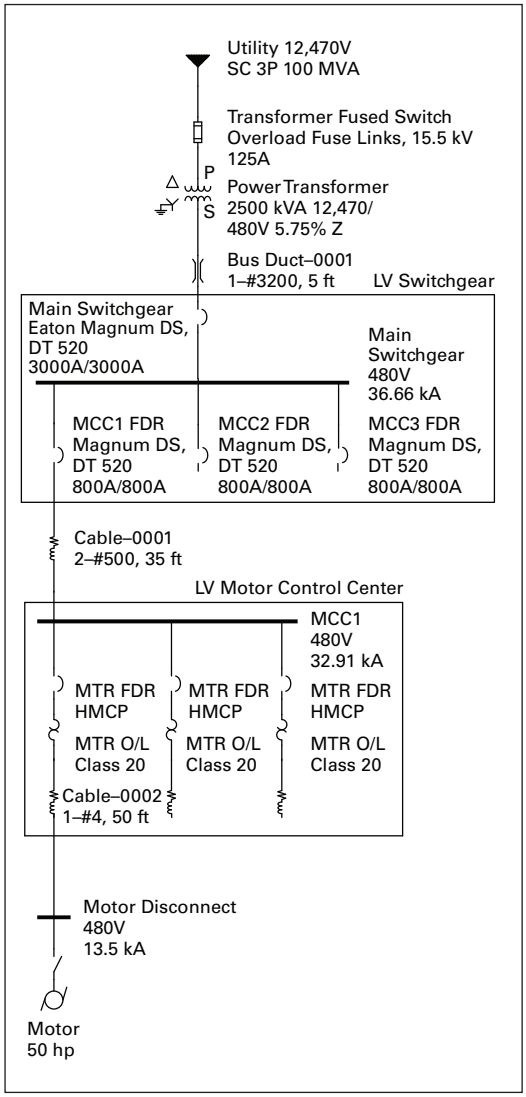


Figure 1.

Powering Business Worldwide

Combination short-circuit current ratings for non-fusible safety switches

Product enhancement

In **Table 1**, Eaton non-fusible safety switches, within the noted ampere ratings, now carry series combination short-circuit ratings as shown when combined with the identified MCCB or fuse type. With this listed rating, the safety switch shown in the one-line diagram, **Figure 1**, can be correctly applied **when the motor feeder Eaton HMCP circuit breaker is replaced with an Eaton molded-case circuit breaker** properly sized for the motor hp rating. This is a significant enhancement to the product's performance rating. To achieve these ratings, the switches have been tested in combination with all of the overcurrent devices shown. Furthermore, the applicable combination ratings are marked on the inside of the switch door, ensuring inspector approval.

Information and application

The circuit breaker or fuse rating is not to exceed the ampere rating of the non-fusible switch. When used on systems with greater than 10 kA short-circuit rating available, the UL Listed short-circuit rating of the non-fusible switch is based upon the switch being used in combination with fuses or molded-case circuit breakers identified in **Table 1**.

Table 1. Non-Fusible Safety Switches

Eaton Non-Fusible Safety Switch Ampere Rating ①	Maximum System Voltage AC	Maximum Short-Circuit Rating	Upstream Device ②	
			Fuse Class	Breaker Frame
30 and 60	600	10,000	H, K	Any circuit breaker
		14,000		FDB
		18,000		FD, EGE
		25,000		FDC, HFD, HFDE, EGH
		200,000	R, T, J, L	
100	480	10,000	H, K	Any circuit breaker
		35,000		EGH, EGS
		200,000	R, T, J, L	
	600	10,000	H, K	Any circuit breaker
		14,000		FDB
		18,000		FD, EGE
		25,000		FDC, HFD, HFDE, EGH
		200,000 ③	R, T, J, L	
200	480	10,000	H, K	Any circuit breaker
		65,000		HFD, HFDE, HJD, JGH
		200,000	R, T, J, L	
	600	10,000	H, K	Any circuit breaker
		14,000		FDB
		18,000		FD, JD, JGE
		25,000		FDC, HFD, HFDE, HJD, JGH
		200,000	R, T, J, L	

① For use on NEMA® 1, 3R, 12/3R, and 4X switches.

② Fuse or circuit breaker rating is not to exceed switch rating.

③ NEMA 12, 4/4X only. NEMA 1, 3R are 100 kAIC at 600 Vac.

Eaton Corporation
Electrical Sector
1111 Superior Ave.
Cleveland, OH 44114
United States
877-ETN-CARE (877-386-2273)
Eaton.com

© 2011 Eaton Corporation
All Rights Reserved
Printed in USA
Publication No. TD00801005E / Z11208
June 2011

Powering Business Worldwide

Eaton is a registered trademark of Eaton Corporation.

All other trademarks are property of their respective owners.

DH362NRK Safety Switch



1.1 Safety Switches

Product Overview V2-T1-3
Cross-Reference V2-T1-5
Catalog Number Selection V2-T1-13
Options and Accessories V2-T1-14
Modifications—Flex Center V2-T1-16
Standard Lug Capacities V2-T1-20
General Duty V2-T1-26
Heavy-Duty V2-T1-31
Six-Pole Switches V2-T1-43
Double-Throw Switches V2-T1-45
EnviroLine—Stainless Steel Switch V2-T1-53
EnviroLine—Upper and Lower Window Switches V2-T1-56
EnviroLine—Receptacle Switches V2-T1-59
EnviroLine—Non-Metallic KRYDON Switch V2-T1-61
Shunt Trip Safety Switch V2-T1-63
NEMA 7/9—Hazardous Location Disconnect Switch V2-T1-66
Quick Connect Switches V2-T1-68
Solar Disconnect Switch V2-T1-70
316-Grade Stainless Steel Safety Switches V2-T1-72
Mill-Duty Rated, Heavy-Duty, Fusible, Non-Fusible, Single-Throw V2-T1-76
Heavy-Duty Fusible Safety Switches Accepting Cube Fuses V2-T1-78
Elevator Control Switch V2-T1-81
Auxiliary Power Heavy-Duty Safety Switch V2-T1-83
Left-Handed Safety Switch V2-T1-86
200% Neutral Safety Switches V2-T1-87
Pringle Bolted Pressure Switch V2-T1-88
Type DS, Fusible and Non-Fusible V2-T1-91
Type Visi-Flex DE-ION V2-T1-94
Flange Mounted—Variable Depth V2-T1-98
Flange Mounted—Fixed Depth V2-T1-102

1.2 Enclosed Circuit Breakers

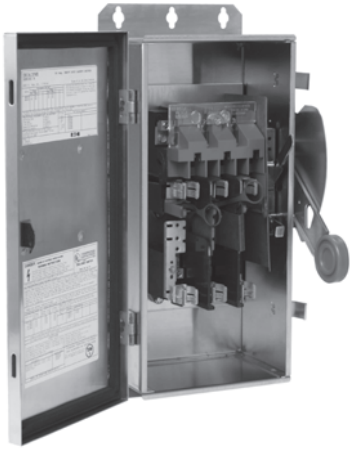
Product Description V2-T1-104
Application Description V2-T1-104
Features, Benefits and Functions V2-T1-105
Standards and Certifications V2-T1-105
Cross-Reference V2-T1-106
Product Selection V2-T1-108
Accessories V2-T1-110
Flex Center V2-T1-112
Technical Data and Specifications V2-T1-113
Dimensions V2-T1-115

1.3 Enclosed Rotary Disconnects

Product Overview V2-T1-122
Product Selection V2-T1-123
Dimensions V2-T1-124

Learn Online

Heavy-Duty Safety Switch



Contents

Description	*Page*
Product Overview	**V2-T1-3**
General Duty	**V2-T1-26**
Heavy-Duty	
Standards and Certifications	**V2-T1-32**
Product Selection	**V2-T1-33**
Dimensions	**V2-T1-42**
Six-Pole Switches	**V2-T1-43**
Double-Throw Switches	**V2-T1-45**
EnviroLine—Stainless Steel Switch	**V2-T1-53**
EnviroLine—Upper and Lower Window Switches	**V2-T1-56**
EnviroLine—Receptacle Switches	**V2-T1-59**
EnviroLine—Non-Metallic KRYDON Switch	**V2-T1-61**
Shunt Trip Safety Switch	**V2-T1-63**
NEMA 7/9—Hazardous Location Disconnect Switch	**V2-T1-66**
Quick Connect Switches	**V2-T1-68**
Solar Disconnect Switch	**V2-T1-70**
316-Grade Stainless Steel Safety Switches	**V2-T1-72**
Mill-Duty Rated, Heavy-Duty, Fusible, Non-Fusible, Single-Throw	**V2-T1-76**
Heavy-Duty Fusible Safety Switches Accepting Cube Fuses	**V2-T1-78**
Elevator Control Switch	**V2-T1-81**
Auxiliary Power Heavy-Duty Safety Switch	**V2-T1-83**
Left-Handed Safety Switch	**V2-T1-86**
200% Neutral Safety Switches	**V2-T1-87**
Pringle Bolted Pressure Switch	**V2-T1-88**
Type DS, Fusible and Non-Fusible	**V2-T1-91**
Type Visi-Flex DE-ION	**V2-T1-94**
Flange Mounted—Variable Depth	**V2-T1-98**
Flange Mounted—Fixed Depth	**V2-T1-102**

Heavy-Duty

Product Description

- 30–1200A
- 600 Vac, 600 Vdc maximum
- Horsepower rated
- Fusible and non-fusible switches are 100% load break and 100% load make rated
- The continuous load current of fusible switches is not to exceed 80% of the rating of fuses employed in other than motor circuits. Non-fusible switches are 100% fully rated
- Suitable for service entrance applications unless otherwise noted
- For factory modifications, refer to **Pages V2-T1-16** through **V2-T1-19**

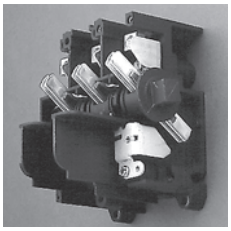
Application Description

For heavy commercial and industrial applications where reliable performance and service continuity are critical.

For the toughest heavy commercial and industrial applications, refer to **Page V2-T1-76** for catalog information on our mill-duty safety switch

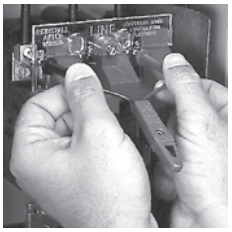
Features, Benefits and Functions

- Deionizing arc chutes; arc chutes confine and suppress the arcs produced by opening contacts under load
- Mechanically interlocked cover to prevent easy access when the switch is in the ON position
- Clearly visible palm fitting red handle
- Complete accessory and renewal parts data shown on inner door label.
- 30–800A NEMA 12 designs convertible to NEMA 3R by opening factory-installed drain hole
- 30–1200A switches are seismic qualified and exceed the requirements of the Uniform Building Code® (UBC) and California Code Title 24
- Tri-lingual nameplates



Visible Double-Break Rotary Blade Mechanism

- Two points of contact provide a positive open and close, easier operation, and also help prevent contact burning for longer contact life



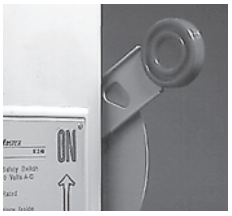
Clear Line Shield

- Protects against accidental contact with energized parts. Probe holes enable the user to test if the line side is energized without removing the shield. Not typically provided on general-duty switches, but available as a field kit or factory installed



Built-In Fuse Pullers (NEMA 12 and 4X 30–200A Only)

- Provide easy removal of fuses



Clearly Visible Handle

- The position (ON or OFF) can be clearly seen from a distance and the length provides for easy operation



Triple Padlocking Capability

- Personnel safety feature because the large hasp can accommodate up to three 3/8-inch (9.5 mm) shank locks



Additional Locking Capability

- Cabinet door can be further padlocked at the top and bottom as applicable



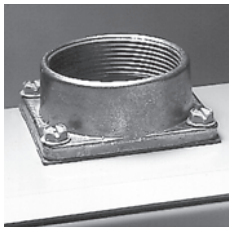
Interlocking Mechanism

- Door cannot be opened when the handle is in the ON position. Front and side operable defeater mechanism provides for user access when necessary on single-throw switches



Tangential Knockouts

- An ample number are provided on the top, bottom and sides of both NEMA Types 1 and 3R enclosures through 200A



Bolt-On Hub Kits

- For switches in a NEMA Type 3R, 30–200A. Use a Myers type hub for all others

Standards and Certifications

- UL listed File No. E5239
- Meets UL 98 for enclosed switches and NEMA Std. KS-1

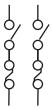
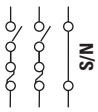
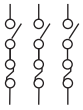
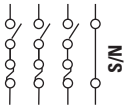
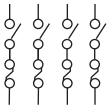
UL Listed

Product Selection

DH221NRK



240 Vac Heavy-Duty, Fusible, Single-Throw, Fusible—NEMA 1, 3R

System	Ampere Rating	Fuse Type Provision	Maximum Horsepower Ratings AC Standard Fuse Single-Phase	Standard Fuse Three-Phase	Time Delay Single-Phase	Time Delay Three-Phase	DC 250V	NEMA 1 Enclosure Indoor Catalog Number	NEMA 3R Enclosure Rainproof Catalog Number
Two-Pole—240 Vac, 250 Vdc (Suitable for Service Entrance Use with a Neutral Kit Installed)									
	30	H	1-1/2	—	—	—	5	**DH221FGK**	②
	60	—	—	—	—	—	—	②	②
	100	—	—	—	—	—	—	②	②
	200	—	—	—	—	—	—	②	②
	400	H	—	50 ①	—	125 ①	50	**DH225FGK**	**DH225FRK**
	600	H	—	75 ①	—	200 ①	—	**DH226FGK**	**DH226FRK**
	800	L	—	100 ①	—	—	—	**DH227FGK**	**—**
Three-Wire (Two Blades, Two Fuses, S/N)—240 Vac, 250 Vdc									
	30	H	1-1/2	3 ③	3	7-1/2 ③	5	**DH221NGK**	**DH221NRK**
	60	H	3	7-1/2 ③	10	15 ③	10	**DH222NGK**	**DH222NRK**
	100	H	7-1/2	15 ③	15	30 ③	20	**DH223NGK**	**DH223NRK**
	200	H	15	25 ③	15	60 ③	40	**DH224NGK**	**DH224NRK**
	400	H	—	50 ③	—	125 ③	50	**DH225NGK**	**DH225NRK**
	600	H	—	75 ③	—	200 ③	—	**DH226NGK**	**DH226NRK**
	800	L	—	100 ③	—	—	—	**DH227NGK**	**DH227NRK**
Three-Pole—240 Vac, 250 Vdc (Suitable for Service Entrance Use with a Neutral Kit Installed)									
	30	H	1-1/2	3	3	7-1/2	5	**DH321FGK**	**DH321FRK**
	60	H	3	7-1/2	10	15	10	**DH322FGK**	**DH322FRK**
	100	H	7-1/2	15	15	30	20	**DH323FGK**	**DH323FRK**
	200	H	15	25	15	60	40	**DH324FGK**	**DH324FRK**
	400	H	—	50	—	125	50	**DH325FGK**	**DH325FRK**
	600	H	—	75	—	200	—	**DH326FGK**	**DH326FRK**
	800	L	—	100	—	—	—	**DH327FGK**	**DH327FRK**
	1200	L	—	—	—	—	—	**DH328FGK**	**DH328FRK**
Four-Wire (Three Blades, Three Fuses, S/N)—240 Vac, 250 Vdc									
	30	H	1-1/2	3	3	7-1/2	5	**DH321NGK**	**DH321NRK**
	60	H	3	7-1/2	10	15	10	**DH322NGK**	**DH322NRK**
	100	H	7-1/2	15	15	30	20	**DH323NGK**	**DH323NRK**
	200	H	15	25	15	60	40	**DH324NGK**	**DH324NRK**
	400	H	—	50	—	125	50	**DH325NGK**	**DH325NRK**
	600	H	—	75	—	200	—	**DH326NGK**	**DH326NRK**
	800	L	—	100	—	—	—	**DH327NGK**	**DH327NRK**
	1200	L	—	—	—	—	—	**DH328NGK**	**DH328NRK**
Four-Pole—240 Vac, 250 Vdc									
	30	H	3	3	10	7-1/2	5	**DH421FGK**	④
	60	H	7-1/2	7-1/2	20	15	10	**DH422FGK**	④
	100	H	15	15	30	30	20	**DH423FGK**	④
	200	H	30	25	50	60	40	**DH424FGK**	④
	400	H	50	50	—	125	50	**DH425FGK**	④⑤
	600	H	—	75	—	200	—	**DH426FGK**	④⑤

Notes

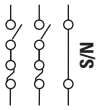
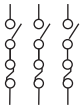
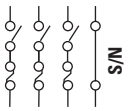
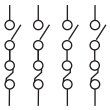
① Horsepower ratings apply only when neutral is field installed and switch is used on a grounded B phase system.
② Use three-pole catalog numbers below.
③ Grounded B phase ratings, UL listed.
④ Use NEMA 12. NEMA 12 enclosures (30–1200A) can be field modified to meet NEMA 3R rainproof requirements when a factory provided drain hole is opened.
⑤ Contact the Safety Switch Flex Center (**1-888-329-9272** or FlexSwitches@eaton.com) for availability of this product.

30A heavy-duty switches with Type J fuse provisions are available from the factory only. See table on **Page V2-T1-18** for catalog numbers.

Suitable for service entrance use, except four-pole switches.

1

240 Vac Heavy-Duty, Fusible, Single-Throw, Fusible—NEMA 12, 4

System	Ampere Rating	Fuse Type Provision	Maximum Horsepower Ratings AC Standard Fuse Single-Phase	Standard Fuse Three-Phase	Time Delay Single-Phase	Time Delay Three-Phase	DC 250V	NEMA 12 Enclosure Industrial, Dust-Tight Catalog Number	NEMA 4 Enclosure Watertight, Painted Steel Catalog Number
Two-Pole—240 Vac, 250 Vdc (Suitable for Service Entrance Use with a Neutral Kit Installed)									
	30	H	1-1/2	—	—	—	5	③	—
	60	—	—	—	—	—	—	③	—
	100	—	—	—	—	—	—	③	—
	200	—	—	—	—	—	—	③	—
	400	H	—	50 ①	—	125 ①	50	**DH225FDK** ④	**DH225FPK**
	600	H	—	75 ①	—	200 ①	—	**DH226FDK** ④	**DH226FPK**
	800	L	—	100 ①	—	—	—	**DH227FDK** ④	—
Three-Wire (Two Blades, Two Fuses, S/N)—240 Vac, 250 Vdc									
	30	H	1-1/2	3 ②	3	7-1/2 ②	5	**DH221NDK** ④	—
	60	H	3	7-1/2 ②	10	15 ②	10	**DH222NDK** ④	—
	100	H	7-1/2	15 ②	15	30 ②	20	**DH223NDK** ④	—
	200	H	15	25 ②	15	60 ②	40	**DH224NDK** ④	—
	400	H	—	50 ②	—	125 ②	50	**DH225NDK** ④	**DH225NPK**
	600	H	—	75 ②	—	200 ②	—	**DH226NDK** ④	**DH226NPK**
	800	L	—	100 ②	—	—	—	**DH227NDK** ④	**DH227NPK**
Three-Pole—240 Vac, 250 Vdc (Suitable for Service Entrance Use with a Neutral Kit Installed)									
	30	H	1-1/2	3	3	7-1/2	5	**DH321FDK** ④	—
	60	H	3	7-1/2	10	15	10	**DH322FDK** ④	—
	100	H	7-1/2	15	15	30	20	**DH323FDK** ④	—
	200	H	15	25	15	60	40	**DH324FDK** ④	—
	400	H	—	50	—	125	50	**DH325FDK** ④	**DH325FPK**
	600	H	—	75	—	200	—	**DH326FDK** ④	**DH326FPK**
	800	L	—	100	—	—	—	**DH327FDK** ④	**DH327FPK**
	1200	L	—	—	—	—	—	**DH328FDK** ④	—
Four-Wire (Three Blades, Three Fuses, S/N)—240 Vac, 250 Vdc									
	30	H	1-1/2	3	3	7-1/2	5	**DH321NDK** ④	—
	60	H	3	7-1/2	10	15	10	**DH322NDK** ④	—
	100	H	7-1/2	15	15	30	20	**DH323NDK** ④	—
	200	H	15	25	15	60	40	**DH324NDK** ④	—
	400	H	—	50	—	125	50	**DH325NDK** ④	**DH325NPK**
	600	H	—	75	—	200	—	**DH326NDK** ④	**DH326NPK**
	800	L	—	100	—	—	—	**DH327NDK** ④⑤	—
	1200	L	—	—	—	—	—	**DH328NDK** ④	—
Four-Pole—240 Vac, 250 Vdc									
	30	H	3	3	10	7-1/2	5	**DH421FDK** ④	—
	60	H	7-1/2	7-1/2	20	15	10	**DH422FDK** ④	—
	100	H	15	15	30	30	20	**DH423FDK** ④	—
	200	H	30	25	50	60	40	**DH424FDK** ④	—
	400	H	50	50	—	125	50	④⑤	—
	600	H	—	75	—	200	—	④⑤	—

Notes

① Horsepower ratings apply only when neutral is field installed and switch is used on a grounded B phase system.
② Grounded B phase ratings, UL listed.
③ Use three-pole catalog numbers below.
④ NEMA 12 enclosures (30–1200A) can be field modified to meet NEMA 3R rainproof requirements when a factory provided drain hole is opened.
⑤ Contact the Safety Switch Flex Center (**1-888-329-9272** or FlexSwitches@eaton.com) for availability of this product.

30A heavy-duty switches with Type J fuse provisions are available from the factory only. See table on **Page V2-T1-18** for catalog numbers.

Suitable for service entrance use, except four-pole switches.

DH322FWK



240 Vac Heavy-Duty, Fusible, Single-Throw, Fusible—NEMA 4X

System	Ampere Rating	Fuse Type Provision	Maximum Horsepower Ratings AC Standard Fuse Single-Phase	Standard Fuse Three-Phase	Time Delay Single-Phase	Time Delay Three-Phase	DC 250V	NEMA 4X Enclosure Corrosion-Resistant, Stainless Steel Catalog Number
Two-Pole—240 Vac, 250 Vdc (Suitable for Service Entrance Use with a Neutral Kit Installed)								
	30	H	1-1/2	—	—	—	5	③
	60	—	—	—	—	—	—	③ or ④
	100	—	—	—	—	—	—	④
	200	—	—	—	—	—	—	④
	400	H	—	50 ①	—	125 ①	50	④
	600	H	—	75 ①	—	200 ①	—	④
	800	L	—	100 ①	—	—	—	④
Three-Wire (Two Blades, Two Fuses, S/N)—240 Vac, 250 Vdc								
S/N	30	H	1-1/2	3 ②	3	7-1/2 ②	5	**DH221NWK**
	60	H	3	7-1/2 ②	10	15 ②	10	**DH222NWK**
	100	H	7-1/2	15 ②	15	30 ②	20	**DH223NWK**
	200	H	15	25 ②	15	60 ②	40	**DH224NWK**
	400	H	—	50 ②	—	125 ②	50	**DH225NWK**
	600	H	—	75 ②	—	200 ②	—	**DH226NWK**
	800	L	—	100 ②	—	—	—	**DH227NWK**
Three-Pole—240 Vac, 250 Vdc (Suitable for Service Entrance Use with a Neutral Kit Installed)								
	30	H	1-1/2	3	3	7-1/2	5	**DH321FWK**
	60	H	3	7-1/2	10	15	10	**DH322FWK**
	100	H	7-1/2	15	15	30	20	④
	200	H	15	25	15	60	40	**DH324FWK**
	400	H	—	50	—	125	50	**DH325FWK**
	600	H	—	75	—	200	—	**DH326FWK**
	800	L	—	100	—	—	—	**DH327FWK**
	1200	L	—	—	—	—	—	**DH328FWK**
Four-Wire (Three Blades, Three Fuses, S/N)—240 Vac, 250 Vdc								
S/N	30	H	1-1/2	3	3	7-1/2	5	**DH321NWK**
	60	H	3	7-1/2	10	15	10	**DH322NWK**
	100	H	7-1/2	15	15	30	20	**DH323NWK**
	200	H	15	25	15	60	40	**DH324NWK**
	400	H	—	50	—	125	50	**DH325NWK**
	600	H	—	75	—	200	—	**DH326NWK**
	800	L	—	100	—	—	—	④
	1200	L	—	—	—	—	—	**DH328NWK**
Four-Pole—240 Vac, 250 Vdc								
	30	H	3	3	10	7-1/2	5	④
	60	H	7-1/2	7-1/2	20	15	10	④
	100	H	15	15	30	30	20	④
	200	H	30	25	50	60	40	④
	400	H	50	50	—	125	50	④
	600	H	—	75	—	200	—	④

Notes

① Horsepower ratings apply only when neutral is field installed and switch is used on a grounded B phase system.

② Grounded B phase ratings, UL listed.

③ Use three-pole catalog numbers below.

④ Contact the Safety Switch Flex Center (**1-888-329-9272** or FlexSwitches@eaton.com) for availability of this product.

30A heavy-duty switches with Type J fuse provisions are available from the factory only. See table on **Page V2-T1-18** for catalog numbers.

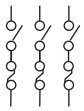
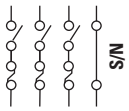
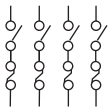
Suitable for service entrance use, except four-pole switches.

1

DH362NRK



600 Vac Heavy-Duty, Fusible, Single-Throw, 277/480–600V—NEMA 1, 3R

System	Ampere Rating	Fuse Class Provision	Maximum Horsepower Ratings with Time Delay Fuses Single-Phase AC 480V	Single-Phase AC 600V	Three-Phase AC 480V	Three-Phase AC 600V	DC 250V	DC 600V	NEMA 1 Enclosure Indoor Catalog Number	NEMA 3R Enclosure Rainproof Catalog Number
Two-Pole—480 Vac—600 Vac or Vdc ① (Suitable for Service Entrance Use with a Neutral Kit Installed)										
	30	H	7-1/2	10	—	—	—	15	**DH261FGK**	**DH261FRK**
	60	H	20	25	—	—	—	25	**DH262FGK**	**DH262FRK**
	100	H	30	40	—	—	20	25	**DH263FGK**	**DH263FRK**
	200	H	50	50	—	—	40	50	**DH264FGK**	**DH264FRK**
	400	H	—	—	—	—	50	—	**DH265FGK**	**DH265FRK**
	600	H	—	—	—	—	50	—	**DH266FGK**	**DH266FRK**
	800	L	—	—	—	—	—	—	**DH267FGK**	**DH267FRK**
	1200	L	—	—	—	—	—	—	②	—
Three-Pole—480 Vac—600 Vac, 250 Vdc (Suitable for Service Entrance Use with a Neutral Kit Installed)										
	30	H	7-1/2	10	15	20	—	—	**DH361FGK**	**DH361FRK**
	60	H	20	25	30	50	—	—	**DH362FGK**	**DH362FRK**
	100	H	30	40	60	75	—	—	**DH363FGK**	**DH363FRK**
	200	H	50	50	125	150	—	—	**DH364FGK**	**DH364FRK**
	400	H	—	—	250	350	—	—	**DH365FGK**	**DH365FRK**
	600	H	—	—	400	500	—	—	**DH366FGK**	**DH366FRK**
	800	L	—	—	500	500	—	—	**DH367FGK**	**DH367FRK**
	1200	L	—	—	500	500	—	—	**DH368FGK**	**DH368FRK**
Four-Wire (Three Blades, Three Fuses, S/N) 480 Vac—600 Vac, 250 Vdc										
	30	H	7-1/2	10	15	20	—	—	**DH361NGK**	**DH361NRK**
	60	H	20	25	30	50	—	—	**DH362NGK**	**DH362NRK**
	100	H	30	40	60	75	—	—	**DH363NGK**	**DH363NRK**
	200	H	50	50	125	150	—	—	**DH364NGK**	**DH364NRK**
	400	H	—	—	250	350	—	—	**DH365NGK**	**DH365NRK**
	600	H	—	—	400	500	—	—	**DH366NGK**	**DH366NRK**
	800	L	—	—	500	500	—	—	**DH367NGK**	**DH367NRK**
	1200	L	—	—	500	500	—	—	**DH368NGK**	**DH368NRK**
Four-Pole—480 Vac—600 Vac, 250 Vdc										
	30	H	20 ③	25 ③	15	20	—	—	**DH461FGK**	④
	60	H	40 ③	50 ③	30	50	—	—	**DH462FGK**	④
	100	H	50 ③	50 ③	60	75	—	—	**DH463FGK**	④
	200	H	—	—	125	150	40	—	**DH464FGK**	④
	400	H	—	—	250	350	50	—	**DH465FGK**	②④
	600	H	—	—	400	500	—	—	**DH466FGK**	②④
	800	L	—	—	—	—	—	—	②	②④

Notes

① DC rating for 800A switches is 250V.

② Contact the Safety Switch Flex Center (**1-888-329-9272** or FlexSwitches@eaton.com) for availability of this product.

③ Ratings are for two-phase AC.

④ Use NEMA 12. NEMA 12 enclosures (30–1200A) can be field modified to meet NEMA 3R rainproof requirements when a factory provided drain hole is opened.

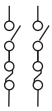
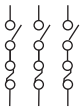
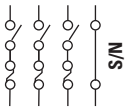
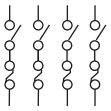
30A heavy-duty switches with Type J fuse provisions are available from the factory only. See table on **Page V2-T1-18** for catalog numbers.

Suitable for service entrance use, except 1200A on 480Y/277 or 600Y/347 grounded wye systems, per NEC 215.10 and 230.95, and four-pole switches.

DH361NDK



600 Vac Heavy-Duty, Fusible, Single-Throw, 277/480–600V—NEMA 12, 4

System	Ampere Rating	Fuse Class Provision	Maximum Horsepower Ratings with Time Delay Fuses Single-Phase AC 480V	Single-Phase AC 600V	Three-Phase AC 480V	Three-Phase AC 600V	DC 250V	DC 600V	NEMA 12 Enclosure Industrial, Dust-Tight Catalog Number	NEMA 4 Enclosure Watertight, Painted Steel Catalog Number
Two-Pole—480 Vac—600 Vac or Vdc ① (Suitable for Service Entrance Use with a Neutral Kit Installed)										
	30	H	7-1/2	10	—	—	—	15	**DH261FDK** ②	—
	60	H	20	25	—	—	—	25	**DH262FDK** ②	—
	100	H	30	40	—	—	20	—	**DH263FDK** ②	—
	200	H	50	50	—	—	—	50	**DH264FDK** ②	—
	400	H	—	—	—	—	50	—	**DH265FDK** ②	④
	600	H	—	—	—	—	—	—	**DH266FDK** ②	④
	800	L	—	—	—	—	—	—	**DH267FDK** ②	④
	1200	L	—	—	—	—	—	—	③	—
Three-Pole—480 Vac—600 Vac, 250 Vdc (Suitable for Service Entrance Use with a Neutral Kit Installed)										
	30	H	7-1/2	10	15	20	—	—	**DH361FDK** ②	—
	60	H	20	25	30	50	—	—	**DH362FDK** ②	—
	100	H	30	40	60	75	—	—	**DH363FDK** ②	—
	200	H	50	50	125	150	—	—	**DH364FDK** ②	—
	400	H	—	—	250	350	—	—	**DH365FDK** ②	**DH365FPK**
	600	H	—	—	400	500	—	—	**DH366FDK** ②	**DH366FPK**
	800	L	—	—	500	500	—	—	**DH367FDK** ②	**DH367FPK**
	1200	L	—	—	500	500	—	—	**DH368FDK**	—
Four-Wire (Three Blades, Three Fuses, S/N) 480 Vac—600 Vac, 250 Vdc										
	30	H	7-1/2	10	15	20	—	—	**DH361NDK** ②	—
	60	H	20	25	30	50	—	—	**DH362NDK** ②	—
	100	H	30	40	60	75	—	—	**DH363NDK** ②	—
	200	H	50	50	125	150	—	—	**DH364NDK** ②	—
	400	H	—	—	250	350	—	—	**DH365NDK** ②	**DH365NPK**
	600	H	—	—	400	500	—	—	**DH366NDK** ②	**DH366NPK**
	800	L	—	—	500	500	—	—	②③	—
	1200	L	—	—	500	500	—	—	**DH368NDK**	—
Four-Pole—480 Vac—600 Vac, 250 Vdc										
	30	H	20 ⑤	25 ⑤	15	20	—	—	②③	—
	60	H	40 ⑤	50 ⑤	30	50	—	—	②③	—
	100	H	50 ⑤	50 ⑤	60	75	—	—	**DH463FDK** ②	—
	200	H	—	—	125	150	40	—	**DH464FDK** ②	—
	400	H	—	—	250	350	50	—	②③	—
	600	H	—	—	400	500	—	—	②③	—
	800	L	—	—	—	—	—	—	②③	—

Notes

① DC rating for 800A switches is 250V.

② Use NEMA 12. NEMA 12 enclosures (30–1200A) can be field modified to meet NEMA 3R rainproof requirements when a factory provided drain hole is opened.

③ Contact the Safety Switch Flex Center (**1-888-329-9272** or FlexSwitches@eaton.com) for availability of this product.

④ Use three-pole catalog numbers below for 600 Vac, 250 Vdc maximum applications.

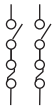
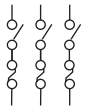
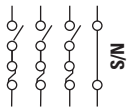
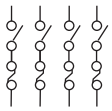
⑤ Ratings are for two-phase AC.

30A heavy-duty switches with Type J fuse provisions are available from the factory only. See table on **Page V2-T1-18** for catalog numbers.

Suitable for service entrance use, except 1200A on 480Y/277 or 600Y/347 grounded wye systems, per NEC 215.10 and 230.95, and four-pole switches.

1

600 Vac Heavy-Duty, Fusible, Single-Throw, 277/480–600V—NEMA 4X

System	Ampere Rating	Fuse Class Provision	Maximum Horsepower Ratings with Time Delay Fuses Single-Phase AC 480V	Single-Phase AC 600V	Three-Phase AC 480V	Three-Phase AC 600V	DC 250V	DC 600V	NEMA 4X Enclosure Corrosion-Resistant, Stainless Steel Catalog Number
Two-Pole—480 Vac—600 Vac or Vdc ① (Suitable for Service Entrance Use with a Neutral Kit Installed)									
	30	H	7-1/2	10	—	—	—	15	**DH261FWK**
	60	H	20	25	—	—	—	25	② or ③
	100	H	30	40	—	—	20	—	② or ③
	200	H	50	50	—	—	—	50	**DH264FWK**
	400	H	—	—	—	—	50	—	② or ③
	600	H	—	—	—	—	—	—	② or ③
	800	L	—	—	—	—	—	—	② or ③
	1200	L	—	—	—	—	—	—	③
Three-Pole—480 Vac—600 Vac, 250 Vdc (Suitable for Service Entrance Use with a Neutral Kit Installed)									
	30	H	7-1/2	10	15	20	—	—	**DH361FWK**
	60	H	20	25	30	50	—	—	**DH362FWK**
	100	H	30	40	60	75	—	—	**DH363FWK**
	200	H	50	50	125	150	—	—	**DH364FWK**
	400	H	—	—	250	350	—	—	**DH365FWK**
	600	H	—	—	400	500	—	—	**DH366FWK**
	800	L	—	—	500	500	—	—	**DH367FWK**
	1200	L	—	—	500	500	—	—	**DH368FWK**
Four-Wire (Three Blades, Three Fuses, S/N) 480 Vac—600 Vac, 250 Vdc									
	30	H	7-1/2	10	15	20	—	—	**DH361NWK**
	60	H	20	25	30	50	—	—	**DH362NWK**
	100	H	30	40	60	75	—	—	**DH363NWK**
	200	H	50	50	125	150	—	—	**DH364NWK**
	400	H	—	—	250	350	—	—	**DH365NWK**
	600	H	—	—	400	500	—	—	**DH366NWK**
	800	L	—	—	500	500	—	—	**DH367NWK** ②
	1200	L	—	—	500	500	—	—	**DH368NWK**
Four-Pole—480 Vac—600 Vac, 250 Vdc									
	30	H	20 ④	25 ④	15	20	—	—	②
	60	H	40 ④	50 ④	30	50	—	—	②
	100	H	50 ④	50 ④	60	75	—	—	②
	200	H	—	—	125	150	40	—	②
	400	H	—	—	250	350	50	—	②
	600	H	—	—	400	500	—	—	②
	800	L	—	—	—	—	—	—	②

Notes

① DC rating for 800A switches is 250V.

② Contact the Safety Switch Flex Center (**1-888-329-9272** or FlexSwitches@eaton.com) for availability of this product.

③ Use three-pole catalog numbers below for 600 Vac, 250 Vdc maximum applications.

④ Ratings are for two-phase AC.

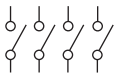
30A heavy-duty switches with Type J fuse provisions are available from the factory only. See table on **Page V2-T1-18** for catalog numbers.

Suitable for service entrance use, except 1200A on 480Y/277 or 600Y/347 grounded wye systems, per NEC 215.10 and 230.95, and four-pole switches.

DH362UGK



600 Vac Heavy-Duty, Non-Fusible, Single-Throw, 277/480–600V—NEMA 1, 3R

System	Ampere Rating	Maximum Horsepower Ratings Single-Phase AC 240V	480V	600V	Three-Phase AC 240V	480V	600V	DC 250V	600V	NEMA 1 Enclosure Indoor Catalog Number	NEMA 3R Enclosure Rainproof Catalog Number
Two-Pole—480 Vac—600 Vac or Vdc ① (Suitable for Service Entrance Use with a Neutral Kit Installed)											
	30	3	7-1/2	10	—	—	—	—	15	**DH261UGK**	**DH261URK**
	60	10	20	25	—	—	—	—	25	**DH262UGK**	**DH262URK**
	100	20	30	40	—	—	—	20	25	**DH263UGK**	**DH263URK**
	200	15	50	50	—	—	—	—	50	**DH264UGK**	**DH264URK**
	400	—	—	—	—	—	—	50	50	**DH265UGK**	**DH265URK**
	600	—	—	—	—	—	—	—	50	**DH266UGK**	**DH266URK**
	800	—	—	—	—	—	—	—	—	**DH267UGK**	**DH267URK**
	1200	—	—	—	—	—	—	—	—	②	—
Three-Pole—480 Vac—600 Vac, 250 Vdc (Suitable for Service Entrance Use with a Neutral Kit Installed)											
	30	3	7-1/2	10	10	20	30	5	—	**DH361UGK**	**DH361URK**
	60	10	20	25	20	50	60	10	—	**DH362UGK**	**DH362URK**
	100	20	40	50	40	75	100	20	—	**DH363UGK**	**DH363URK**
	200	15	50	50	60	125	150	40	—	**DH364UGK**	**DH364URK**
	400	—	—	—	125	250	350	50	—	**DH365UGK**	**DH365URK**
	600	—	—	—	200	400	500	—	—	**DH366UGK**	**DH366URK**
	800	—	—	—	—	500	500	—	—	**DH367UGK**	**DH367URK**
	1200	—	—	—	—	500	500	—	—	**DH368UGK**	**DH368URK**
Four-Pole—480 Vac—600 Vac, 250 Vdc											
	30	10 ③	20 ③	25 ③	10	20	30	5	—	**DH461UGK**	④
	60	20 ③	40 ③	50 ③	20	50	60	10	—	**DH462UGK**	④
	100	40 ③	50 ③	50 ③	40	75	100	20	—	**DH463UGK**	④
	200	50 ③	50 ③	50 ③	60	125	150	40	—	**DH464UGK**	④
	400	50 ③	—	—	125	250	350	50	—	**DH465UGK**	②④
	600	—	—	—	200	400	500	—	—	**DH466UGK**	②④
	800	—	—	—	—	—	—	—	—	②	②④

Notes

① DC rating for 800A switches is 250V.

② Contact the Safety Switch Flex Center (**1-888-329-9272** or FlexSwitches@eaton.com) for availability of this product.

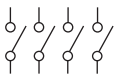
③ Ratings are for two-phase AC.

④ Use NEMA 12. NEMA 12 enclosures (30–1200A) can be field modified to meet NEMA 3R rainproof requirements when a factory provided drain hole is opened.

Suitable for service entrance use, except 1200A on 480Y/277 or 600Y/347 grounded wye systems, per NEC 215.10 and 230.95, and four-pole switches.

1

600 Vac Heavy-Duty, Non-Fusible, Single-Throw, 277/480–600V—NEMA 12, 4

System	Ampere Rating	Maximum Horsepower Ratings Single-Phase AC 240V	480V	600V	Three-Phase AC 240V	480V	600V	DC 250V	600V	NEMA 12 Enclosure Industrial, Dust-Tight Catalog Number	NEMA 4 Enclosure Watertight, Painted Steel Catalog Number
Two-Pole—480 Vac—600 Vac or Vdc ① (Suitable for Service Entrance Use with a Neutral Kit Installed)											
	30	3	7-1/2	10	—	—	—	—	15	**DH261UDK** ②	—
	60	10	20	25	—	—	—	—	25	**DH262UDK** ②	—
	100	20	30	40	—	—	—	20	25	**DH263UDK** ②	—
	200	15	50	50	—	—	—	—	50	**DH264UDK** ②	—
	400	—	—	—	—	—	—	50	—	**DH265UDK** ②	④
	600	—	—	—	—	—	—	—	—	**DH266UDK** ②	④
	800	—	—	—	—	—	—	—	—	**DH267UDK** ②	④
	1200	—	—	—	—	—	—	—	—	③	—
Three-Pole—480 Vac—600 Vac, 250 Vdc (Suitable for Service Entrance Use with a Neutral Kit Installed)											
	30	3	7-1/2	10	10	20	30	5	—	**DH361UDK** ②	—
	60	10	20	25	20	50	60	10	—	**DH362UDK** ②	—
	100	20	40	50	40	75	100	20	—	**DH363UDK** ②	—
	200	15	50	50	60	125	150	40	—	**DH364UDK** ②	—
	400	—	—	—	125	250	350	50	—	**DH365UDK** ②	**DH365UPK**
	600	—	—	—	200	400	500	—	—	**DH366UDK** ②	**DH366UPK**
	800	—	—	—	—	500	500	—	—	**DH367UDK** ②	**DH367UPK**
	1200	—	—	—	—	500	500	—	—	**DH368UDK**	—
Four-Pole—480 Vac—600 Vac, 250 Vdc											
	30	10 ⑤	20 ⑤	25 ⑤	10	20	30	5	—	**DH461UDK** ②	—
	60	20 ⑤	40 ⑤	50 ⑤	20	50	60	10	—	**DH462UDK** ②	—
	100	40 ⑤	50 ⑤	50 ⑤	40	75	100	20	—	**DH463UDK** ②	—
	200	50 ⑤	50 ⑤	50 ⑤	60	125	150	40	—	**DH464UDK** ②	—
	400	50 ⑤	—	—	125	250	350	50	—	②③	—
	600	—	—	—	200	400	500	—	—	②③	—
	800	—	—	—	—	—	—	—	—	②③	—

Notes

① DC rating for 800A switches is 250V.

② NEMA 12 enclosures (30–1200A) can be field modified to meet NEMA 3R rainproof requirements when a factory provided drain hole is opened.

③ Contact the Safety Switch Flex Center (**1-888-329-9272** or FlexSwitches@eaton.com) for availability of this product.

④ Use three-pole catalog numbers below for 600 Vac, 250 Vdc maximum applications. For 600 Vdc, see note ③.

⑤ Ratings are for two-phase AC.

Suitable for service entrance use, except 1200A on 480Y/277 or 600Y/347 grounded wye systems, per NEC 215.10 and 230.95, and four-pole switches.

DH361UWK



600 Vac Heavy-Duty, Non-Fusible, Single-Throw, 277/480–600V—NEMA 4X

System	Ampere Rating	Maximum Horsepower Ratings Single-Phase AC 240V	480V	600V	Three-Phase AC 240V	480V	600V	DC 250V	600V	NEMA 4X Enclosure Corrosion-Resistant, Stainless Steel Catalog Number
Two-Pole—480 Vac—600 Vac or Vdc ① (Suitable for Service Entrance Use with a Neutral Kit Installed)										
	30	3	7-1/2	10	—	—	—	—	15	② or ③
	60	10	20	25	—	—	—	—	25	② or ③
	100	20	30	40	—	—	—	20	25	② or ③
	200	15	50	50	—	—	—	—	50	② or ③
	400	—	—	—	—	—	—	50	—	② or ③
	600	—	—	—	—	—	—	—	—	② or ③
	800	—	—	—	—	—	—	—	—	② or ③
	1200	—	—	—	—	—	—	—	—	②
Three-Pole—480 Vac—600 Vac, 250 Vdc (Suitable for Service Entrance Use with a Neutral Kit Installed)										
	30	3	7-1/2	10	10	20	30	5	—	**DH361UWK**
	60	10	20	25	20	50	60	10	—	**DH362UWK**
	100	20	40	50	40	75	100	20	—	**DH363UWK**
	200	15	50	50	60	125	150	40	—	**DH364UWK**
	400	—	—	—	125	250	350	50	—	**DH365UWK**
	600	—	—	—	200	400	500	—	—	**DH366UWK**
	800	—	—	—	—	500	500	—	—	**DH367UWK**
	1200	—	—	—	—	500	500	—	—	**DH368UWK**
Four-Pole—480 Vac—600 Vac, 250 Vdc										
	30	10 ④	20 ④	25 ④	10	20	30	5	—	**DH461UWK**
	60	20 ④	40 ④	50 ④	20	50	60	10	—	②
	100	40 ④	50 ④	50 ④	40	75	100	20	—	②
	200	50 ④	50 ④	50 ④	60	125	150	40	—	②
	400	50 ④	—	—	125	250	350	50	—	②
	600	—	—	—	200	400	500	—	—	②
	800	—	—	—	—	—	—	—	—	②

Notes

① DC rating for 800A switches is 250V.

② Contact the Safety Switch Flex Center (**1-888-329-9272** or FlexSwitches@eaton.com) for availability of this product.

③ Use three-pole catalog numbers below for 600 Vac, 250 Vdc maximum applications. For 600 Vdc, see note ②.

④ Ratings are for two-phase AC.

Suitable for service entrance use, except 1200A on 480Y/277 or 600Y/347 grounded wye systems, per NEC 215.10 and 230.95, and four-pole switches.

1

Dimensions

Approximate Dimensions in Inches (mm)

Note: Dimensions are for estimating purposes only.

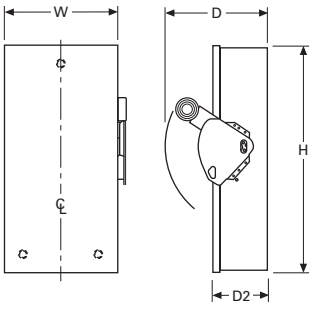
Heavy-Duty, Non-Fusible, 600V, Three-Pole, Single-Throw

Ampere Rating	Width (W)	Height (H)	Depth (D)	Depth (D2)	Weight Lbs (kg)
NEMA 1, 3R					
30	8.13 (206.5)	15.88 (403.4)	10.00 (254.0)	5.25 (133.3)	16 (7.264)
60	8.13 (206.5)	15.88 (403.4)	10.00 (254.0)	5.25 (133.3)	16 (7.264)
100	11.13 (282.7)	21.69 (550.9)	10.00 (254.0)	5.25 (133.3)	22 (9.988)
200	16.00 (406.4)	27.63 (701.8)	11.25 (285.8)	6.14 (156.0)	46 (20.884)
400	23.00 (584.2)	45.19 (1147.8)	12.63 (320.8)	7.27 (184.7)	110 (49.94)
600	24.00 (609.6)	52.70 (1338.6)	14.25 (362.0)	8.95 (227.3)	135 (61.29)
800	25.38 (644.7)	56.69 (1439.9)	14.25 (362.0)	8.95 (227.3)	158 (71.732)
1200	41.47 (1053.3)	70.31 (1785.9)	19.94 (506.5)	12.44 (316.0)	430 (195.22)
NEMA 12, 4X Stainless Steel, 4					
30	8.13 (206.5)	12.13 (308.1)	10.00 (254.0)	5.50 (139.7)	17 (7.718)
60	8.13 (206.5)	12.13 (308.1)	10.00 (254.0)	5.50 (139.7)	17 (7.718)
100	11.13 (282.7)	24.00 (609.6)	10.25 (260.4)	5.50 (139.7)	28 (12.712)
200	16.00 (406.4)	34.38 (873.3)	11.50 (292.1)	6.44 (163.6)	55 (24.97)
400	23.00 (584.2)	57.63 (1463.8)	12.63 (320.8)	7.19 (182.6)	125 (56.75)
600	24.00 (609.6)	63.00 (1600.2)	14.25 (362.0)	8.88 (225.6)	167 (75.818)
800	25.38 (644.7)	71.75 (1822.5)	14.25 (362.0)	8.88 (225.6)	175 (79.45)
1200	41.47 (1053.3)	70.31 (1785.9)	19.94 (506.5)	13.51 (343.2)	475 (215.65)

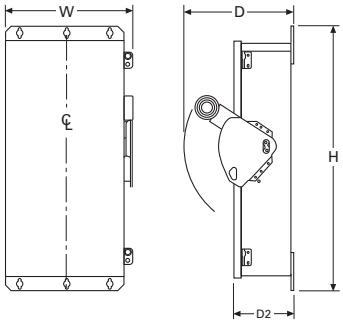
Heavy-Duty, Fusible, 240V and 600V, Three-Pole Solid Neutral, Single-Throw

Ampere Rating	Width (W)	Height (H)	Depth (D)	Depth (D2)	Weight Lbs (kg)
NEMA 1, 3R					
30	8.13 (206.5)	15.88 (403.4)	10.00 (254.0)	5.25 (133.3)	20 (9.08)
60	8.13 (206.5)	15.88 (403.4)	10.00 (254.0)	5.25 (133.3)	20 (9.08)
100	11.13 (282.7)	21.69 (550.9)	10.00 (254.0)	5.25 (133.3)	27 (12.258)
200	16.00 (406.4)	27.63 (701.8)	11.25 (285.8)	6.14 (156.0)	52 (23.608)
400	23.00 (584.2)	45.19 (1147.8)	12.63 (320.8)	7.27 (184.7)	120 (54.48)
600	24.00 (609.6)	52.70 (1338.6)	14.25 (362.0)	8.95 (227.3)	153 (69.462)
800	25.38 (644.7)	56.69 (1439.9)	14.25 (362.0)	8.95 (227.3)	168 (76.272)
1200	41.47 (1053.3)	70.31 (1785.9)	19.94 (506.5)	12.44 (316.0)	465 (211.11)
NEMA 12, 4X Stainless Steel, 4					
30	8.13 (206.5)	17.88 (454.2)	10.00 (254.0)	5.50 (139.7)	22 (9.988)
60	8.13 (206.5)	17.88 (454.2)	10.00 (254.0)	5.50 (139.7)	22 (9.988)
100	11.13 (282.7)	24.00 (609.6)	10.25 (260.4)	5.50 (139.7)	30 (13.62)
200	16.00 (406.4)	34.38 (873.3)	11.50 (292.1)	6.44 (163.6)	61 (27.694)
400	23.00 (584.2)	57.63 (1463.8)	12.63 (320.8)	7.19 (182.6)	135 (61.29)
600	24.00 (609.6)	63.00 (1600.2)	14.25 (362.0)	8.88 (225.6)	203 (92.162)
800	25.38 (644.7)	71.75 (1822.5)	14.25 (362.0)	8.88 (225.6)	213 (96.702)
1200	41.47 (1053.3)	70.31 (1785.9)	19.94 (506.5)	13.51 (343.2)	510 (231.54)

NEMA 1-3R Heavy-Duty 30–1200A



NEMA 4, 4X and 12 Heavy-Duty 30–1200A



Note: A factory-installed ground lug is supplied on all NEMA 4, 4X and 12 safety switches, as well as all 400A and higher NEMA 1 and 3R safety switches. A factory-installed ground lug is also supplied on all heavy-duty NEMA 1 and 3R 30–200A switches that do NOT have a factory-installed neutral.

SPD, Power Conditioning, PF Capacitors and Harmonic Filters

Industrial Surge Protection Products



2.1 Surge Protection and Power Conditioning

Introduction V3-T2-2
Product Overview V3-T2-5
SPD Series for Integration into Electrical Distribution Equipment. . . . V3-T2-7
SPD Series for Mounting External to Electrical Distribution Equipment V3-T2-11
SPD MAX Series Surge Protection V3-T2-16
SPV Surge Protective Device V3-T2-20
CVX050/100. . . . . V3-T2-22
SP1 Surge Protective Device. V3-T2-25
SP2 Surge Protective Device. V3-T2-27
AEGIS Powerline Filters. V3-T2-29
Sag Ride-Through (SRT2). V3-T2-34
Electronic Voltage Regulator (EVR) V3-T2-38
Power-Sure 800 . . . . . V3-T2-40
Power-Suppress 100 . . . . . V3-T2-44

2.2 Power Factor Correction and Harmonic Filtering

Product Overview V3-T2-47
UNIPUMP V3-T2-49
UNIPAK V3-T2-52
AUTOVAR 300 Automatic Power Factor Correction Capacitor Systems V3-T2-61
AUTOVAR 600 Automatic Power Factor Correction Capacitor Systems V3-T2-65
AUTOVAR Filter—LV Automatic Detuned Filter V3-T2-72
Transient-Free Static Switching Power Factor Correction Units V3-T2-79
HCU2 Harmonic Correction Unit V3-T2-81

SPV



Contents

Description	Page
Introduction	V3-T2-2
Product Overview	V3-T2-5
SPD Series for Integration into Electrical Distribution Equipment	V3-T2-7
SPD Series for Mounting External to Electrical Distribution Equipment	V3-T2-11
SPD MAX Series Surge Protection	V3-T2-16
SPV Surge Protective Device	
Catalog Number Selection	V3-T2-21
Technical Data and Specifications	V3-T2-21
Dimensions	V3-T2-21
CVX050/100	V3-T2-22
SP1 Surge Protective Device	V3-T2-25
SP2 Surge Protective Device	V3-T2-27
AEGIS Powerline Filters	V3-T2-29
Sag Ride-Through (SRT2)	V3-T2-34
Electronic Voltage Regulator (EVR)	V3-T2-38
Power-Sure 800	V3-T2-40
Power-Suppress 100	V3-T2-44

SPV Surge Protective Device

Product Description

Eaton's SPV series is a commercial grade and light industrial surge protective device (SPD) that combines surge suppression components and EMI/RFI filtering, providing effective protection for sensitive electronic loads. Surges (also known as transients), due to lightning, utility grid switching, switching of external/internal inductive or capacitive loads, and other sources, travel on power line conductors throughout the electrical distribution system, causing system operating problems and equipment downtime. Use of the SPV units can prevent these costly occurrences and equipment damage. Available with six surge current capacity ratings, the SPV can be installed on the main of light commercial buildings, on any subpanel in a facility and in any control panel to protect sensitive electronic equipment.

Application Description

The ever-increasing use of microprocessors and other sensitive electronic equipment has increased the necessity for facility-wide surge protection. These sensitive electronic components are used within many pieces of equipment, including computers, programmable logic controllers, and other commonly used electrical and electronic equipment. Surges can wreak havoc on equipment, causing catastrophic failures, process interruptions and premature aging leading to failure. The application of SPDs can mitigate problems with sensitive electronic equipment, keeping the equipment and the related processes up and running reliably without disruption or damage due to surge-related events.

In addition to externally generated surge events, such as lightning and grid switching, equipment is also susceptible to damage by internally generated surges. In fact, the majority of surges are generated internally by commonly used items, such as fluorescent lighting ballasts, light dimmers, photocopiers, fax machines and variable frequency drives. This further reinforces the necessity for facility-wide surge protection applied at all stages of the electrical distribution system, from the electrical service entrance down to the single-phase loads.

Features

- SurgePlane™ technology to ensure reliability and performance by using a low impedance copper platform
- Compact design to enable close mounting to electrical distribution equipment
- Parallel hybrid filter technology
- Individually fused surge suppression components
- Status indicator lights to monitor supply power, surge suppression component status and fusing
- Can be remotely monitored using Form C contacts
- Audible alarm
- Ideal for OEM panel applications
- 50 through 200 kA surge current capacity ratings
- Contains no replaceable parts or items that require periodic maintenance
- 10-year warranty (15-year with registration)

Eaton is the leading supplier of power protection technology to a number of Fortune 500 companies. We have applied our extensive experience in power quality and have included a number of innovative features in the development of the Eaton SPV series.

Standards and Certifications

- UL 1449 4th Edition Listed
- UL 1283 5th Edition Listed
- CSA TIL I-11B
- CSA C22.2 No.8

c UL us Listed

Catalog Number Selection

SPV

SPV 050 400D 2 K

Surge Rating	Voltage Code	Display	Enclosure
050 = 50 kA/phase **080** = 80 kA/phase **100** = 100 kA/phase **120** = 120 kA/phase **160** = 160 kA/phase **200** = 200 kA/phase	See table below	**2** = Standard (LED/audible alarm)	**K** = NEMA 1 **R** = NEMA 3R

SPV Voltage Codes

Nominal Voltages (Use These Codes to Complete the Model Number)	Voltage Code 120/208 240 V	230/400 499 V ①	277/480 480 V
120/240 single/split-phase (3W plus G)	240S	—	—
Three-phase wye (4W plus G)	208Y	400Y	480Y
Three-phase delta (3W plus G)	240D	400D	480D

Technical Data and Specifications

SPV

Description	SPV050	SPV080	SPV100	SPV120	SPV160	SPV200
Surge current per phase	50 kA	80 kA	100 kA	120 kA	160 kA	200 kA
Surge current per mode	25 kA	40 kA	50 kA	60 kA	80 kA	100 kA
Filter attenuation (MIL-STD-220 A at 100 kHz)	0–40 dB	0–40 dB	0–40 dB	0–40 dB	0–40 dB	0–40 dB
Circuit construction	Surge-Plane	Surge-Plane	Surge-Plane	Surge-Plane	Surge-Plane	Surge-Plane
UL 1449 3rd Edition Listed	Yes	Yes	Yes	Yes	Yes	Yes
UL 1283 Listed	Yes	Yes	Yes	Yes	Yes	Yes
Nominal discharge current (I_n) ②	20 kA	20 kA	20 kA	20 kA	20 kA	20 kA
cUL Listed	Yes	Yes	Yes	Yes	Yes	Yes
Enclosure						
NEMA 1	Standard	Standard	Standard	Standard	Standard	Standard
NEMA 3R	Optional	Optional	Optional	Optional	Optional	Optional
Short-circuit current rating (SCCR) ③	42 kA	42 kA	42 kA	42 kA	42 kA	42 kA
Warranty	10 years	10 years	10 years	10 years	10 years	10 years

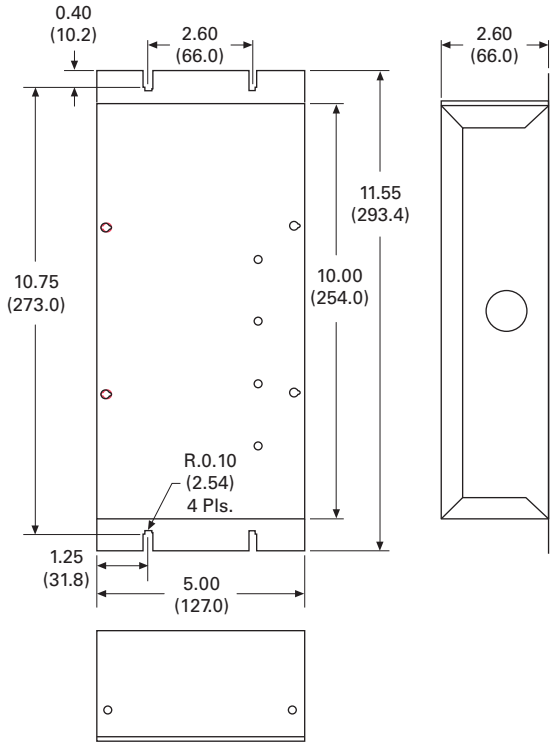
Physical Specifications

Description	Specification
Operating temp range	–40 °C to +60 °C
Altitude	< 13,000 ft (4000 m)
Dimensions	5.00 x 11.55 x 2.60 inches (127.0 x 293.4 x 66.0 mm)
Weight	3.5 lb (1.6 kg)

Dimensions

Approximate Dimensions in Inches (mm)

SPV—NEMA 1



Notes

① Contact factory for other configurations: Applicable for 220/380 and 240/415 system voltages.
② 208Y, 240S, 240D, 400Y and 480Y units rated 10 kA I_n.
③ 5 kA SCCR for 400D and 480D.

Instruction Manual **IM01005038E** Effective September 2011 Rev. 3

Installation and Operation Manual for the SPV



Contents

Description	Page
1. Introduction	2
2. Preparation	2
3. Installation Procedures	3
4. Ordering Guidelines	5
5. Specifications	6
6. Diagnostics and Safety Features	7
6.1 Indicator Lights	7
7. Warranty and Liability Information	7
7.1 Ten Year Warranty	7
8. Technical Assistance	7

Powering Business Worldwide

1.0 Introduction

1.1 Manual Organization

This Installation Manual describes the safe installation, and operation of the Eaton® SPV Series Surge Protective Device (SPD).

This manual is organized into eight sections, as follows:

1.0 Introduction

2.0 Preparation

3.0 Installation Procedures

4.0 Ordering Guidelines

5.0 Specifications

6.0 Diagnostics and Safety Features

7.0 Warranty and Liability Information

8.0 Technical Assistance

1.2 Product Overview

The Eaton SPV Series protects critical electrical and electronic equipment from damage by power surges. This is done by shunting high energy lightning surges (and other transient disturbances) away from the equipment being protected. It does this by providing a low impedance surge path to ground while supporting power, frequency, and voltage.

The Eaton SPV Series is available with a Basic Feature Package. Each model is available in Delta, Wye, and Split Phase wiring configurations. An optional flush mount plate kit is also available, Catalog # SPVFLUSHMTPLTG.

All Eaton SPV Series models have been tested and certified by Underwriter's Laboratory® (UL®), to comply with UL Standard 1449, 3rd Edition and UL1283 5th Edition (Type 2 SPDs only).

1.3 Safety Precautions

A licensed/qualified electrician must complete all instructions in this manual in accordance with the National Electric Code (NEC®), state, and local codes, or other applicable country codes. All applicable local electrical codes supersede these instructions.

⚠ WARNING

IMPROPER INSTALLATION COULD CAUSE DEATH, INJURY AND EQUIPMENT DAMAGE. FOLLOW ALL WARNINGS AND CAUTIONS. COMPLETELY READ AND UNDERSTAND THE INFORMATION IN THIS INSTRUCTION MANUAL BEFORE ATTEMPTING TO INSTALL OR OPERATE THIS EQUIPMENT.

IMPROPER WIRING COULD CAUSE DEATH, INJURY AND/OR EQUIPMENT DAMAGE. ONLY LICENSED/QUALIFIED ELECTRICIANS WHO ARE TRAINED IN THE INSTALLATION AND SERVICE OF ELECTRICAL SERVICES ARE TO INSTALL AND SERVICE THIS EQUIPMENT.

HAZARDOUS VOLTAGES ARE PRESENT INSIDE THE SPD DURING NORMAL OPERATION. FOLLOW ALL SAFE WORK PRACTICES TO AVOID ELECTRICAL SHOCK.

⚠ WARNING

ARC FLASH DURING INSTALLATION COULD CAUSE INJURY. USE APPROPRIATE SAFETY PRECAUTIONS AND EQUIPMENT FOR ARC FLASH PROTECTION.

1.4 Equipment Testing

⚠ WARNING

CONDUCTING DIELECTRIC, MEGGER, OR HI-POTENTIAL TESTING WITH THE SPD INSTALLED WILL CAUSE INTERNAL DAMAGE TO THE SPD. THE SPD WILL ALSO CAUSE THE TEST TO FAIL.

Every Eaton SPV Series unit is tested at the factory for dielectric breakdown. No further SPD testing is required for installation.

If you desire to test distribution equipment by performing dielectric, megger, or hi-potential tests, any installed SPD must be disconnected from the power distribution system to prevent damage to the unit.

Follow this procedure to safely disconnect the SPD:

1. Isolate SPDs connected via conductors as follows:
   a. 3-wire delta SPDs: Turn off the circuit breaker to isolate the SPD, if connected through a circuit breaker.
   b. Wye connected SPDs: Turn off the circuit breaker and remove the Neutral connection.

2.0 Preparation

⚠ WARNING

INSTALLING A SPD THAT IS IMPROPERLY RATED FOR THE ELECTRICAL SYSTEM VOLTAGE COULD CREATE A POTENTIALLY HAZARDOUS CONDITION, RESULTING IN INJURY OR EQUIPMENT DAMAGE.

2.1 Preparation for Installation

⚠ CAUTION

EATON SPV SERIES PRODUCTS MUST BE INSTALLED OR REPLACED BY A LICENSED/QUALIFIED ELECTRICIAN TO AVOID INJURY OR EQUIPMENT DAMAGE.

Before installing an Eaton SPV Series unit, do the following:

- Verify that the area is clear of any dirt, debris or clutter that may hamper the installation process.
- Verify that there is enough space to install the SPD.
- Confirm that all tools and equipment needed for the installation are available.
- Confirm that the system voltage and wiring configuration is the same as the SPD you are installing.

⚠ WARNING

TURN OFF THE POWER SUPPLY BEFORE WORKING IN ANY ELECTRICAL CABINET OR ON ANY CIRCUIT BREAKER PANEL. FAILURE TO DO SO COULD RESULT IN INJURY OR DEATH FROM ELECTRICAL SHOCK.

NOTICE

A POOR GROUND, OR GROUNDING/BONDING VIOLATIONS, COULD PREVENT THE SPD FROM PERFORMING AS SPECIFIED.

DO NOT USE THE SPD TO CARRY OR PASS THROUGH GROUND TO OTHER DEVICES OR LEADS. DAMAGE TO THE EQUIPMENT MAY RESULT.

- Check the facility grounding system. All grounding, bonding, and earthing must meet the NEC and any other national, state and local electrical codes.

3.0 Installation Procedures

The SPV uses 10 AWG wire for connecting to the distribution system. The wires require protection from a **15 A circuit breaker**. This ensures protection against fault current and fire. The SPV mounting orientation does not affect the SPV operation. The SPV can also be mounted using the optional flush mount plate. To use the optional flush mount plate remove the six screws on top of the unit. Place the plate on top of the device and re-install the six screws to hold the plate in place. See Figure 2 for optional flush mount plate dimensions. The SPV must be connected in accordance with NEC/CEC and local codes for all safety ratings.

1. Locate an available **15 A breaker** space immediately after the main breaker in the electrical equipment being protected.
2. If there is no space available within the electrical equipment, locate the closest existing 15 A breaker within the electrical equipment.
3. Turn OFF the power to the electrical equipment where the SPD is to be installed.
4. Install a 15 A branch circuit breaker to feed the SPD.
5. The SPV may be installed using a standard knockout. If so, remove lock-nut from nipple, insert nipple and 10 AWG wires through knockout, re-install lock-nut and tighten. If not installed directly into the electrical equipment use a metal conduit (rigid or flexible) between the SPD and the electrical equipment.
6. Run the 10 AWG wires from the SPD to the electrical equipment.
7. To ensure maximum effectiveness and provide the best possible protection for the sensitive electrical equipment as possible, the 10 AWG wire lead length between the SPD and installation breaker should be 35 cm (14") or less.

Note: Twist the wires tightly together. Minimize overall lead length to optimize SPD performance.

8. Strip the ends of the wires and terminate at the line side terminals of the identified branch breaker mounted within the electrical equipment. Tighten all connections.
9. If a remote monitoring option is required, connect the Form C Contacts to an alarm or building monitoring system. **Form C conductors are optional and are not required for proper SPV operation.** These relay contacts are rated at:

   ac – 150 V, 0.46 A maximum

   dc – 30 V, 1 A maximum
10. Recheck all connections.
11. Switch the MAIN power to the ON position for the electrical equipment and SPD.
12. Check all status indicator lamps to verify system operation.

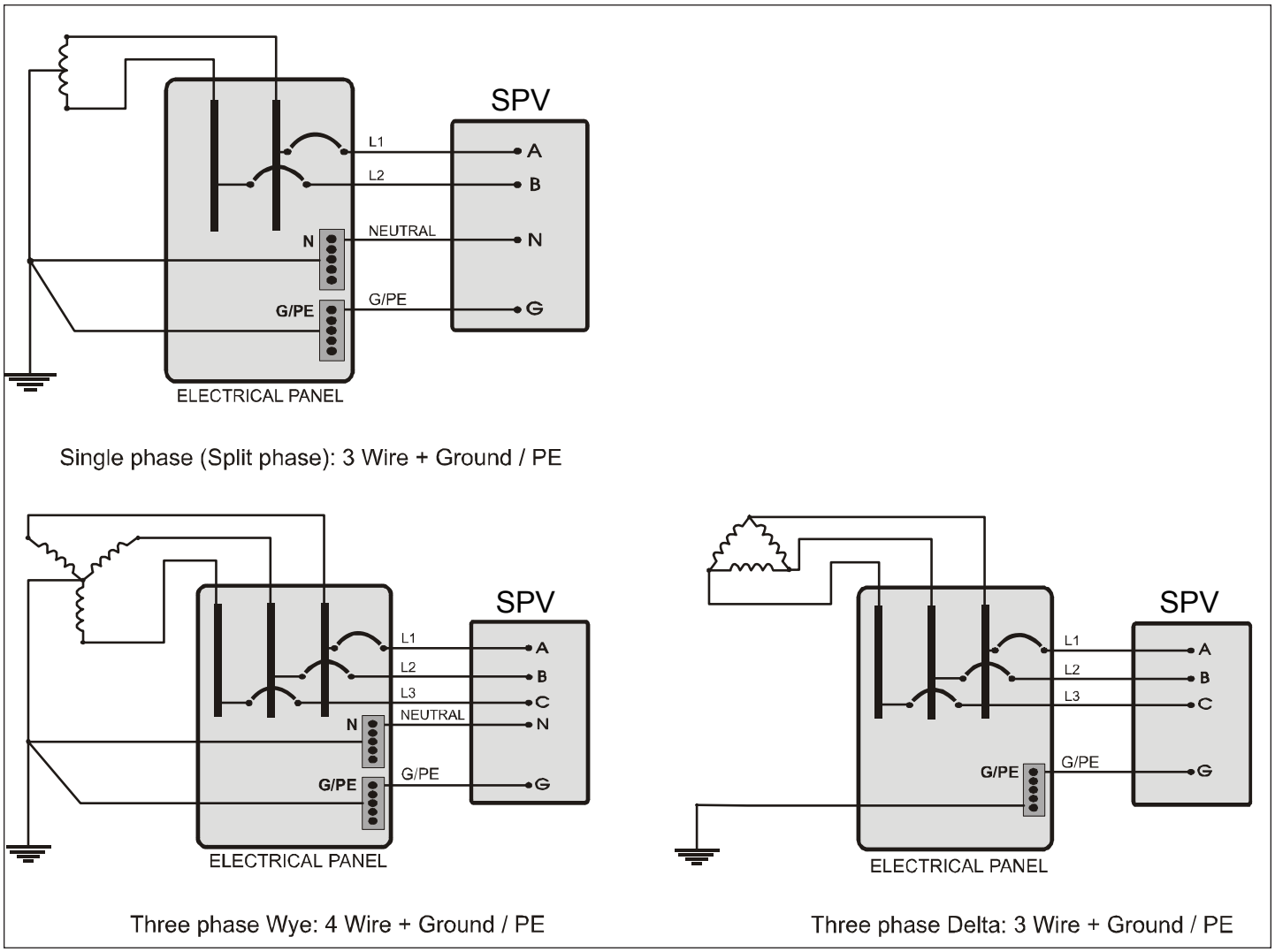


Figure 1. Wiring Diagrams

Table 1. Power Wire Color Code

Power Wire Color Code		Form C Wire Color Code	
Mode	**SPV**	**Mode**	**Color**
L1 (A)	Black	Common	Blue/White
L2 (B)	Black	Normally open	Red/White
L3 (C)	Black	Normally closed	Orange/White
Neutral	White		
Ground/PE	Green/Yellow		

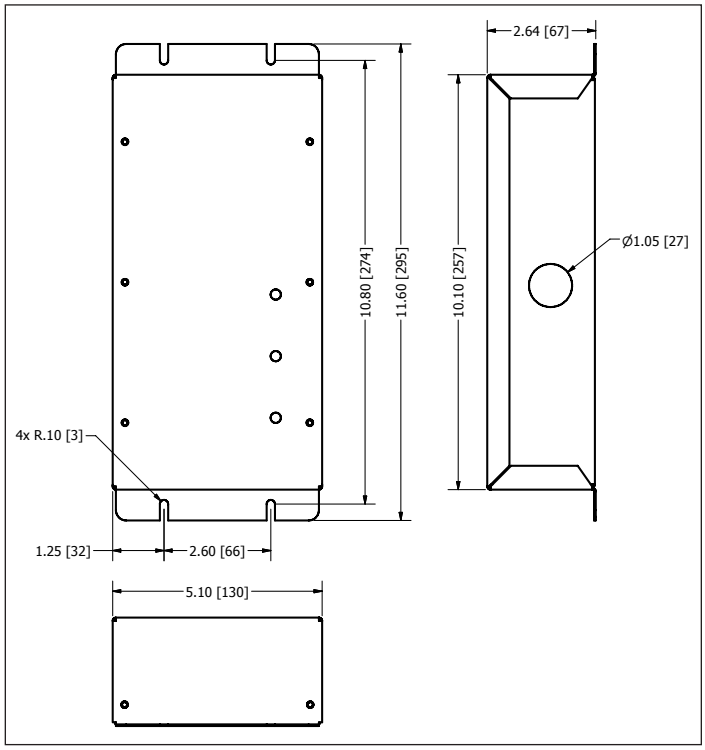


Figure 3. NEMA 1 Steel Enclosure Dimensions

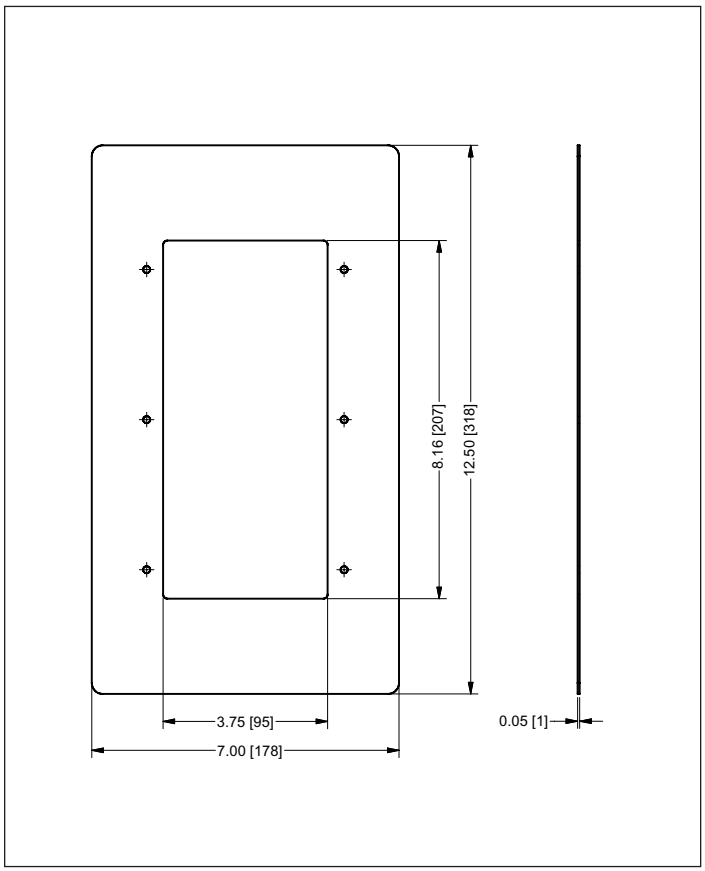


Figure 2. Optional Flush Mount Steel Plate Catalog Number = SPVFLUSHMTPLTG.

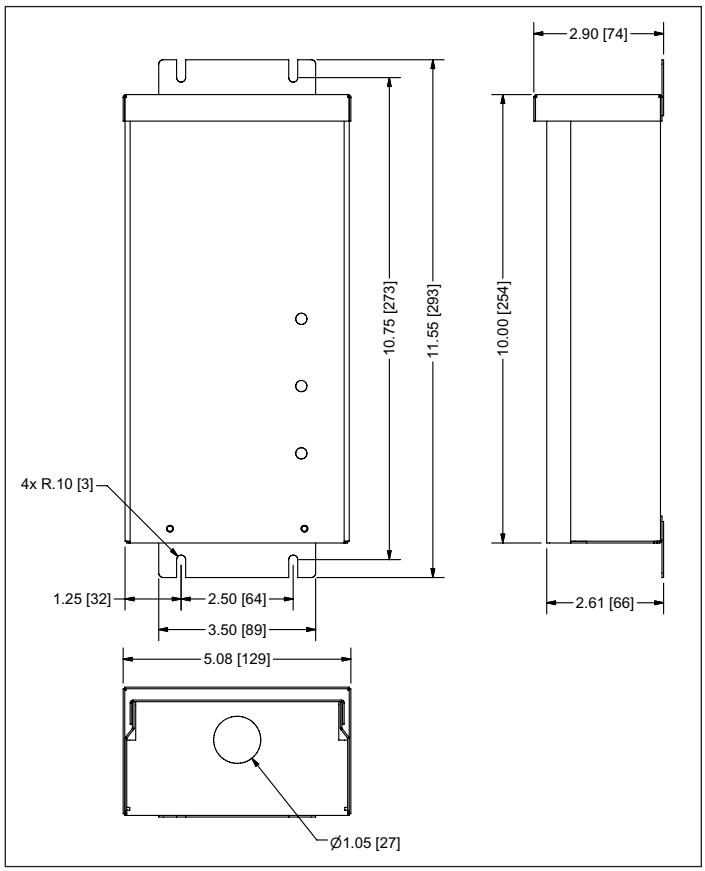
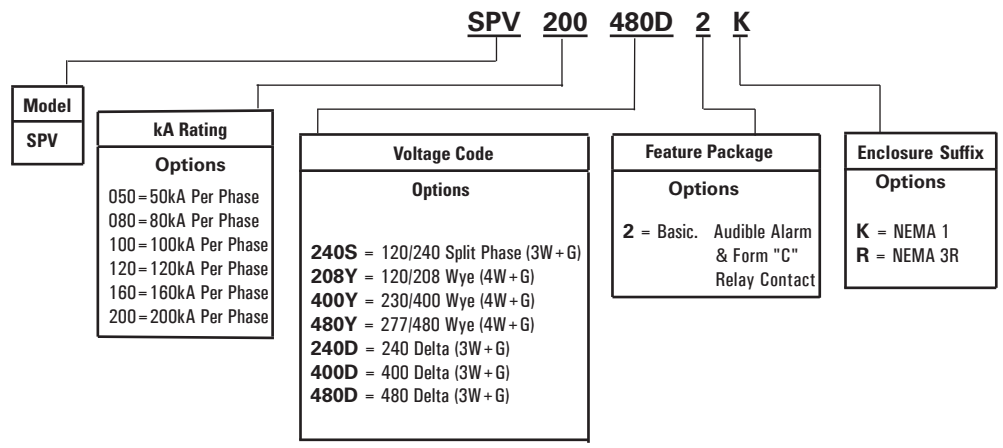


Figure 4. NEMA 3R Steel Enclosure Dimensions

4.0 Ordering Guidelines



Example: SPV200480D2K = SPV Series, 200kA Per Phase, 480D Voltage, Basic Feature Package, NEMA 1 Enclosure

Optional Flush Mount Plate Catalog # = SPVFLUSHMTPLTG

Figure 5. Eaton SPV Series

5.0 Specifications

Table 2. Specifications

Description	Specification
Surge current capacity per phase	50, 80, 100, 120, 160, 200 kA ratings available
Nominal discharge current (In) 208Y, 240S, 240D, 400Y & 480Y 400D & 480D	 10kA 20kA
Short circuit current rating (SCCR) 208Y, 240S, 240D, 400Y & 480Y 400D & 480D	 42kA 5kA
SPD Type	Type 2
Standard split phase voltages available	240
Three phase wye system voltages available	120/208, 230/400, 277/480
Three phase delta system voltages	240, 400, 480
Input Power Frequency	50/60 Hz
Protection modes	Single split phase .....L-N, L-G, N-G, L-L Three phase Wye..... L-N, L-G, N-G, L-L Three phase delta.....L-G, L-L
Maximum continuous operating voltage (MCOV)	
208Y and 240S voltage codes	150 L-N, 150 L-G, 150 N-G, 150 L-L
400Y and 480Y voltage codes	320 L-N, 320 L-G, 320 N-G, 640 L-L
240D voltage code	320 L-G, 300 L-L
400D and 480D voltage codes	550 L-G, 640 L-L
Ports	1
Operating temperature	-40 through 50° C (-40 through 122° F)
Operating humidity	5% through 95%, non-condensing
Operating altitude	Up to 16,000 ft (5000 m)
Weight	Approximately 1.6 kg (3.5 lbs)
Conductor Lead Length	24 inches
Form C relay contact ratings	150 Vac, 0.46A maximum or 30 Vdc, 1A maximum
Form C relay contact logic	Power on, normal state - NO contact = OPEN, NC contact = CLOSED Power off, fault state, - NO contact = CLOSED, NC contact = OPEN
EMI/RFI filtering attenuation	Up to 40 dB from 10 kHz to 100 MHz
Agency certifications and approvals	UL1449 3rd Edition listed device for the US and Canada, UL1283 5th Edition (Type 2 SPDs only)
Warranty	10 Years

6.0 Diagnostics and Safety Features

6.1 Indicator Lights

The SPV provides the user with three Phase Indicator Lights, to keep you informed of the SPD's operating status.

Depending on your voltage you may have 2 or 3 green Phase Indicator Lights. These lights will illuminate when the system is operating properly. If any of these lights are OFF the power may not be applied or a problem may exist within the SPD. Check incoming power, or breaker for power; if the Phase Indicator Lights remain OFF the unit may be damaged, contact the Power Quality Technical Support team.

The SPV also provides an Audible Alarm and Form C contacts for additional remote indication of power loss to the SPD. Connection of the Form C contacts are optional. For additional information on Form C connection please contact the Power Quality Technical Support team.

7.0 Warranty and Liability Information

This instruction booklet is published solely for information purposes and should not be considered all-inclusive. If further information is required, you should consult Eaton. Sale of the product shown in this literature is subject to terms and conditions outlined inappropriate Eaton selling policies or other contractual agreements between the parties. This literature is not intended to and does not enlarge or add to any such contract. The sole source governing the rights and remedies of any purchaser of this equipment is the contract between the purchaser and Eaton.

NO WARRANTIES, EXPRESSED OR IMPLIED,INCLUDING WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY,OR WARRANTIES ARISING FROM COURSE OF DEALING OR USAGE OF TRADE, ARE MADE REGARDING THE INFORMATION, RECOMMENDATIONS AND DESCRIPTIONS CONTAINED HEREIN.

In no event will Eaton be responsible to the purchaser or user in contract, in tort (including negligence), strict liability or otherwise for any special, indirect, incidental or consequential damage or loss whatsoever, including but not limited to damage or loss of equipment use, plant or power system, cost of capital, loss of power, additional expenses in the use of existing power facilities or claims against the purchaser or user by its customers resulting from the use of the information, recommendations and description contained herein.

7.1 Ten Year Warranty

Eaton warrants the SPV to be free from defects in both workmanship and materials for a period of ten years from the date of delivery to the purchaser.

Eaton assumes no risk or liability for results of the use of the product purchased, including but not limiting the generality of the foregoing:

(1) The use in combination with any electrical or electronic components, circuits, systems, assemblies or any other materials or substances.

(2)Unsuitability of any product for use in any circuit or assembly. Purchaser's rights under the warranty shall consist solely of requiring Eaton to repair, or at Eaton's sole discretion, replace, free of charge, F.O.B. factory,any defective items received at said factory within said term determined by Eaton to be defective. The giving of or failure to give any advice or recommendations by Eaton shall not constitute any warranty by or impose any liability upon Eaton AND IS IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESSED, IMPLIED OR STATUTORY AS TO THE MERCHANTABILITY,FITNESS FOR PURPOSE SOLD, PRODUCTIVENESS OR ANY OTHER MATTER. In no event shall Eaton be liable for special or consequential damages or for delay in performance of the warranty.

This warranty does not apply if the unit has been misused, abused, altered, tampered with, or applied in excess of the specifications other than those written on the nameplate. At the end of the warranty period Eaton shall be under no further warranty obligation expressed or implied. The SPV SPD covered by this warranty certificate can only be repaired or replaced by the factory. A RETURN MATERIAL AUTHORIZATION NUMBER (RMA) must be obtained. Please enter a Vista warranty claim or contact CORE (Center of Returns Excellence) at 1-800-410-2910 for help with entering a claim or to obtain an update on your claim status. Repair or replacement will be returned collect. If it is determined that the returned product contains manufacturer's defects then Eaton will replace the defective product at Eaton's expense (including shipping charges).

8.0 Technical Assistance

For additional information, technical assistance or referral to a local authorize distributor, contact Power Quality Technical Support at 1-800-809-2772, option 4/ option 2. You can also e-mail us at surgeprotection@eaton.com or visit us on the web, www.eaton.com/spd.

Instruction Manual **IM01005038E**
Effective September 2011

Installation and Operation Manual for the SPV

Eaton's Electrical business is a global leader in electrical control, power distribution, and industrial automation products and services. Through advanced product development, world-class manufacturing methods, and global engineering services and support, Eaton's Electrical business provides customer-driven solutions under brand names such as Cutler-Hammer®,Durant®, Heinemann®, Holec® and MEM®, which globally serve the changing needs of the industrial, utility, light commercial, residential, and OEM markets. For more information, visit www.EatonElectrical.com.

Eaton Corporation is a diversified industrial manufacturer with 2010 sales of $13.7 billion. Eaton is a global leader in fluid power systems and services for industrial, mobile and aircraft equipment; electrical systems and components for power quality, distribution and control;automotive engine air management systems and powertrain controls for fuel economy; and intelligent drivetrain systems for fuel economy and safety in trucks. Eaton has 70,000 employees and sells products to customers in more than 150 countries. For more information, visit www.eaton.com

Eaton Corporation
Electrical Sector
1111 Superior Ave.
Cleveland, OH 44114
United States
877-ETN-CARE (877-386-2273)
Eaton.com

© 2011 Eaton Corporation
All Rights Reserved
Printed in USA
Publication No. IM01005038E/TBG000562
September 2011

Powering Business Worldwide

Eaton is a registered trademark of Eaton Corporation.

All other trademarks are property of their respective owners.

Furnas Series 54 Rotary Limit Switches

Adjustment and Maintenance Instructions

HUBBELL
Workplace Solutions

Standard and Long Dwell Cams without Fine Adjustment Feature
Catalog No. 54BB23, 33, 43 & 54EB23, 33, 43

OPERATION

Rotation of drive shaft (D) in either direction causes all cam gear assemblies (I) to turn, actuating the contact blocks (K). A timing line appears in the notch (J) when the corresponding contact block is actuated. Cam for each contact block is independently adjustable. Each contact block contains one normally open and one normally closed contact set.



WARNING

Hazardous Voltage. Can cause death, serious personal injury, or property damage.

Disconnect power before working on this equipment.

CAUTION

When mounting Rotary Limit Switch, align drive shaft (D) with coupling to minimize stress on shaft and bushings.
DO NOT USE HAMMER OR SIMILAR TOOL TO FORCE COUPLING OR SPROCKET ONTO DRIVE SHAFT.
Excessive stress on shaft may result in damage to rotary limit switch and could invalidate warranty.

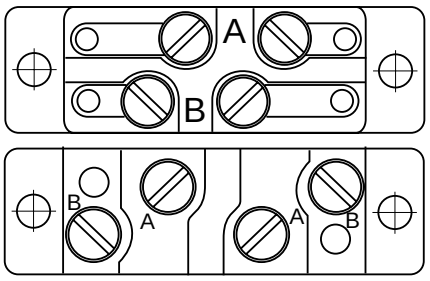
ADJUSTMENT

1. Operate the equipment until the desired travel limit is reached, taking into account coasting or braking distance.
2. Loosen the screw (C) for the cam wheel which actuates the contact block you wish to adjust.
3. Insert the adjustment tool (G) into the guide hole (H) closest to the cam wheel being adjusted. Engage teeth on adjustment tool with teeth on cam wheel.
4. Rotate adjusting tool, either direction, until the black line (E) appears in the notch (J). This will be the approximate position at which the contact block will be actuated.
5. Tighten the cam screw (C). Avoid over-tightening which could damage screw and screw threads.

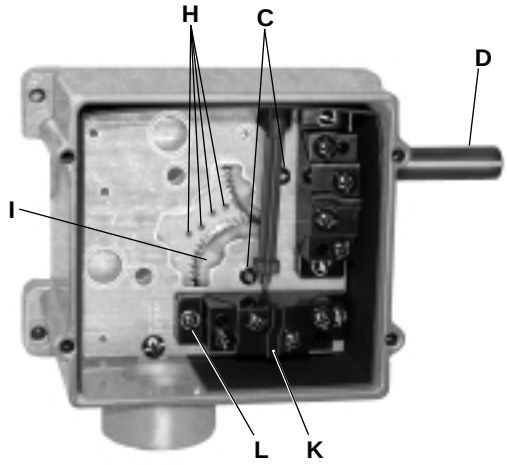
CAUTION

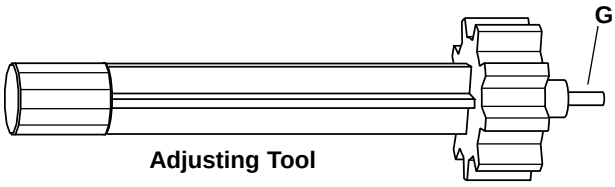
Terminal of individual snap switch must be wired same polarity.

Contact Block Terminals Viewed from Top
A Terminals N.C. B Terminals N.O.

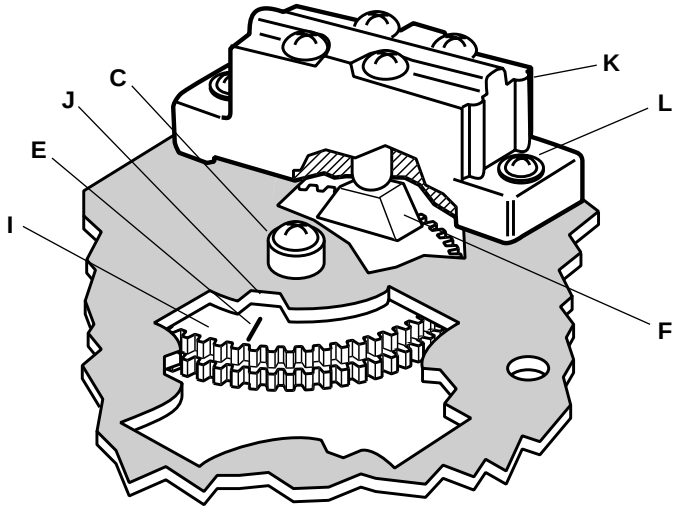


NOTE:
Limit switch may be equipped with contact blocks manufactured by Square D (top) or Micro Switch (bottom). Use drawings at left as guides when wiring.





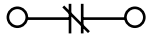
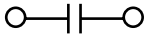
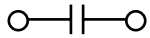
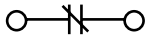
Adjusting Tool



Legend

- C - Cam Screw
- D - Drive Shaft
- E - Black Timing Line *(Black on white cam for Standard Dwell. White on black cam for Long Dwell)*
- F - Cam
- G - Adjustment Tool
- H - Guide Hole
- I - Cam Gear Assembly *(White for Standard Dwell. Black for Long Dwell)*
- J - Notch
- K - Contact Block
- L - Contact Block Screws

CIRCUIT OPERATION

Switch Terminals	Position of Line* on Cam Gear Not in Notch	In Notch
A – NC		
B – NO		

*Timing line is black on white standard dwell cam.
Line is white on black long dwell cam.

FIELD MODIFICATIONS



Contact Block Kit*	Cat. No.
Standard Cam	54BBGB
Long Dwell Cam	54EBGB

*Includes contact block, cam & screws)



WARNING

Hazardous Voltage. Can cause death, serious personal injury, or property damage.

Disconnect power before working on this equipment.

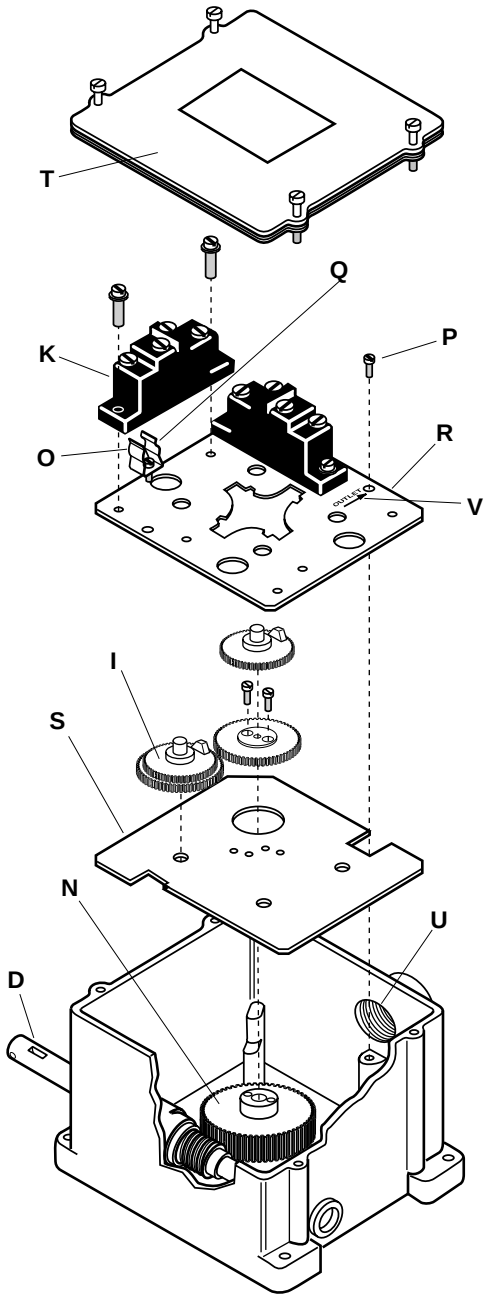
CONTACT BLOCK KIT INSTALLATION

1. Remove switch cover (T) and disconnect wiring to contact blocks.
2. Remove top plate (R) which is secured by two screws (Q). Top plate screws are also used to attached ground terminal (P) and adjustment tool clip (O) to the top plate.
3. Lift out old cam gear assembly (I) and replace with a new assembly.
4. Verify that the bottom plate (S) can be easily moved around in the switch housing.
5. Place top plate (R) into switch housing with the outlet arrow (V) pointing towards the threaded outlet (U).

CAUTION

To prevent gear (N) from binding, push top plate (R) towards threaded outlet (U) and tighten top plate screws (Q) securely.

6. Identify the contact block which corresponds to new cam gear assembly. Remove two machine screws which secure that contact block to top plate.
7. Install new contact block and contact block screws.
8. Adjust cam gear assembly as outlined on page one (over).
9. Connect wiring to new contact block and replace switch cover.



Legend

- D - Drive Shaft Assembly
- I - Cam Gear Assembly
- K - Contact Block and (2) 6-32 x 1" screws
- N - Worm Gear Assembly
- O - Adjustment Tool Clip
- P - Ground Screw
- Q - Top Plate Screws
- R - Top Plate
- S - Bottom Plate
- T - Cover
- U - Threaded Outlet
- V - Outlet Arrow

HUBBELL®

Workplace Solutions

Gleason Reel Corp.
600 South Clark Street • P O Box 26
Mayville, WI 53050
Phone: 920-387-4120
FAX: 920-387-4189
www.gleasonreel.com

Part No. 626382.b

Electric Heaters



© 2012 Pentair Technical Products
PH 763 422 2211 • hoffmanonline.com
P/N 28359001

INTRODUCTION

1. Before installing the electric heater, read these instructions carefully. Failure to follow these instructions could damage the product or cause a hazardous condition.
2. Check the ratings on the heater label to assure the product is suitable for your application.

WARNING



To avoid electric shock and equipment damage, disconnect any power supplies to the enclosure before installing the electric heater. Do not energize any circuits before all internal and external electrical and mechanical clearances are checked to assure that all assembled equipment functions safely and properly.

GENERAL SAFETY INFORMATION

1. Protect the lead wires from coming in contact with sharp objects, hot surfaces, and/or chemicals.
2. If continuous operation of the heater is essential to the safe functioning of any other equipment, adequate warning devices must be installed to assure safe operation at all times.

CAUTION

Do not use these electric heaters in dusty, dirty, corrosive, or hazardous locations.

Reduce the thermostat from factory setting to a recommended setting not to exceed 75 F for most applications.

Portions of the heater can get hot. Adequate protection must be taken to protect people from potential burns and to protect other components from this heat. Always allow the heater to cool before touching it.

Thermal sensitive devices or materials may need to be located further from the heater than the minimum recommended distance.

Heaters must not be installed on wood or other combustible surfaces.

This heater must only be installed in a totally enclosed enclosure.

© 2012 Pentair Technical Products

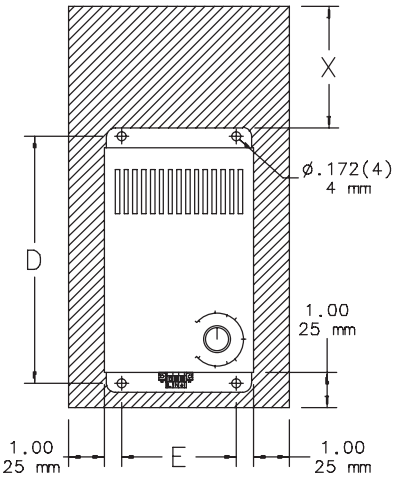
LOCATION AND MOUNTING

1. Hoffman electric heaters should be centered as low as possible in the enclosure for optimum heat distribution.
2. It is recommended that the heater be installed on a non-combustible metal panel for optimum performance. It may, however, be mounted on any metal surface.

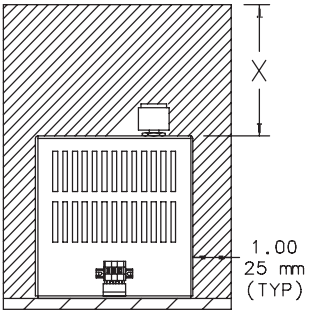
   WARNING: Heaters must not be installed on wood or other combustible surfaces.
3. The heater should be mounted in a vertical position with the terminal block at the bottom and the air outlet openings at the top as shown.
4. The recommended clearances shown by the shadowed area indicates the space that should be kept free of components for safe operation of the heater.

   WARNING: Heat sensitive components must not be placed above the heater discharge area.
5. Four 10−32 UNF, self−tapping screws are included for installation.

Vertical Surface Mounting

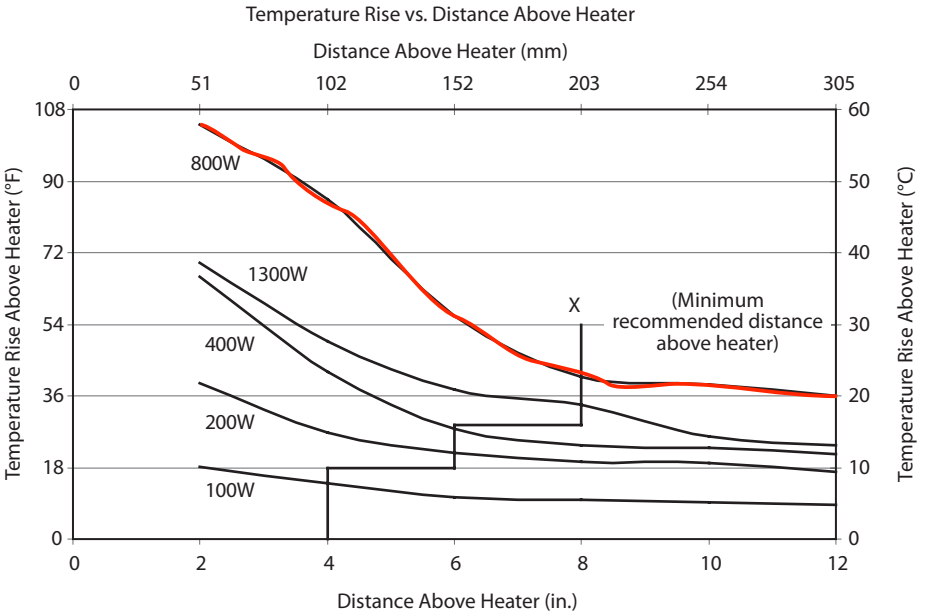


Optional Horizontal Surface Mounting



	Watts	X	D	E
DAH1001A, DAH1002A	100	4	5.00 (127 mm)	3.25 (83 mm)
DAH2001A, DAH2002A	200	6		
DAH4001B, DAH4002B	400	6	7.00 (178 mm)	3.50 (89 mm)
DAH8001B, DAH8002B	800	8		
DAH13001C, DAH13002C	1300	8		

© 2012 Pentair Technical Products



WIRING

Reference Wiring Illustration on page 6

1. All wiring must comply with applicable local codes and ordinances.
2. Connect the heater lead wires to the proper A.C. power source. Power source for 800 and 1300 watt heaters should be continuous.
3. The heater must be properly grounded.

NOTE: Exposed wires should not come in contact with the heater housing.

SETTING THE THERMOSTAT

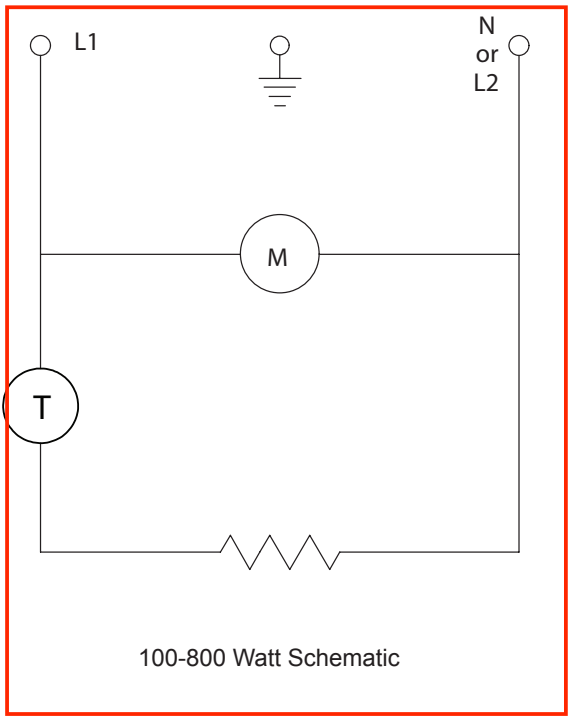
1. The heater is controlled by an adjustable thermostat. Set the thermostat to the desired temperature. It is recommended not to exceed 75 F for most applications.

MAINTENANCE

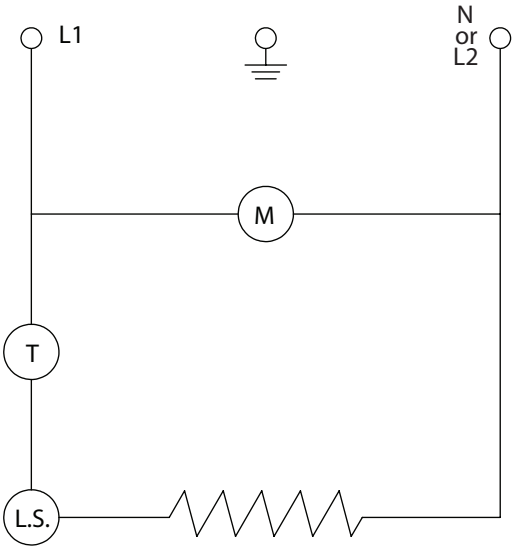
1. Always disconnect power supply before inspecting or working on the heater.
2. Generally the unit requires no maintenance since the fan bearings are permanently lubricated and sealed.

© 2012 Pentair Technical Products

English



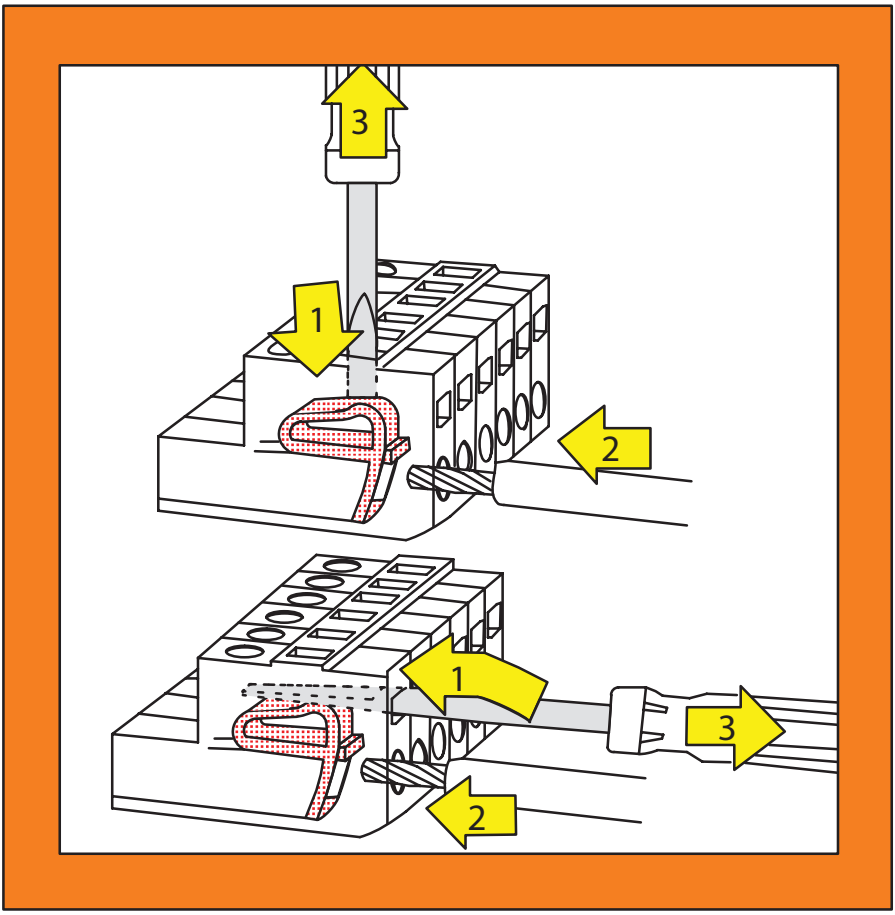
100-800 Watt Schematic



1300 Watt Schematic

© 2012 Pentair Technical Products

Wiring Illustration



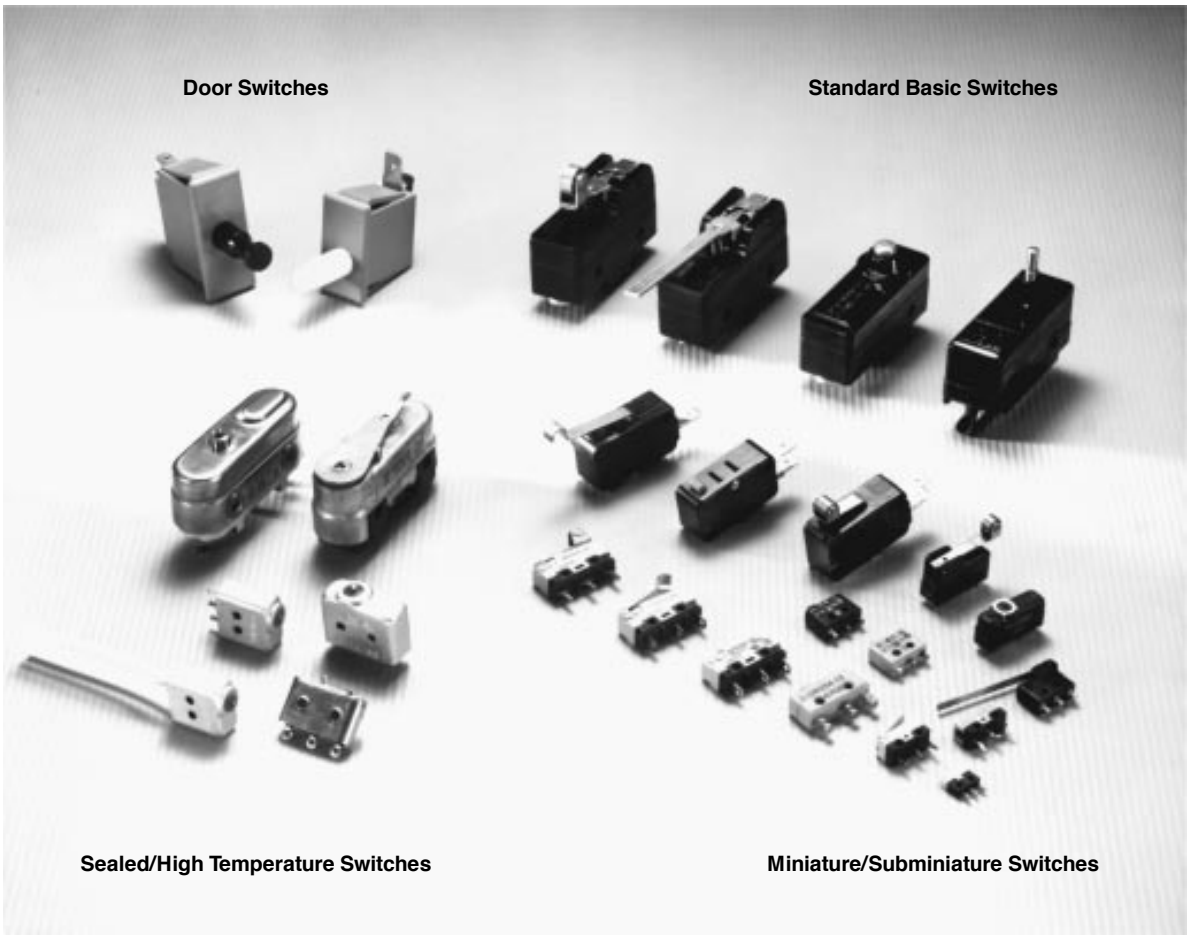
© 2012 Pentair Technical Products

Notes

Notes

© 2012 Pentair Technical Products

Basic Switches PAWL MICRO SWITCH - MD3211Q



Selection

SUBMINIATURE/MINIATURE BASIC SWITCHES

The U Series of subminiature basic switches are our newest line. The US is the smallest snap-action switch available. The UX and UM are versatile, low cost, full featured products with ample electrical capacity in a compact package. SM subminiature basic switches are a versatile collection of small size and ample electrical capacities, including 11 amp power load handling and ¼ hp motor load. SX subminiature basic switches are smaller than SM switches, yet are big in performance and selection. They provide up to 7 amp power load capacity. V3 miniature basic switches put a 25 amp power load capacity and a choice of 11 other electrical ratings into a relatively small package with many choices of actuators, contact materials, and terminal designs. V7 miniature basic switches have electrical ratings up to 15 amps. Both commercial and European versions are UL recognized and CSA certified. The latter is also designed to meet all leading European approval agency requirements. TB miniature basic small double-break units can control 2, 3 or 4 isolated circuits.

STANDARD BASIC SWITCHES

Power load switching and motor handling capacity are among the attractions of thumb-size BZ/BA standard basic switches. Double-pole double-throw switching is added by DT switches. Where there's a need for reliable switching of high capacity systems involving DC motors and solenoids, MT magnetic blow-out switches do the job. The 3MN has double-break switching. 6AS assemblies have two tandem mounted standard basic switches under a common actuator.

SEALED AND HIGH TEMPERATURE BASIC SWITCHES

Specially adapted basic switches include: SE/XE environment-proof switches which protect subminiature SM/SX basic switches within a sealed housing; HM hermetically sealed switches are interchangeable in operating point with the SM switches; HS hermetically sealed switches which parallel the size and mounting scheme of the standard basic switches; and HT high temperature switches for use up to +1000°F.

DOOR SWITCHES

AC, WW and DM switches automatically cut power when a service door or drawer is opened.

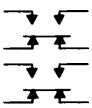
Table of Contents

Typical Applications . . . . . p. 2
Index by Product Type . . . . . p. 3
Selection Guides . . . . . p. 4 to 7
Catalog Listings/Order Guides . . . . . p. 8 to 93
Reference Data . . . . . p. 94
Catalog Listing/Page Number Index . . . . . p. 102

Basic Switches
Subminiature/Miniature

ELECTRICAL DATA AND UL CODES
MINIATURE/SUBMINIATURE BASIC SWITCHES
Most of the switches in this section are UL recognized and CSA certified. The current and voltage values shown are based on test conditions specified by these agencies. Electrical life of the switch is influenced by each application condition as well as by voltage and current.

Circuitry	Electrical Data
Single-pole double-throw 	**A** 5 amps res., 3 amps ind., (sea level), 4 amps res., 2 amps ind., (50,000 feet), 28 vdc 5 amps res. or ind. 115 vac, 60 Hz. UL/CSA rating: 5 amps, 250 vac.
Single-pole double-throw 	**B** 7 amps res., 4 amps ind., (sea level), 7 amps res., 2.5 amps ind., (50,000 feet), 28 vdc. UL/CSA rating: 7 amps, 250 vac.
Single-pole double-throw 	**C** 3.5 amps res., 2 amps ind., (sea level), 3.5 amps res., 1.5 amps ind., (50,000 feet), 28 vdc. UL rating: 7 amps, 250 vac.
Single-pole double-throw 	**D** 1 amp res., 0.5 amp ind., (sea level and 50,000 feet), 28 vdc. UL/CSA rating: 1 amp, 125 vac.
Single-pole double-throw 	**E** 3 amps res., 2 amps ind., (sea level), 28 vdc. UL rating: 3 amps, 250 vac.
Single-pole double-throw 	**F** 7 amps res., 4 amps ind., 2.5 amps lamp load, (sea level), 4 amps res., 2.5 amps ind., 2.5 amps lamp load, (50,000 feet), 28 vdc. 7 amps res., 7 amps ind., 2 amps lamp load, 115 vac, 60 Hz (sea level).
Single-pole double-throw 	**G** 2 amps res., lamp ind., (sea level) 28 vdc.
Single-pole double-throw 	**H** .010 amp res. and ind., (sea level). 28 vdc. UL/CSA rating: 1 amp, 125 vac.
Single-pole double-throw 	**I** 7 amps res., 4 amps ind., (sea level), 28 vdc.
Single-pole double-throw 	**J** 5 amps res., 3 amps ind., (sea level), 5 amps res., 2.5 amps ind., (50,000 feet), 28 vdc. UL rating: 5 amps, 250 vac.
Single-pole double-throw 	**K** UL rating: 5 amps, 125 or 250 vac.
Single-pole double-throw 	**L** 1 amp res., 1/2 amp ind., (sea level) 28 vdc.
Single-pole double-throw 	**M** UL rating: 11 amps and 1/4 hp, 125 or 250 vac.
Single-pole double-throw 	**N** 1 amp res., 0.5 amp ind., 30 vdc. UL rating: 1 amp, 125 vac.
Single-pole double-throw 	**P** 1 amp res., 30 vdc. UL rating: .1 amp, 125 vac.
Single-pole double-throw 	**R** 5 amps res., 3 amps ind., 2.4 amps lamp load (sea level), 5 amps res., 2.5 amps ind., 2.4 amps lamp load, (50,000 feet), 28 vdc. 5 amps res., 5 amps ind., 1.5 amps lamp load, 115 vac. 60 Hz (sea level)

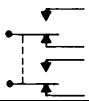
Circuitry	Electrical Data
Single-pole double-throw 	**S** UL rating: 4 amps, 250 vac.
Single-pole double-throw 	**T** UL/CSA rating: 11 amps and 1/3 hp, 125, 250, or 277 vac; 1/2 amp, 125 vdc; 1/4 amp, 250 vdc; 4 amps, 125 vac "L" (lamp load).
	TT UL/CSA rating: 10 amps and 1/3 hp, 125 or 250 vac; 1/2 amp, 125 vdc; 1/4 amp, 250 vdc; 4 amps, 125 vac "L" (lamp load).
Single-pole double-throw unless otherwise noted in order guide 	**UU** 10 amps res., 10 amps ind., (sea level), 6 amps ind. (50,000 feet), 6 amps motor load, 30 vdc.
	U UL/CSA rating: 15.1 amps and 1/2 hp, 125 or 250 vac. 1/2 amp, 125 vdc; 1/4 amp, 250 vdc; 5 amps, 120 vac "L" (lamp load).
Single-pole double-throw 	**VV** UL/CSA rating: 3 amps-125, 250, 277 vac; 1/10 hp-250 vac
Single-pole double-throw 	**V** UL/CSA rating: 10 amps and 1/4 hp, 125 or 250 vac; 1/2 amp, 125 vdc; 1/4 amp, 250 vdc; 3 amps, 125 vac "L" (lamp load).
Single-pole double-throw 	**W** 10 amps, 250 vac or 28 vdc; 1/2 amp, 125 vdc; 1/4 amp, 250 vdc.
Single-pole double-throw 	**X** UL rating: 1 amp, 125 vac.
Single-pole double-throw 	**Y** 10 amps and 1/3 hp, 125 or 250 vac; 4 amps, 125 vac "L" (lamp load).
Single-pole double-throw 	**YY** UL/CSA rating: 5 amps-125, 250, 277 vac 1/10 hp-250 vac
Two-circuit double-break  Four-circuit double-break 	**Z** 10 amps, 125 or 250 vac, or 30 vdc. UL/CSA rating: 10 amps, 125 or 250 vac; 1/2 hp, 125 vac.
Single-pole double-throw 	**ZZ** UL rating: 5 amps and 1/10 hp. 125 or 250 vac.
Single-pole double-throw 	**AA** UL rating: 20 amps, 277 vac. 1 hp, 125 vac; 2 hp, 250 vac.
Single-pole double-throw 	**BB** UL rating: 25 amps, 277 vac. 1 hp, 125 vac; 2 hp, 250 vac.

Basic Switches
Standard

ELECTRICAL DATA AND UL CODES STANDARD BASIC SWITCHES

Most of the switches in this section are UL recognized and CSA certified. The current and voltage values shown are based on test conditions specified by these agencies. Electrical life of the switch is influenced by each application condition as well as by voltage and current. For application assistance contact the 800 number.

Circuitry	Electrical Data and UL Codes
Single-pole double-throw unless otherwise noted in order guide 	**A** 15 amps, 125, 250 or 480 vac; ⅛ hp, 125 vac; ¼ hp, 250 vac; ½ amp, 125 vdc; ¼ amp, 250 vdc. UL Code L96
Single-pole double-throw unless otherwise noted in order guide 	**B** 5 amps, 125, 250 or 480 vac; ½ amp, 125 vdc; ¼ amp, 250 vdc. UL Code L35
Single-pole double-throw unless otherwise noted in order guide 	**C** 10 amps, 125, 250 or 480 vac; UL Code L8
Single-pole double-throw unless otherwise noted in order guide 	**D** 15 amps, 125, 250 or 480 vac; ⅛ hp, 125 vac; ¼ hp, 250 vac. UL Code L103
Single-pole double-throw unless otherwise noted in order guide 	**E** 15 amps, 125, 250 or 480 vac; ¼ hp, 125 vac, ½ hp, 250 vac; ½ amp, 125 vdc; ¼ amp, 250 vdc. UL Code L67
Single-pole double-throw unless otherwise noted in order guide 	**F** 22 amps, 125, 250 or 480 vac; ½ hp, 125 vac, 1 hp, 250 vac. UL Code L161
Single-pole double-throw unless otherwise noted in order guide 	**G** 20 amps, 125, 250 or 480 vac; 10 amps, 125 vac "L" (tungsten lamp load); 1 hp, 125 vac; 2 hp, 250 vac; ½ amp, 125 vdc; ¼ amp, 250 vdc. UL Code L23
Single-pole double-throw unless otherwise noted in order guide 	**H** Motor Control 25 amps, 125, 250 or 480 vac; 1 hp, 125 vac; 2 hp, 250 vac; Pilot Duty—750 VA, 125, 250, or 277 vac.
Single-pole double-throw unless otherwise noted in order guide 	**I** 10 amps, 125, 250 or 480 vac; ⅛ hp, 125 vac; ¼ hp, 250 vac; UL Code L95

Circuitry	Electrical Data and UL Codes
Double-pole double-throw 	**J** 10 amps, 125 or 250 vac; 0.3 amp, 125 vdc; 0.15 amp, 250 vdc. UL Code L59
Single-pole double-throw unless otherwise noted in order guide 	**K** Rating established with switch non-polarized 10 amps, 125 vac or vdc; ¼ hp, 125 vac or vdc. UL Code L 168 Non-polarized: 10 amps res. or ¼ hp, 125 vdc; 3 amps max. res. 250 vdc. Polarized*: 10 amps res. or ½ hp, 125 vdc; 3 amps max. res., 250 vdc.
*To polarize, connect negative side of line to common terminal. To achieve the same effect, mount switch with brass screws, using a non-magnetic barrier (at least ¼" thick) between the switch and mounting surface.	
Two-circuit double-break 	**M** 25 amps, 125, 250 or 480 vac; ¾ hp, 125 vac; 1¼ amp, 250 vac. 1 amp, 125 vdc; ½ amp, 250 vdc. UL Code L58
Single-pole double-throw 	**P** 1 amp, 125 VAC UL Code L22
Single-pole double-throw 	**R** 10 amps, 125 or 250 vac; ⅓ hp, 125 vac; ¾ hp, 250 vac; ½ amp, 125 vdc; ¼ amp, 250 vdc. UL Code L115
Single-pole double-throw 	**S** 10 amps, 125 or 250 vac; ⅓ hp, 125 or 250 vac. UL Code L93
Two-circuit double-break 	**T** 15 amps, 125, 250 or 480 vac; 1 amp, 125 vdc; ½ amp, 250 vdc; ¼ hp, 125 vac; ½ hp, 250 vac UL Code L73
Single-pole double-throw 	**U** 5 amps, 250 vac. UL Code L4
Two-circuit double-break 	**V** Motor Control 15 amps, 120, 240, 480 or 600 vac; ½ hp, 120 vac; 1 hp, 240 vac; 0.8 amp, 115 vdc; 0.4 amp, 230 vdc.
Single-pole single-throw (N.C.) 	**W** 20 amps, 125, 250 or 277 vac; ¾ hp, 125 vac; ½ hp, 250 vac UL Code L178B
Single-pole double-throw 	**X** 15 amps, 125, 250 or 480 vac; 2 amps, 600 vac; ⅛ hp, 125 vac; ¼ hp, 250 vac; ½ amp, 125 vdc; ¼ amp, 250 vdc. UL Code L74
Single-pole double-throw 	**Y** 20 amps, 125, 250 or 480 vac; ¾ hp, 125 vac; 1½ hp, 250 vac; UL Code L17

Basic Switches
Operating Characteristics

ELECTROMECHANICAL SWITCHES

Definitions below explain the meaning of operating characteristics. Characteristics shown in tables throughout catalog were chosen as most significant. They are taken at normal room temperature and humidity. These may vary as temperature and humidity conditions differ. Sketches show how characteristics are measured for in-line plunger actuation.

Linear dimensions for in-line actuation are from top of plunger to a reference line, usually the center of the mounting holes.

Differential Travel (D.T.)—Plunger or actuator travel from point where contacts ''snap-over'' to point where they ''snap-back.''

Free Position (F.P.)—Position of switch plunger or actuator when no external force is applied (other than gravity).

Full Overtravel Force—Force required to attain full overtravel of actuator.

Operating Position (O.P.)—Position of switch plunger or actuator at which point contacts snap from normal to operated position. Note that in the case of flexible or adjustable actuators, the operating position is measured from the end of the lever or its maximum length. Location of operating position measurement shown on mounting dimension drawings.

Operating Force (O.F.)—Amount of force applied to switch plunger or actuator to cause contact ''snap-over.'' Note in the case of adjustable actuators, the force is measured from the maximum length position of the lever.

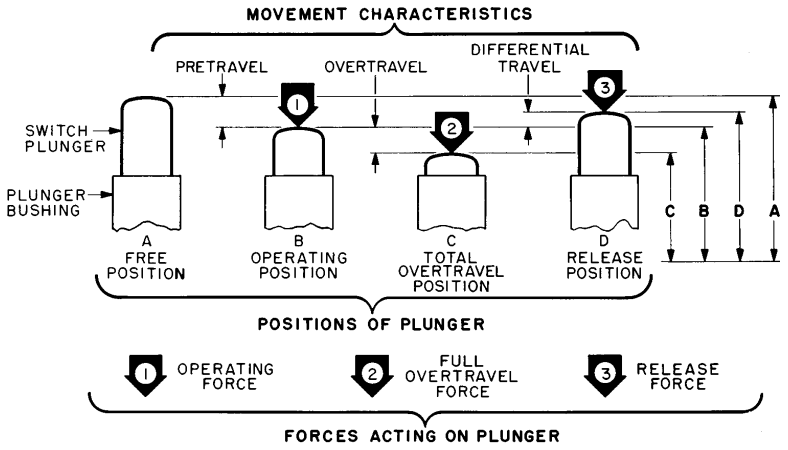
Overtravel (O.T.)—Plunger or actuator travel safely available beyond operating position.

Pretravel (P.T.)—Distance or angle traveled in moving plunger or actuator from free position to operating position.

Release Force (R.F.)—Amount of force still applied to switch plunger or actuator at moment contacts snap from operated position to unoperated position.

Total Travel (T.T.)—Distance from actuator free position to overtravel limit position.

IN-LINE PLUNGER ACTUATION



For application help: call 1-800-537-6945.

Basic Switches
Auxiliary Actuators Standard Basic



FEATURES
- Additional overtravel
- Quick, easy installation
- Corrosion resistance
- MIL-S-8805 listed units

NOTE: Switches shown are not included with the actuator. All actuators are for use with pin plunger types only except catalog listing JR.

GENERAL INFORMATION
Auxiliary actuators adapt the plunger-type standard basic switches to many application needs. Auxiliary actuators minimize the need for a large inventory of switch types. Actuators and switches are sold as separate items and must be ordered separately. Mounting hardware is furnished with the actuator.

Characteristics:
O.T. — Overtravel;
O.P. — Operating Position;
F.P. — Free Position.

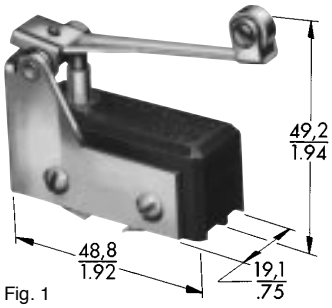


Fig. 1

ORDER GUIDE

Description	Catalog Listing	Use Only With	O.T. min. mm inches	O.P.* mm inches	F.P. max. mm inches
Roller lever for "S" plunger type BZ and DT switches only. Permits cam operation.	**JR**	**BZ DT**	**11.1 .437**	**44,45±3,18 1.75±.125**	

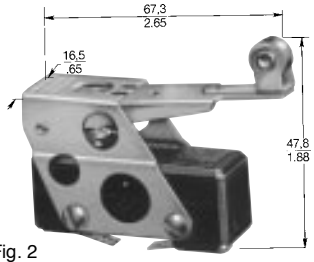


Fig. 2

Adjustable roller lever. Tang on top of actuator can be bent to adjust O.P. and F.P.	**AD5721R (8805/59) AN3169-1**	BZ BM	11,1 **.437** approx.	31,75-41,15 **1.25-1.62**	39,6-43,7 **1.56-1.72**
	ADA3721R	BA BE	9,53 **.375** approx.	40,48 **1.594** approx.	43,03 **1.812**
	ADD3721R	DT MT	9,53 **.375** approx.	39,6 **1.562** approx.	46,03 **1.812**

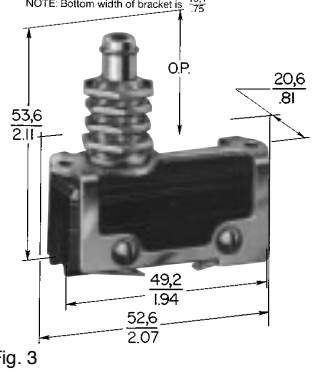


Fig. 3

Straight plunger. Panel mount.	**MC2711 (8805/59) AN3168-2**	BZ BM	4,78 **.188**	27,79 **.188**	29,4 **1.156**
	MCA2711	BA BE	3,96 **.156**	28,17 **1.109**	30,18 **1.188**
	MCD2711	DT MT	3,58 **.141**	27,79 **1.094**	30,18 **1.188**

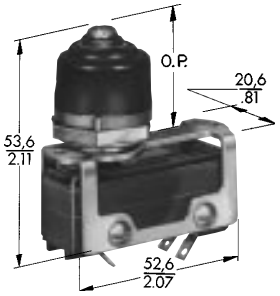
Dimensions shown are for reference only.

Except where stated * ±1,14 mm ±.045 in.

Basic Switches

Auxiliary Actuators Standard Basics

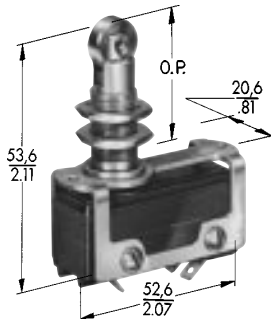
Fig. 4



ORDER GUIDE

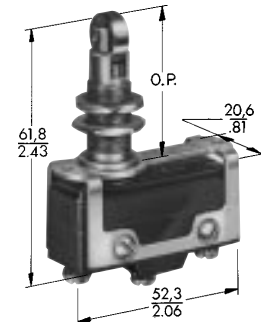
Description	Catalog Listing	Use Only With	O.T. min. mm Inches	O.P.* mm Inches	F.P. max. mm Inches
Sealed straight plunger. Panel mount. Elastomer seal boot keeps out liquid splash and dirt. Furnished unassembled.	**MC2711H**	BZ BM	4,78 **.188**	28,98 **1.141**	29,4 **1.156**
	MCA2711H	BA BE	4,37 **.172**	27,38±0,76 **1.078±.030**	29,56 **1.156**
	MCD2711H	DT MT	3.58 **.141**	27,79 **1.094**	30,18 **1.188**

Fig. 5



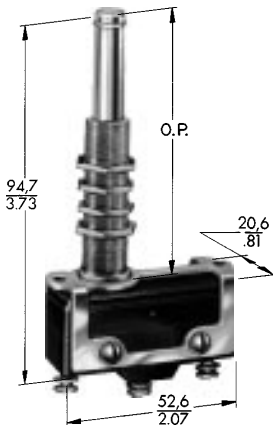
Roller plunger. Panel mount. Roller parallel to long axis of the switch.	**MD3211Q**	BZ BM	3,18 **.125** approx.	35,7 **1.406**	37,69 **1.484**
	MDA3711Q	BA BE	3,18 **.125**	36,12 **1.422**	37,69 **1.484**
	MD3211Q	DT MT	3,18 **.125**	35,7 **1.406**	37,69 **1.484**

Fig. 6



Cross roller plunger. Panel mount. Roller perpendicular to long axis of the switch.	**MD3211Q1**	BZ BM	3,18 **.125** approx.	35,7 **1.406**	37,69 **1.484**
	MDA3711Q1	BA BE	3,18 **.125**	36,12 **1.422**	37,69 **1.484**
	MD3211Q1	DT MT	3,18 **.125**	35,7 **1.406**	37,69 **1.484**

Fig. 7



High overtravel plunger. Panel mount.	**MC7711 (8805/58) AN3167-1**	BZ BM	20,62 **.812**	69,1 **2.719**	70,64 **2.781**
	MCA7711	BA BE	19,84 **.781**	69,44 **2.734**	71,42 **2.812**
	MCD7711	DT MT	18,26 **.719**	69,1 **2.719**	71,42 **2.812**

Except where stated* ±1,14 mm
±.045 in.



Flex 6EX EU System

Radio Control Equipment

Instruction Manual

MAGNETEK
RADIO CONTROLS

CE

191-00193-0002 R2
March 2014
© Copyright 2014 Magnetek Material Handling

Service Information

Your New Radio System

Thank you for your purchase of Magnetek's Enrange™ Flex EX radio remote control system. Without a doubt, our Flex EX system is the ultimate solution for providing precise, undeterred, and safe control of your material.

If your product ever needs modification or service, please contact one of our representatives at the following locations:

U.S. Service Information

For questions regarding service or technical information contact:
+1.866.MAG.SERV
+1.866.624.7378

World Headquarters:

Magnetek, Inc.
N49 W13650 Campbell Drive
Menomonee Falls, WI 53051

Telephone: +1.800.288.8178
Website: www.magnetek.com
e-mail: MHCustomerservice@magnetek.com

Fax Numbers:
Main: +1.800.298.3503
Sales: +1.262.783.3510
Service: +1.262.783.3508

Canada Service Information:
4090B Sladeview Crescent
Mississauga, Ontario
L5L 5Y5 Canada
Phone: +1.800.792.7253
Fax: +1.905.828.5707
+1.416.424.7617 (24/7 Service pager)

EU Market Contact:
Brian Preston
Magnetek (UK) Ltd.
Unit 3 Bedford Business Centre
Mile Road
Bedford, MK42 9TW UK
Phone: +44.1234.349191
Fax: +44.1234.268955

Magnetek, Inc. has additional satellite locations for Canada and the United States. For more information, please visit http://www.magnetek.com.

©2014 MAGNETEK

All rights reserved. This notice applies to all copyrighted materials included with this product, including, but not limited to, this manual and software embodied within the product. This manual is intended for the sole use of the person(s) to whom it was provided, and any unauthorized distribution of the manual or dispersal of its contents is strictly forbidden. This manual may not be reproduced in whole or in part by any means whatsoever without the expressed written permission of MAGNETEK.

PRODUCT MANUAL SAFETY INFORMATION

Magnetek, Inc. (Magnetek) offers a broad range of radio remote control products, control products and adjustable frequency drives, and industrial braking systems for material handling applications. This manual has been prepared by Magnetek to provide information and recommendations for the installation, use, operation and service of Magnetek's material handling products and systems (Magnetek Products). Anyone who uses, operates, maintains, services, installs or owns Magnetek Products should know, understand and follow the instructions and safety recommendations in this manual for Magnetek Products.

The recommendations in this manual do not take precedence over any of the following requirements relating to cranes, hoists lifting devices or other material handling equipment which use or include Magnetek Products:

- Instructions, manuals, and safety warnings of the manufacturers of the equipment where the radio system is used,
- Plant safety rules and procedures of the employers and the owners of facilities where the Magnetek Products are being used,
- Regulations issued by the Occupational Health and Safety Administration (OSHA),
- Applicable local, state or federal codes, ordinances, standards and requirements, or
- Safety standards and practices for the industries in which Magnetek Products are used.

This manual does not include or address the specific instructions and safety warnings of these manufacturers or any of the other requirements listed above. It is the responsibility of the owners, users and operators of the Magnetek Products to know, understand and follow all of these requirements. It is the responsibility of the employer to make its employees aware of all of the above listed requirements and to make certain that all operators are properly trained. **No one should use Magnetek Products prior to becoming familiar with and being trained in these requirements and the instructions and safety recommendations in this manual**.

WARRANTY INFORMATION

For information on Magnetek's product warranties by product type, please visit www.magnetek.com.

Table of Contents

1. INTRODUCTION 5
2. RADIO CONTROLLED SAFETY 6
   2.1 CRITICAL INSTALLATION CONSIDERATIONS 7
   2.2 GENERAL 7
   2.3 PERSONS AUTHORIZED TO OPERATE RADIO CONTROLLED CRANES 7
   2.4 SAFETY INFORMATION AND RECOMMENDED TRAINING FOR RADIO CONTROLLED EQUIPMENT OPERATORS 8
   2.5 TRANSMITTER UNIT 9
   2.6: PRE-OPERATION TEST 9
   2.7 BATTERIES 9
   2.8 BATTERY HANDLING 10
   2.9 BATTERY CHARGING 10
   2.10 BATTERY DISPOSAL 10
   2.11 SPECIFIC SYSTEM WARNINGS 10
3. GENERAL SYSTEMS INFORMATION 11
   3.1 TRANSMITTER HANDSET 11
      3.1.1 External Illustration 11
      3.1.2 Internal Illustration 12
   3.2 RECEIVER UNIT 13
      3.2.1 External Illustration 13
      3.2.2 Internal Illustration 14
4. FUNCTION SETTINGS 15
   4.1 TRANSMITTER HANDSET 15
      4.1.1 System Channel Settings 15
      4.1.2 Continuous Transmitting Time Adjustment 16
      4.1.3 Channel Change via Push Buttons 17
      4.1.4 Optional 4-Digit Security Code 18
      4.1.5 I-CHIP 19
   4.2 RECEIVER UNIT 20
      4.2.1 System Channel Settings 20
      4.2.2 Output Relay Configurations 21
         4.2.2.1 Output Relay Types 21
         4.2.2.2 Output Relay Actions at 2nd Speed 21
         4.2.2.3 START/AUX Function 22
         4.2.2.4 Momentary Contact 22
         4.2.2.5 Toggled Contact 22
         4.2.2.6 Auxiliary STOP Push Button Function 23
      4.2.3 Receiver Auto-Scanning Settings 23
      4.2.4 Dip-Switch Settings 24
         4.2.4.1 Interlocked Functions 24
         4.2.4.2 Non-Interlocked Functions 25
      4.2.5 Jumper Settings 26
      4.2.6 I-CHIP Programming Port 27
      4.2.7 Fuse Ratings 27
5. SYSTEM CHANNELS TABLE 28
6. RECEVIER INSTALLATION 29
   6.1 OUTPUT RELAY CONTACT DIAGRAM 29
   6.2 PRE-INSTALLATION PRECAUTIONS 30
   6.3 STEP-BY-STEP INSTALLATION 30
   6.4 SYSTEM TESTING 31
7. OPERATING PROCEDURE 32
   7.1 TRANSMITTER OPERATION 32
      7.1.1 General Operating Procedure 32
      7.1.2 Automatic Channel Scanning Operating Procedure 33
      7.1.3 Changing Transmitter Batteries 34
   7.2 STATUS LIGHT INDICATORS & WARNINGS 35
      7.2.1 Transmitter STATUS Light Indication 35

7.2.2 Receiver STATUS Light Indication 36
7.2.3 Receiver SQ Light Indication 36
7.2.4 Receiver POWER Light Indication 36
7.2.5 Receiver COM Light Indication 36
7.3 TROUBLE SHOOTING TIPS 37
8. SYSTEM SPECIFICATIONS 38
9. DECLARATION OF CONFORMITY 39

1. INTRODUCTION

The Flex radio remote control systems are designed for control of industrial equipment and machinery such as overhead traveling cranes, jib cranes, gantry cranes, tower cranes, electric hoists, winches, monorails, conveyor belts, mining equipment and other material handling equipment where wireless control is preferred.

Each Flex system consists of a transmitter handset and receiver unit. Other standard-equipped accessories include transmitter waist belt, spare transmitter power key, clear vinyl pouch, "AA" alkaline batteries, compass direction decal sheet and user's manual.

List of notable features include:

* **62 user-programmable channels** – Advanced synthesized RF controls with 62 built-in channels; there are no more fixed channels and fragile quartz crystals to break.

* **Automatic channel scanning receiver** – No more hassle of climbing up the crane to change receiver channels.

* **Over one million unique ID codes (20bit)** – Each and every Flex system has its own unique ID codes and serial number, never repeats.

* **Advanced controls** – The Flex system utilizes advanced microprocessor controls with 32bit CRC and Hamming Code, which provide ultra-fast, safe, precise, and error-free encoding and decoding.

* **Unique I-CHIP design** – The I-CHIP functions in a way that is very similar to SIM cards used on mobile phones, with the ability to transfer system information and settings from one transmitter to another without the hassle of resetting the spares.

* **Reliable push buttons** – The in-house designed push buttons with gold-plated contacts are rated for more than one million press cycles.

* **Low power consumption** – Requires only two "AA" Alkaline batteries for more than 100 hours of operating time between replacements.

* **Ultra-durable nylon and fiberglass composite enclosures** – Highly resistant to breakage and deformation even in the most abusive environments.

* **Full compliance** – All systems are fully compliant with the FCC Part-15 Rules, European Directives (Safety, EMC, R&TTE, Machinery), and Industry Canada Specifications (IC).

2. RADIO CONTROLLED SAFETY

WARNINGS and CAUTIONS

Throughout this document WARNING and CAUTION statements have been deliberately placed to highlight items critical to the protection of personnel and equipment.

WARNING – A warning highlights an essential operating or maintenance procedure, practice, etc. which if not strictly observed, could result in injury or death of personnel, or long term physical hazards. Warnings are highlighted as shown below:



CAUTION – A caution highlights an essential operating or maintenance procedure, practice, etc. which if not strictly observed, could result in damage to, or destruction of equipment, or loss of functional effectiveness. Cautions are highlighted as shown below:



WARNINGS and CAUTIONS SHOULD NEVER BE DISREGARDED.

The safety rules in this section are not intended to replace any rules or regulations of any applicable local, state, or federal governing organizations. Always follow your local lockout and tagout procedure when maintaining any radio equipment. The following information is intended to be used in conjunction with other rules or regulations already in existence. It is important to read all of the safety information contained in this section before installing or operating the Radio Control System.

2.1 CRITICAL INSTALLATION CONSIDERATIONS

WARNING

PRIOR TO INSTALLATION AND OPERATION OF THIS EQUIPMENT, READ AND DEVELOP AN UNDERSTANDING OF THE CONTENTS OF THIS MANUAL AND THE OPERATION MANUAL OF THE EQUIPMENT OR DEVICE TO WHICH THIS EQUIPMENT WILL BE INTERFACED. FAILURE TO FOLLOW THIS WARNING COULD RESULT IN SERIOUS INJURY OR DEATH AND DAMAGE TO EQUIPMENT.

ALL EQUIPMENT MUST HAVE A MAINLINE CONTACTOR INSTALLED AND ALL TRACKED CRANES, HOISTS, LIFTING DEVICES AND SIMILAR EQUIPMENT MUST HAVE A BRAKE INSTALLED. FAILURE TO FOLLOW THIS WARNING COULD RESULT IN SERIOUS INJURY OR DEATH AND DAMAGE TO EQUIPMENT.

AN AUDIBLE AND/OR VISUAL WARNING MEANS MUST BE PROVIDED ON ALL REMOTE CONTROLLED EQUIPMENT AS REQUIRED BY CODE, REGULATION, OR INDUSTRY STANDARD. THESE AUDIBLE AND/OR VISUAL WARNING DEVICES MUST MEET ALL GOVERNMENTAL REQUIREMENTS. FAILURE TO FOLLOW THIS WARNING COULD RESULT IN SERIOUS INJURY OR DEATH AND DAMAGE TO EQUIPMENT.

FOLLOW YOUR LOCAL LOCKOUT TAGOUT PROCEDURE BEFORE MAINTAINING ANY REMOTE CONTROLLED EQUIPMENT. ALWAYS REMOVE ALL ELECTRICAL POWER FROM THE CRANE, HOIST, LIFTING DEVICE OR SIMILAR EQUIPMENT BEFORE ATTEMPTING ANY INSTALLATION PROCEDURES. DE-ENERGIZE AND TAGOUT ALL SOURCES OF ELECTRICAL POWER BEFORE TOUCH-TESTING ANY EQUIPMENT. FAILURE TO FOLLOW THIS WARNING COULD RESULT IN SERIOUS INJURY OR DEATH AND DAMAGE TO EQUIPMENT.

THE DIRECT OUTPUTS OF THIS PRODUCT ARE NOT DESIGNED TO INTERFACE DIRECTLY TO TWO STATE SAFETY CRITICAL MAINTAINED FUNCTIONS, I.E., MAGNETS, VACUUM LIFTS, PUMPS, EMERGENCY EQUIPMENT, ETC. A MECHANICALLY LOCKING INTERMEDIATE RELAY SYSTEM WITH SEPARATE POWER CONSIDERATIONS MUST BE PROVIDED. FAILURE TO FOLLOW THIS WARNING COULD RESULT IN SERIOUS INJURY OR DEATH OR DAMAGE TO EQUIPMENT.

2.2 GENERAL

Radio controlled material handling equipment operates in several directions. Cranes, hoists, lifting devices and other material handling equipment can be large, and operate at high speeds. Quite frequently, the equipment is operated in areas where people are working in close proximity to the material handling equipment. **The operator must exercise extreme caution at all times**. Workers must constantly be alert to avoid accidents. The following recommendations have been included to indicate how careful and thoughtful actions may prevent injuries, damage to equipment, or even save a life.

2.3 PERSONS AUTHORIZED TO OPERATE RADIO CONTROLLED CRANES

Only properly trained persons designated by management should be permitted to operate radio controlled equipment.

Radio controlled cranes, hoists, lifting devices and other material handling equipment should not be operated by any person who cannot read or understand signs, notices and operating instructions that pertain to the equipment.

Radio controlled equipment should not be operated by any person with insufficient eyesight or hearing or by any person who may be suffering from a disorder or illness, is taking any medication that may cause loss of equipment control, or is under the influence of alcohol or drugs.

2.4 SAFETY INFORMATION AND RECOMMENDED TRAINING FOR RADIO CONTROLLED EQUIPMENT OPERATORS

Anyone being trained to operate radio controlled equipment should possess as a minimum the following knowledge and skills before using the radio controlled equipment.

The operator should:

- have knowledge of hazards pertaining to equipment operation
- have knowledge of safety rules for radio controlled equipment
- have the ability to judge distance of moving objects
- know how to properly test prior to operation
- be trained in the safe operation of the radio transmitter as it pertains to the crane, hoist, lifting device or other material handling equipment being operated
- have knowledge of the use of equipment warning lights and alarms
- have knowledge of the proper storage space for a radio control transmitter when not in use
- be trained in transferring a radio control transmitter to another person
- be trained how and when to report unsafe or unusual operating conditions
- test the transmitter emergency stop and all warning devices prior to operation; testing should be done on each shift, without a load
- be thoroughly trained and knowledgeable in proper and safe operation of the crane, hoist, lifting device, or other material handling equipment that utilizes the radio control
- know how to keep the operator and other people clear of lifted loads and to avoid "pinch" points
- continuously watch and monitor status of lifted loads
- know and follow cable and hook inspection procedures
- know and follow the local lockout and tagout procedures when servicing radio controlled equipment
- know and follow all applicable operating and maintenance manuals, safety procedures, regulatory requirements, and industry standards and codes

The operator shall not:

- lift or move more than the rated load
- operate the material handling equipment if the direction of travel or function engaged does not agree with what is indicated on the controller
- use the crane, hoist or lifting device to lift, support or transport people
- lift or carry any loads over people
- operate the crane, hoist or lifting device unless all persons, including the operator, are and remain clear of the supported load and any potential pinch points
- operate a crane, hoist or lifting device when the device is not centered over the load
- operate a crane, hoist or lifting device if the chain or wire rope is not seated properly in the sprockets, drum or sheave
- operate any damaged or malfunctioning crane, hoist, lifting device or other material handling equipment

- change any settings or controls without authorization and proper training
- remove or obscure any warning or safety labels or tags
- leave any load unattended while lifted
- leave power on the radio controlled equipment when the equipment is not in operation
- operate any material handling equipment using a damaged controller because the unit may be unsafe
- operate manual motions with other than manual power
- operate radio controlled equipment when low battery indicator is on

WARNING

THE OPERATOR SHOULD NOT ATTEMPT TO REPAIR ANY RADIO CONTROLLER. IF ANY PRODUCT PERFORMANCE OR SAFETY CONCERNS ARE OBSERVED, THE EQUIPMENT SHOULD IMMEDIATELY BE TAKEN OUT OF SERVICE AND BE REPORTED TO THE SUPERVISOR. DAMAGED AND INOPERABLE RADIO CONTROLLER EQUIPMENT SHOULD BE RETURNED TO MAGNETEK FOR EVALUATION AND REPAIR. FAILURE TO FOLLOW THIS WARNING COULD RESULT IN SERIOUS INJURY OR DEATH AND DAMAGE TO EQUIPMENT.

2.5 TRANSMITTER UNIT

Transmitter switches should never be mechanically blocked ON or OFF. When not in use, the operator should turn the transmitter OFF. A secure storage space should be provided for the transmitter unit, and the transmitter unit should always be placed there when not in use. This precaution will help prevent unauthorized people from operating the material handling equipment.

Spare transmitters should be stored in a secure storage space and only removed from the storage space after the current transmitter in use has been turned OFF, taken out of the service area and secured.

2.6: PRE-OPERATION TEST

At the start of each work shift, or when a new operator takes control of the crane, operators should do, as a minimum, the following steps before making lifts with any crane or hoist:

Test all warning devices.

Test all direction and speed controls.

Test the transmitter emergency stop.

2.7 BATTERIES

WARNING

KNOW AND FOLLOW PROPER BATTERY HANDLING, CHARGING AND DISPOSAL PROCEDURES. IMPROPER BATTERY PROCEDURES CAN CAUSE BATTERIES TO EXPLODE OR DO OTHER SERIOUS DAMAGE. FAILURE TO FOLLOW THIS WARNING COULD RESULT IN SERIOUS INJURY OR DEATH AND DAMAGE TO EQUIPMENT.

2.8 BATTERY HANDLING

Use only batteries approved by Magnetek for the specific product.

Do not dispose of a battery pack in fire; it may explode.

Do not attempt to open the battery pack.

Do not short circuit the battery.

For intrinsically safe environments only use specified Magnetek intrinsically safe batteries.

Keep the battery pack environment cool during charging operation and storage (i.e., not in direct sunlight or close to a heating source).

2.9 BATTERY CHARGING

For those transmitters equipped with battery chargers, please familiarize all users with the instructions of the charger before attempting to use.

Do not attempt to charge non-rechargeable battery packs.

Avoid charging partially discharged rechargeable batteries to help prolong battery cycle life.

Avoid charging the battery pack for more than 24 hours at a time.

Do not charge batteries in a hazardous environment.

Do not short the charger.

Do not attempt to charge a damaged battery.

Use only Magnetek approved chargers for the appropriate battery pack.

Do not attempt to use a battery that is leaking, swollen or corroded.

Charger units are not intended for outdoor use. Use only indoors.

2.10 BATTERY DISPOSAL

Before disposing of batteries consult local and governmental regulatory requirements for proper disposal procedure.

2.11 SPECIFIC SYSTEM WARNINGS

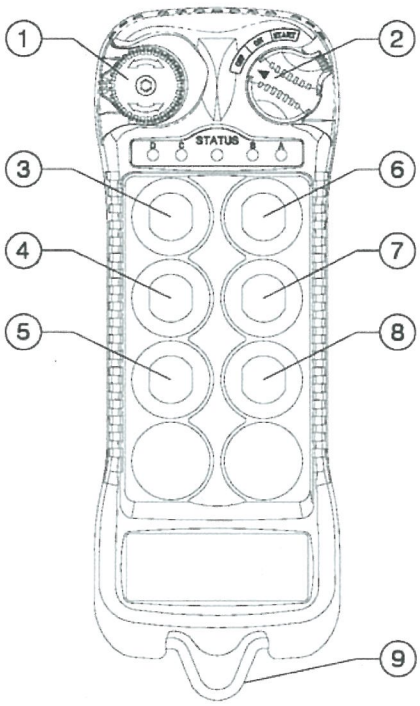
Below are some specific operating safety tips that should be strictly followed when operating a Flex 6EX System:

1. Check the Status LED on the transmitter for any signs of low battery power (refer to page 35).
2. Check the Status LED on the transmitter for any signs of irregularities (refer to page 35).
3. Make sure the system is not set to the same channel as any other Flex systems in use within a distance of 300 meters (900 feet).

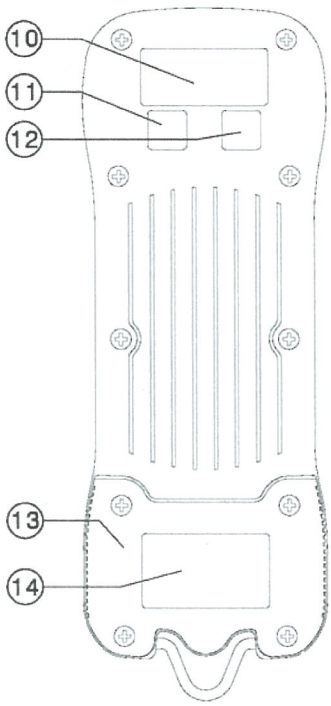
3. GENERAL SYSTEMS INFORMATION

3.1 TRANSMITTER HANDSET

3.1.1 External Illustration



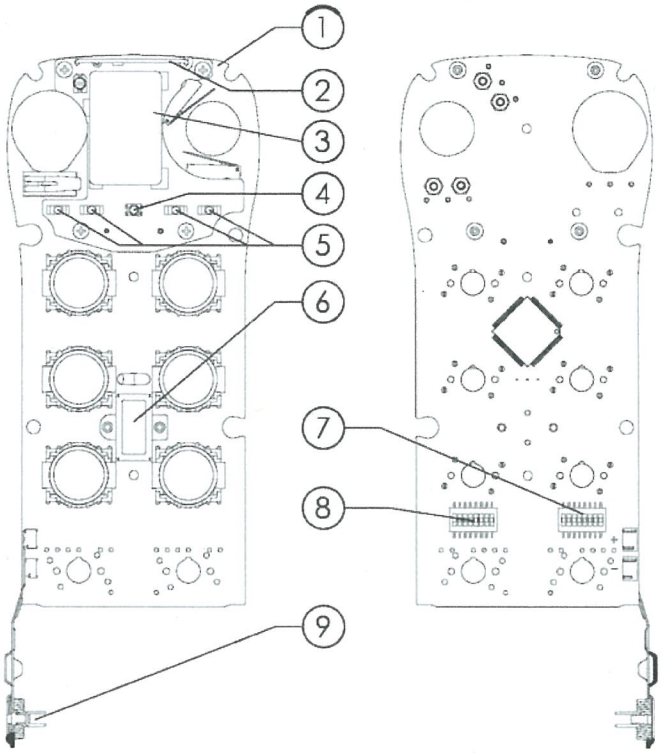
(Fig. 01)



(Fig. 02)

1. Emergency Stop Button
2. Removable Power Key Switch
3. Push Button #2
4. Push Button #4
5. Push Button #6
6. Push Button #1
7. Push Button #3
8. Push Button #5
9. Strap Ring
10. System Information
11. System Channel
12. Crane Number
13. Battery Cover
14. FCC Information

3.1.2 Internal Illustration



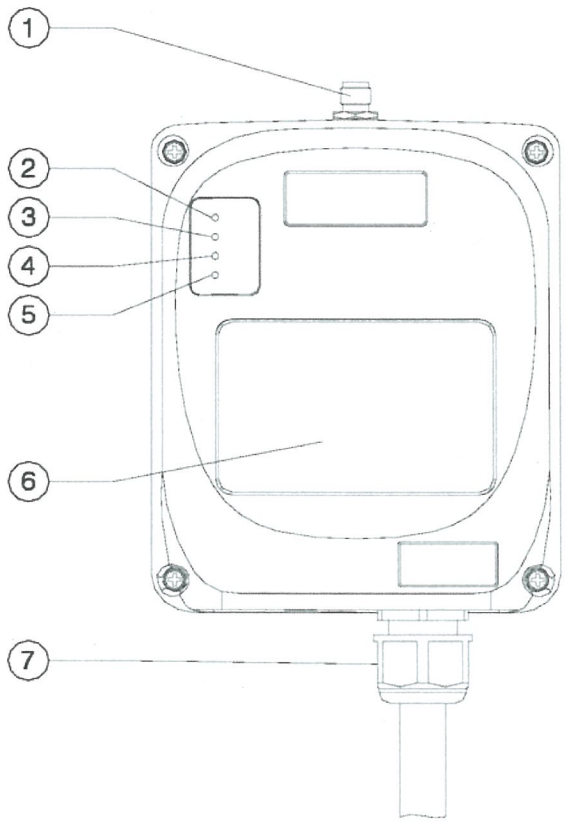
(Fig. 03)

(Fig. 04)

1. Encoder Board
2. Aerial Antenna
3. Transmitting Module
4. Status LED Display
5. Function LED Displays
6. I-CHIP
7. Function Dip-Switch
8. Channel Dip-Switch
9. Battery Contact Mechanism

3.2 RECEIVER UNIT

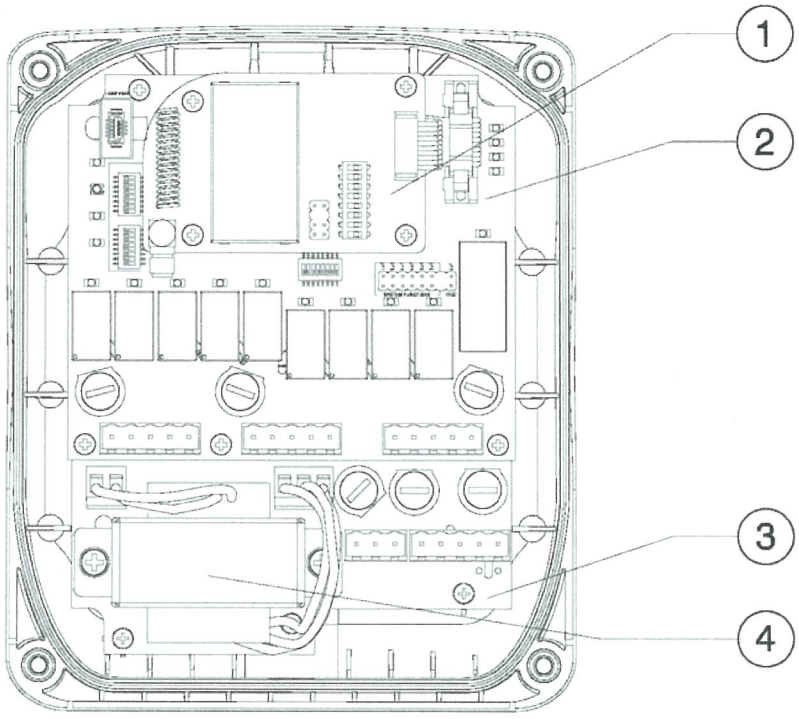
3.2.1 External Illustration



(Fig. 05)

1. External Antenna Jack (optional)
2. Power LED Display
3. Status LED Display
4. SQ LED Display
5. COM LED Display
6. Output Contact Diagram
7. Cord Grip

3.2.2 Internal Illustration



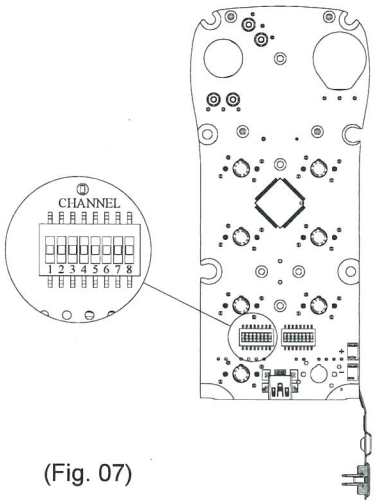
(Fig. 06)

1. Receiving Module
2. Decoder/Relay Board
3. AC Line Filter/Relay Board
4. Power Transformer

4. FUNCTION SETTINGS

4.1 TRANSMITTER HANDSET

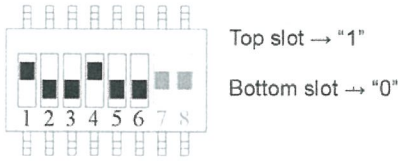
4.1.1 System Channel Settings



(Fig. 07)

Set the transmitter channel by adjusting the channel dip-switch located on the backside of the transmitter encoder board (refer to Fig. 07 above). Only the first six (6) positions are used for channel programming (refer to Fig. 08 below). The system channels table located on page 28 illustrates which dip-switch setting corresponds to which channel. Once the transmitter channel is altered, make sure to change the receiver channel as well. The channel on both the transmitter and the receiver must be identical in order for the system to work. To change the receiver channel please refer to page 20.

Example:

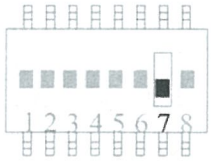


(Fig. 08)

The above dip-switch setting **"1 0 0 1 0 0"** corresponds to "channel 36" in the system channels table on page 28.

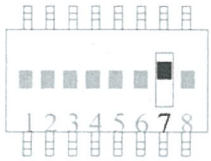
4.1.2 Continuous Transmitting Time Adjustment

(Type 1)



After the push button is released the transmitter will continue to transmit neutral signals to the receiver for up to one (1) minute. After one (1) minute the transmitter will cease transmission thus temporarily disconnecting the receiver MAIN.

(Type 2)



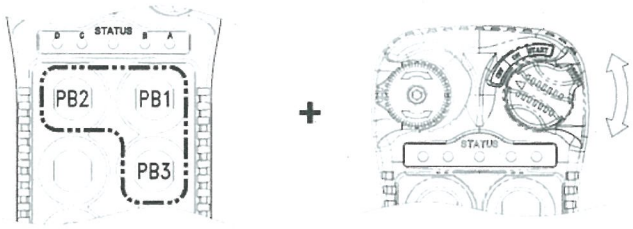
After the push button is released the transmitter will continue to transmit neutral signals to the receiver for up to three (3) minutes. After three (3) minutes the transmitter will cease transmission thus temporarily disconnecting the receiver MAIN. Please contact your local dealer if your application requires transmitting on time other than the pre-set value above.

4.1.3 Channel Change via Push Buttons

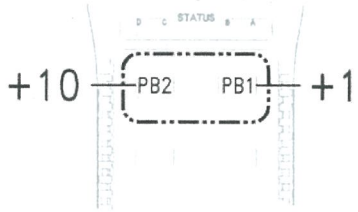
Other than CHANNEL dip-switch on the encoder board, the transmitter channel can also be changed directly on the push buttons. Please refer to the instructions below on how to change the transmitter channel via push buttons.

a. Press and hold PB1, PB2 and PB3 and rotate the power key to START position at the same time. A series of green and red blinks will appear on the Status LED showing the current channel setting. A green blink represents the tens (+10) and a red blink represents the units (+1).

Examples: 2 green blinks followed by 5 red blinks represents channel 25.
6 red blinks represents channel 06.



b. Select a new channel by pressing PB1 and PB2 on the transmitter. Press PB1 to increment the units (+1) and PB2 to increment the tens (+10).



Examples: Press PB2 two times and then PB1 four times will give you channel 24.
Press PB1 nine times with give you channel 09.

c. When finished, the newly selected channel will appear on the Status LED via series of green and red blinks again.

d. Exit the channel programming by turning off the transmitter power.

e. Make sure the receiver channel is set identical to the transmitter. Please refer to page 20 and page 23 on how to change the receiver channel.

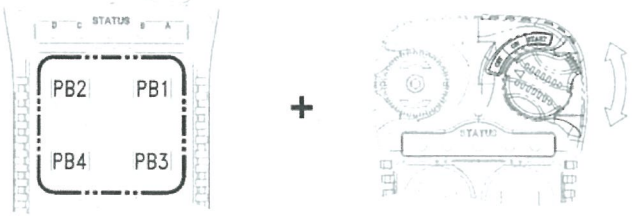
f. Please note that when the CHANNEL dip-switch inside the transmitter is changed, the priority will revert back to the new channel set on the CHANNEL dip-switch.

g. Please note that when the channel is set beyond channel 62 via PB1 and PB2 (i.e. channel 63, 68, 88, etc...), the system will recognize it as channel 62.

4.1.4 Optional 4-Digit Security Code

The 4-digit Security Code is an optional feature that can be programmed into the transmitter to allow operation only to those who know the code. If this feature is desired, set up as follows: Prior to rotating the transmitter power key-switch to START position to begin operation, you first enter a 4-digit security code in order to proceed further. When this 4-digit security code is entered correctly, a green light will appear on the Status LED. Please refer to the instruction below on how to program the 4-digit security code.

a. Release E-Stop, then press and hold PB1, PB2, PB3 and PB4 (all at once), and then rotate the power key to START position.



b. A constant orange light will appear on the Status LED telling you that you are in the security code programming mode.

c. For newly purchased system with the security code function deactivated (default setting), press PB1 four times (1111) to activate the security code function. At this time the Status LED on the transmitter will blink orange slowly, telling you that the 4 digits entered is correct. Then select your own 4-digit security code by pressing PB1, PB2, PB3 or PB4 on the transmitter (four presses randomly). At this time, fast orange blinks are displayed on the Status LED telling you to reconfirm the 4-digit security code you have just entered. A green light will appear once you have re-entered the same 4-digit security code again (programming completed). If any mistake is made during this process, or if a red light is shown on the Status LED after you have re-entered the security code (incorrect input), or even if you believe you have entered the correct code but the transmitter fails to work properly, then you must reset the transmitter power (by power-cycling the transmitter*) and then repeat steps a, b, and c again.

**NOTE: To power-cycle the transmitter, you must first remove, then reinstall the batteries. Simply turning the power switch off, then on will NOT properly clear the memory. This process must be used for any errors regarding proper transmitter operation (not just for security code settings).*

***Steps:** Press and hold PB1~PB4 and rotate power key to START position → constant orange → press PB1 four times (for new systems) or 4-digit security code → slow orange blinks → enter the new 4-digit security code → fast orange blinks → re-enter the same 4-digit security code again → green light*

d. If you wish to cancel the security code function, then repeat a, b, and c above and press PB1 four times as your new security code (security code function disabled).

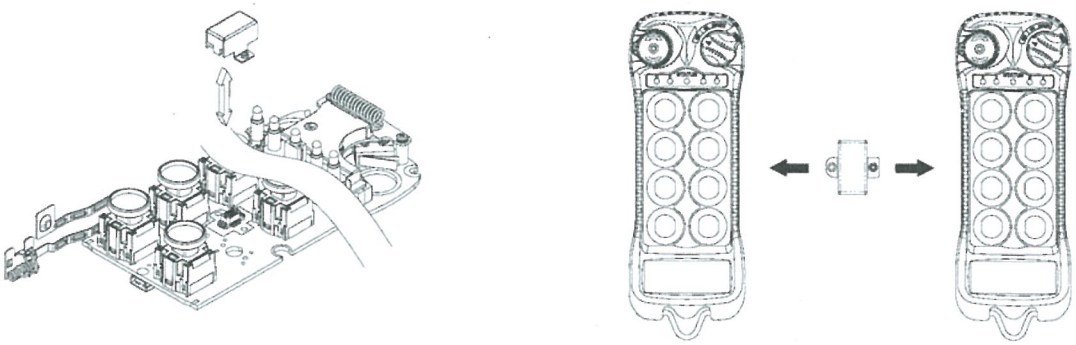
e. If you do not remember the 4-digit security code, then you must contact your dealer or distributor for further assistance.

4.1.5 I-CHIP

The I-CHIP functions in a way that is very similar to a SIM card inside a mobile phone, which stores system information such as your telephone number, account number, phone book and other settings. I-CHIP works exactly the same way, as it stores information such as system serial number/ID code, channel and push button configurations.

When replacing a transmitter handset, just take the I-CHIP out of the old transmitter and install it into the new one (refer to Fig. 09 below). For complete information transfer, make sure both the Channel and Function dip-switch is set to all "1". If both dip-switches are set to all "1", then the transmitter will operate according to the push button configurations and channel stored inside the I-CHIP. If both Channel and Function dip-switch is set to other values other than all "1", then the transmitter will operate according to the channel and push button configurations set on these two dip-switches, not the ones stored inside the I-CHIP. Every time when the settings on these two dip-switches have changed, the new settings will be stored into the I-CHIP automatically. In this case the previous channel and push button configurations stored inside the I-CHIP will be replaced by the new settings.

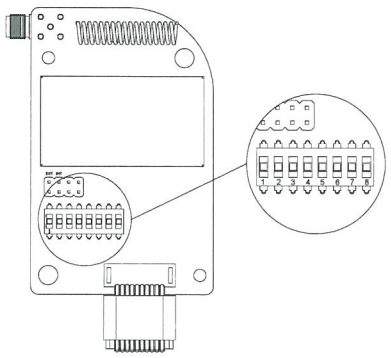
For safety purposes, the system serial number/ID code stored inside the I-CHIP can not be changed directly on the transmitter encoder board. Only channels and push button configurations can be changed directly on the encoder board via Channel and Function dip-switches. There are only two ways that you can change transmitter serial number/ID code: via I-CHIP programming port located on the decoder module inside the receiver unit, (please refer to page 27 on how to program the I-CHIP (serial number/ID code) via the receiver unit); or via an external I-CHIP programmer or duplicator unit available from the factory. Please ask your local dealers for assistance if your system requires serial number/ID code adjustments.



(Fig. 09)

4.2 RECEIVER UNIT

4.2.1 System Channel Settings

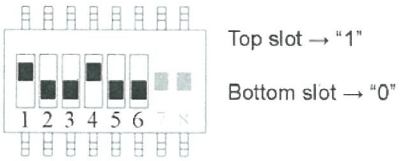


(Fig. 10)

Even though the Flex system is equipped with an automatic channel scanning mode, the user can also set the receiver channel manually. Please refer to page 33 on how automatic channel scanning receiver works.

Set the receiver channel by adjusting the channel dip-switch located on the receiver module (refer to Fig. 10 above). Only the first six (6) positions are used for channel programming (refer to Fig. 11 below). The system channels table located on page 28 illustrates which dip-switch setting corresponds to which channel. Once the receiver channel is altered, make sure to change transmitter channel as well. The channel on both transmitter and receiver must be identical in order for system to work. To change the transmitter channel please refer to page 15.

Example:



(Fig. 11)

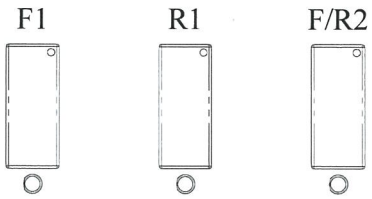
The above dip-switch setting **"1 0 0 1 0 0"** corresponds to "channel 36" in the system channels table on page 28.

4.2.2 Output Relay Configurations

4.2.2.1 Output Relay Types

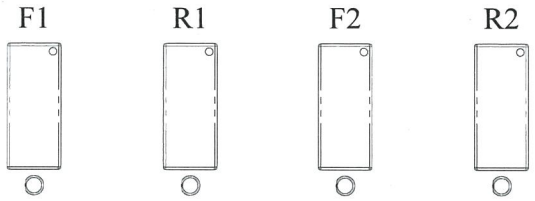
a. Three (3) output relays per motion – shared 2nd speed output relay

Output relays with Forward 1st speed (F1), Reverse 1st speed (R1) and Forward/Reverse 2nd speed (F/R2). Forward and Reverse 2nd speed (F/R2) shared the same output relay.



b. Four (4) output relays per motion – separate 1st and 2nd speed output relays

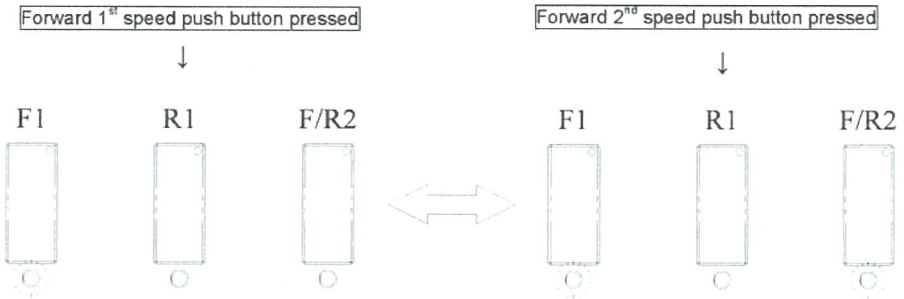
Output relays with Forward 1st speed (F1), Reverse 1st speed (R1), Forward 2nd speed (F2) and Reverse 2nd speed (R2). Forward and Reverse 2nd speed with separate output relays.



4.2.2.2 Output Relay Actions at 2nd Speed

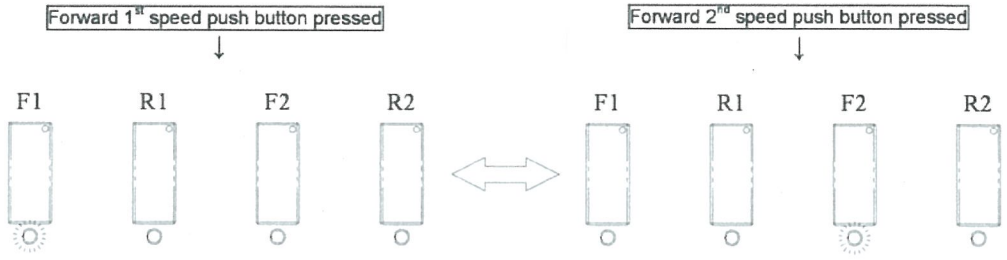
a. 3-output relays configuration with Closed/Closed contact at 2nd speed

At 2nd speed, both 1st speed (F1 or R1) and 2nd speed (F/R2) output relays are closed (refer to page 24 on how to set to this function).



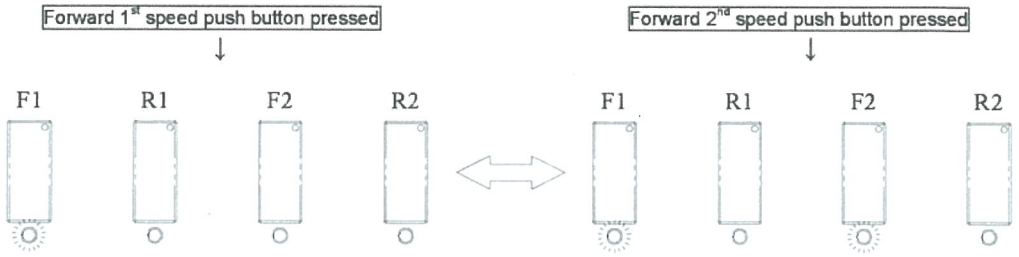
b. 4-output relays configuration with Opened/Closed contact at 2nd speed

At 2nd speed, only the 2nd speed (F2 or R2) output relay is closed (refer to page 24 on how to set to this function).



c. 4-output relays configuration with Closed/Closed contact at 2nd speed

At 2nd speed, both 1st speed (F1 or R1) and 2nd speed (F2 or R2) output relays are closed (refer to page 24 on how to set to this function).



4.2.2.3 START/AUX Function

After initiating the START function the Start position will become an auxiliary function with momentary contact. For auxiliary applications such as horns or buzzers, please connect it to the FUNC output relay (wire #5) located inside the receiver unit.

4.2.2.4 Momentary Contact

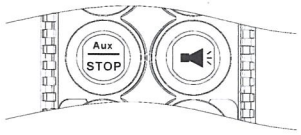
When the push button is released, the output relay that corresponds to that push button will open (refer to page 25 on how to set to this function). This type of contact is usually applied to external application such as horns or buzzers.

4.2.2.5 Toggled Contact

When the push button is released, the output relay that corresponds to that push button will remain closed (maintained contact) until next time the user presses the same push button again (refer to page 25 on how to set to this function). This type of contact is usually applied to external application such as lights.

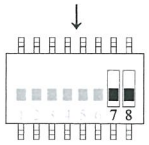
4.2.2.6 Auxiliary STOP Push Button Function

The auxiliary STOP function acts as a 2nd emergency stop button. Other than by emergency stop button and transmitter power key switch, the receiver MAIN is also deactivated when this auxiliary stop push button is pressed (refer to page 25 on how to set to this function).

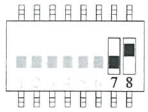


4.2.3 Receiver Auto-Scanning Settings

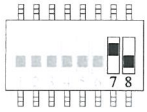
Receiver Channel Dip-switch



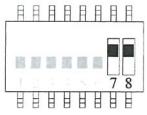
(1) → Scans all 62 channels (manufacture preset)
For standard operation



(2) → Single fixed channel
Auto scanning function disabled



(3) → Scanning 2 channels only*



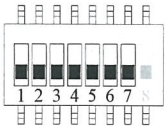
(4) → Scanning 3 channels only

* If the first 6 dip-switch positions on the receiving module is set to Ch.01 ("000000" or "000001"), when set to 2-channel scanning (type-3 above), then the receiver will only scan Ch.01 and Ch.02.

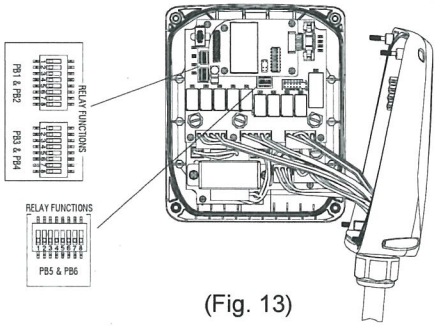
4.2.4 Dip-Switch Settings

4.2.4.1 Interlocked Functions

Interlocked means the two adjacent push buttons cannot be activated simultaneously as they will cancel each other out. Interlocked settings are usually applied to forward and reverse motions. Each dip-switch on the decoder module corresponds to one (1) motion or two (2) adjacent push buttons (refer to Fig. 12 & 13 below). Only the first seven (7) dip-switch positions are used (counting from left to right); the 8th dip-switch position (far right) is not used.



(Fig. 12)



(Fig. 13)

Manufacture preset

Dip Settings	Function Descriptions	# of Relays Used
0000000	Normal (single speed only, F2 & R2 relays not used)	2
0000001	Closed/Closed Relay Action at 2nd Speed (separate 2nd speed relay)	4
0000010	Closed/Closed Relay Action at 2nd Speed (shared 2nd speed relay)	3
0000011	Opened/Closed Relay Action at 2nd Speed (separate 2nd speed relay)	4
0001001	On + Start / Off + Start -- Prior to pressing the button you must first rotate and hold the power key switch at START position to activate On or Off relays.	2
0001010	FWD/REV toggled (latched).	2
0001011	FWD/REV toggled (latched) and affected by the E-stop command.	2

4.2.4.2 Non-Interlocked Functions

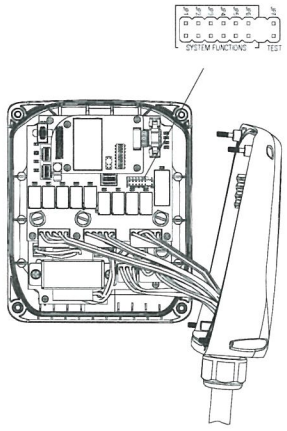
Contrary to interlocked settings, non-interlocked settings allow the two adjacent push buttons be used simultaneously. Non-interlocked settings are usually applied to a crane's auxiliary functions, such as lights, horn, 3rd speed and auxiliary stop. Each dip-switch on the decoder module corresponds to one (1) motion or two (2) adjacent push buttons (left & right push buttons).

Function Code	Dip Position Setting #1	Dip Position Setting #2 - #4 (left button) & #5 - #7 (right button)	Function Description
A	1	000	Normal (momentary) contact.
B	1	001	Toggled (latching) contact.
C	1	011	Normal + Start function. For added safety, you must first rotate and hold the power key switch at "START" position and then press the intended push button at the same time to activate the output relay.
D	1	111	Auxiliary Stop.

Example #1: Left button (set to function code A) / right button (set to function code A) → **1 000 000**
Example #2: Left button (set to function code B) / right button (set to function code B) → **1 001 001**
Example #3: Left button (set to function code A) / right button (set to function code C) → **1 000 011**
Example #4: Left button (set to function code C) / right button (set to function code B) → **1 011 001**

4.2.5 Jumper Settings

Jumper settings are applied to functions such as main-disconnect time, Start function, system information (serial number/ID code) programming, and system testing. Jumpers #1 - #7 are located on the decoder/relay board between the receiving RF module and the output relays (refer to Fig.14 below).

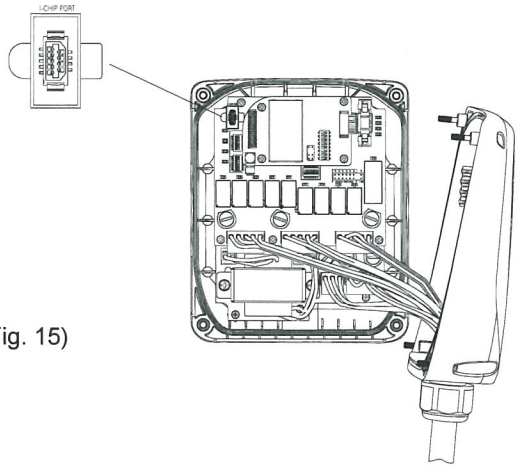


(Fig. 14)

Manufacture preset

Jumper Settings	Function
JP3 (Blank)	After 1 or 3 minutes of transmitter inactivity (MAIN deactivated), press any push button on the transmitter to reactivate the receiver MAIN.
JP3 (Inserted)	After 1 or 3 minutes of transmitter inactivity (MAIN deactivated), rotate the transmitter power key-switch to "START" position to reactivate the receiver MAIN.
JP6 (Blank)	Program system serial number/ID code and channel from decoder module to I-CHIP.
JP6 (Inserted)	Program system serial number/ID code and channel from I-CHIP to decoder module.
JP7 (Inserted)	For system test only, receiver MAIN disabled.

4.2.6 I-CHIP Programming Port



(Fig. 15)

The I-CHIP programming port, located on the decoder module (refer to Fig. 15 above) inside the receiver, is designed for the purpose of transferring a system serial number/ID code from the I-CHIP to the receiver or vice versa. If you wish to transfer system information from the receiver to the I-CHIP, just insert the I-CHIP onto the programming port (JP6 jumper not inserted), wait until the Status LED on the decoder module turned displays a constant green light (within 2 seconds), and then take the I-CHIP out of the programming port (programming completed). At this time the I-CHIP should also possess the same serial number/ID code as the receiver.

If the Status LED on the decoder module displays a constant red light after inserting the I-CHIP (programming failed), then you must reinsert the I-CHIP one more time. On the other hand, if you wish to transfer system information from I-CHIP to receiver, then you must first insert JP6 jumper prior to inserting the I-CHIP, then wait for the green light to appear on the Status LED. At this time the receiver should also possess the same system information as the I-CHIP. Please note that the receiver unit must be powered in order to proceed with the programming.

4.2.7 Fuse Ratings

FUSE #	110 - 120VAC	220 - 240VAC	380 - 400VAC	410 - 460VAC	24VAC	42 & 48VAC	12 - 24VDC
F1 - F8	5.0A (clear)	5.0A (clear)	5.0A (clear)	5.0A (clear)	5.0A (clear)	5.0A (clear)	5.0A (clear)
F9 - F10	0.5A (blue)	0.5A (blue)	0.5A (blue)	0.5A (blue)	1.0A (red)	1.0A (red)	1.0A (red)

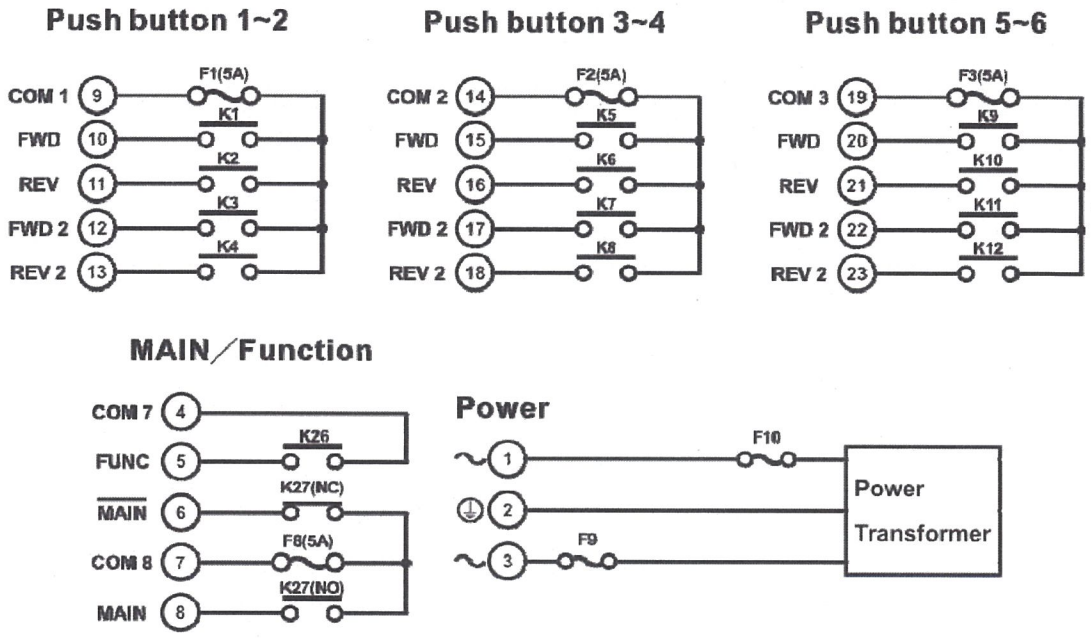
5. SYSTEM CHANNELS TABLE

Channel	Frequency	Dip-switch Setting	Channel	Frequency	Dip-switch Setting
01	433.000MHZ	000000	32	433.775MHZ	100000
01	433.000MHZ	000001	33	433.800MHZ	100001
02	433.025MHZ	000010	34	433.825MHZ	100010
03	433.050MHZ	000011	35	433.850MHZ	100011
04	433.075MHZ	000100	36	433.875MHZ	100100
05	433.100MHZ	000101	37	433.900MHZ	100101
06	433.125MHZ	000110	38	433.925MHZ	100110
07	433.150MHZ	000111	39	433.950MHZ	100111
08	433.175MHZ	001000	40	433.975MHZ	101000
09	433.200MHZ	001001	41	434.000MHZ	101001
10	433.225MHZ	001010	42	434.025MHZ	101010
11	433.250MHZ	001011	43	434.050MHZ	101011
12	433.275MHZ	001100	44	434.075MHZ	101100
13	433.300MHZ	001101	45	434.100MHZ	101101
14	433.325MHZ	001110	46	434.125MHZ	101110
15	433.350MHZ	001111	47	434.150MHZ	101111
16	433.375MHZ	010000	48	434.175MHZ	110000
17	433.400MHZ	010001	49	434.200MHZ	110001
18	433.425MHZ	010010	50	434.225MHZ	110010
19	433.450MHZ	010011	51	434.250MHZ	110011
20	433.475MHZ	010100	52	434.275MHZ	110100
21	433.500MHZ	010101	53	434.300MHZ	110101
22	433.525MHZ	010110	54	434.325MHZ	110110
23	433.550MHZ	010111	55	434.350MHZ	110111
24	433.575MHZ	011000	56	434.375MHZ	111000
25	433.600MHZ	011001	57	434.400MHZ	111001
26	433.625MHZ	011010	58	434.425MHZ	111010
27	433.650MHZ	011011	59	434.450MHZ	111011
28	433.675MHZ	011100	60	434.475MHZ	111100
29	433.700MHZ	011101	61	434.500MHZ	111101
30	433.725MHZ	011110	62	434.525MHZ	111110
31	433.750MHZ	011111	I-CHIP		111111*

* *When set to all "1" the priority goes to the channel assigned inside the I-CHIP.*

6. RECEVIER INSTALLATION

6.1 OUTPUT RELAY CONTACT DIAGRAM



* For 3-relay (shared 2nd speed) and 4-relay (separate 2nd speed) configurations please refer to page 21.

* For 4-relay closed/closed and 4-relay opened/closed relay configurations please refer to page 21.

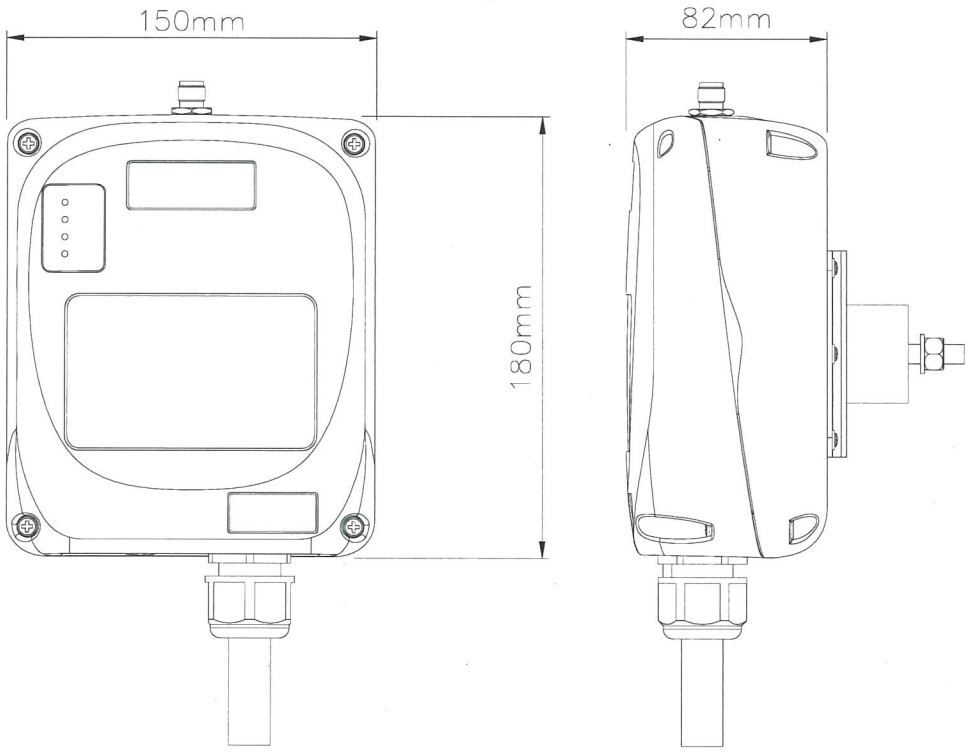
* For 12-24VDC power supply, wire #1 corresponds to the negative charge (-) and wire #3 corresponds to the positive charge (+). Wire #2 is for GROUND.

* Wire #6 is for "Normal Close" and wire #8 is for "Normal Open" MAIN output.

6.2 PRE-INSTALLATION PRECAUTIONS

1. Make sure the transmitter and receiver have identical serial number/ID codes and channels.
2. Make sure the receiver is not set to the same channel as any other systems in use in the surrounding area.
3. Make sure that the crane or equipment is working properly prior to installation.
4. Make sure the power source to the receiver is set correctly.
5. Switch off the main power source to the crane or equipment prior to installation.

6.3 STEP-BY-STEP INSTALLATION



(Fig. 16)

1. For best reception the location of the receiver should be visible to the operator at all time.

2. The location selected should not be exposed to high levels of electric noise. Mounting the receiver next to an unshielded variable frequency drive may cause minor interference. Always locate the receiver as far away from the variable frequency drive as possible.

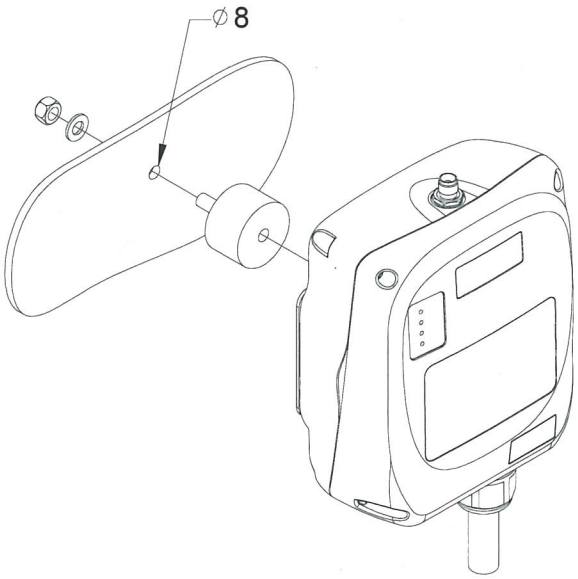
3. Ensure the selected location has adequate space to accommodate the receiver (refer to Fig. 16 on page 30).

4. For better reception, make sure the receiver is in an upright position.

5. Drill one hole (8mm in diameter) on the control panel or location where the receiver is to be installed (refer to below).

6. Make sure the bolt is tightened after installation.

7. For system wiring please refer to page 29.



6.4 SYSTEM TESTING

1. Turn on the power source to the receiver and test the MAIN relay output by pressing the red emergency stop button and observe that it properly opens and closes the mainline disconnect contactor.

2. Test the operation of each function to ensure it corresponds to the transmitter direction labels or the pendant it is replacing.

3. Test the limit switches (if any) to see if they are working properly.

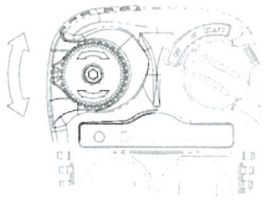
4. If your new remote control is replacing an existing pendant, make sure it is completely disconnected and placed in a safe location to prevent unwanted control commands.

7. OPERATING PROCEDURE

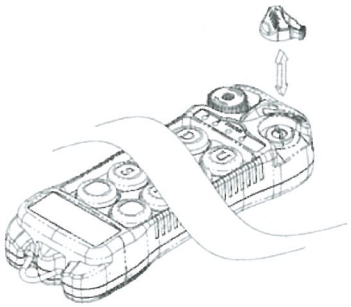
7.1 TRANSMITTER OPERATION

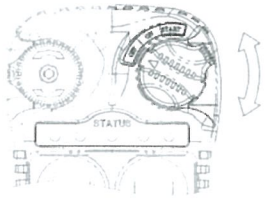
7.1.1 General Operating Procedure

a. Reset the red emergency stop button located on the top left hand side of the transmitter handset by rotating it either clockwise or counter clockwise. The red button will pop up.



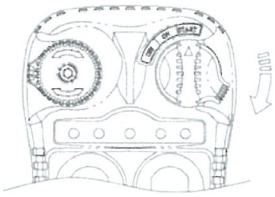
b. Turn on the transmitter power by inserting the black-colored key into the power key slot (located on the top right hand side of the transmitter handset), and rotate it clockwise to "On" position.





c. After turning on the transmitter power, check the Status LED on the transmitter handset for any sign of system irregularities (refer to "Status Light Indicators & Warnings" on page 35). If the system is normal the Status LED will light up green for two (2) seconds.

d. If there are no signs of any system irregularities, then rotate the power key-switch further to START position for up to 1.0 second to activate all transmitter push button functions and as well as the receiver MAIN. Then press any push button on the transmitter to begin operation. Pressing any push button prior to initiating the START command will result in no signal transmitted (blinking orange light).



e. In case of an emergency, pressing down the red emergency stop button will immediately disconnect the receiver MAIN and as well as the transmitter power. To resume operation, rotate the red button clockwise or counter clockwise, it will pop up. Then rotate the power key-switch to START position for up to 1.0 second to activate all transmitter push button functions and the receiver MAIN. Please note that every time when you turn the transmitter power off and back on again, or after resetting the emergency stop button, all push button functions will be locked to avoid any unintentional controls. For safety, initiating the START command after turning on the transmitter power or after resetting the emergency stop button is strictly required.

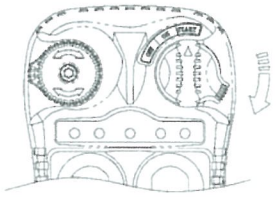
f. After 1 minute of inactivity (push button not pressed) the receiver MAIN will be disconnected temporarily. To resume operation, just press any push button on the transmitter to resume operation (depending on JP3 setting on page 26). If this 1-minute inactivity time is not sufficient for your application, you can also extend this inactivity time from 1 minute up to 3 minutes (refer to Continuous Transmitting Time Adjustment on page 16). The receiver MAIN will also be disconnected temporarily when the receiver encounters strong radio interference or when the operator is controlling the crane or equipment beyond the transmitting range.

g. To turn off the transmitter power just rotate the power key to "Off" position, it will disconnect the transmitter power and the receiver MAIN altogether.

7.1.2 Automatic Channel Scanning Operating Procedure

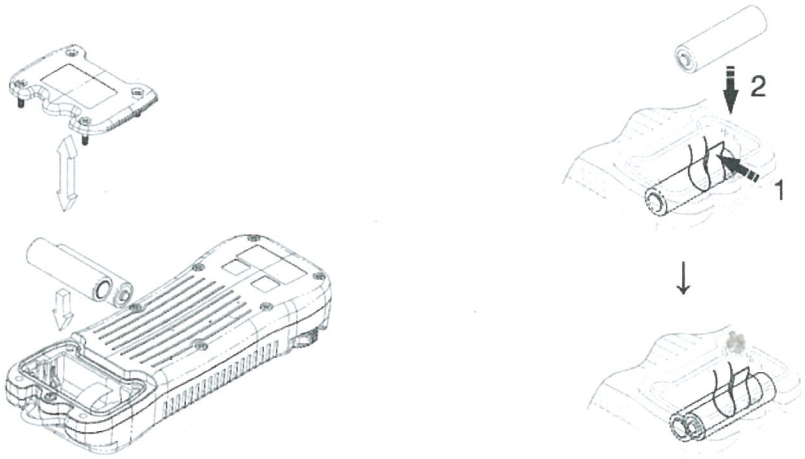
After changing the transmitter channel (refer to page 15), turn on the transmitter power and rotate the power key switch to "Start" position and hold it there for up to 1 minute. Within this 1-minute period the receiver will search (channel 01 - channel 62) and lock onto the newly selected transmitter channel automatically. Please note that in order for the receiver to switch to auto-scanning mode, prior to changing the transmitter channel, you must first deactivate the receiver MAIN by shutting off the transmitter power or press down the emergency stop button. Please refer to page 23 if you do not want the receiver to auto-scan all 62 channels.

Change Transmitter Channel →



7.1.3 Changing Transmitter Batteries

Change the transmitter batteries by unscrewing the battery cover located on the backside of the transmitter (refer to Fig. 17 below). During battery installation make sure that the blue ribbon is centered between the two batteries. After changing the batteries also make sure that all screws are tightened to avoid water, moisture, dirt, grease, or other liquid penetration.



(Fig. 17)

7.2 STATUS LIGHT INDICATORS & WARNINGS

7.2.1 Transmitter STATUS Light Indication

Type	Display Type	Indication
1	Constant red	Voltage below 1.9V at initial power on - transmitter power and receiver MAIN shuts off.
		Voltage below 1.8V during operation - transmitter power and receiver MAIN shuts off.
2	1 red blink followed by a 2-second pause	Voltage goes below 1.85V during operation - change batteries immediately.
3	2 red blinks followed by a 2-second pause	The push button is defective after turning on the transmitter power.
4	No light displayed	When a defective push button condition occurs (2 red blinks, type 3 above), find out which push button is defective by pressing all the push buttons on the transmitter one at a time. If the push button is in good working order, the LED will not light up when pressed. If the push button is defective the LED will continue to display 2 red blinks when pressed.
5	3 red blinks followed by a 2-second pause	EEPROM error.
6	4 red blinks followed by a 2-second pause	Transmitting error; system can not lock on to the designated channel.
7	Constant green for up to 2 seconds	Transmitter power on with no faults detected.
8	Blinking green	Transmission in progress.
9	Blinking orange	Transmitter push button functions locked.

7.2.2 Receiver STATUS Light Indication

Type	Display Type	Indication
1	Fast green blinks	Decoding in process
2	Slow green blinks	Decoding on standby
3	Two red blinks	Receiver MAIN jammed or defective
4	Fast red blinks	Incorrect transmitter serial number/ID code
5	Constant red	Receiver under-voltage, LV output relay activated
6	No light displayed	Decoding microprocessor is defective

7.2.3 Receiver SQ Light Indication

Type	Display Type (Red)	Indication
1	Fast blinks	Transmission received
2	Completely off	No transmission
3	Blinks intermittently	Other radio interference

7.2.4 Receiver POWER Light Indication

Type	Display Type (Red)	Indication
1	On	Power to receiver
2	Off	No power to receiver

7.2.5 Receiver COM Light Indication

Type	Display Type (Red)	Indication
1	On	Power to relay board
2	Off	No power to relay board

7.3 TROUBLE SHOOTING TIPS

Problems	Possible Reasons	Suggestions
No response when transmitter push button is pressed (Improper startup & settings)	Transmitter has low battery power	Check the transmitter battery level.
	Emergency stop button activated prior to startup	Prior to turning on the transmitter power switch make sure that the red emergency stop button is elevated.
	Transmitter push button functions locked	Initiate the Start command by rotating the power key-switch to START position.
	Incorrect system RF channel	Check to ensure that the transmitter handset and receiver unit both have the same channel.
	Incorrect system serial number/ID code	Check to ensure that the transmitter handset and receiver unit both have the same serial number/ID code.
	System out of range	Make sure that the startup procedure is initiated within 100 meters (300 feet) from the receiver location.
No response when transmitter push button is pressed (Damaged hardware)	Defective transmitting and receiving module	Check the SQ display on the face of the receiver unit. If it does not light up when push button is pressed then either the transmitting or receiving module is defective. First replace the transmitting module. If SQ display is still not lit when the push button is pressed, go ahead and replace the receiving module.
	Defective encoder board or decoder module	If still no response, then replace the transmitter encoder board. If it still doesn't work then the decoder module is defective.
No AC power to the receiver	Incorrect input voltage	Make sure the source voltage is set correctly.
	Blown fuse	Check for any blown fuses.
	Incorrect wiring	Check input voltage connection.
Outputs do not correspond to transmitter	Incorrect output connection	Check the system wiring again. Please refer to the output contact diagram inside this manual or on the receiver cover.

8. SYSTEM SPECIFICATIONS

Frequency Range	:	433 - 434 MHz
Frequency Deviation	:	12.5 KHz
Number of Channels	:	62 channels
Modulation	:	Digital Frequency Modulation based on Manchester Code, 20bit address, 32bit CRC Parity Check and Hamming Code.
Encoder & Decoder	:	Microprocessor-controlled
Transmitting Range	:	>100 Meters / 300 Feet
Frequency Control	:	Synthesized PLL (Phase Lock Loop)
Receiver Type	:	Frequency Auto Scanning
Receiver Sensitivity	:	-116dBm
Antenna Impedance	:	50 ohms
Responding Time	:	60 Milliseconds (average)
Transmitting Power	:	0.3mW
Enclosure Type	:	NEMA-4
Enclosure Rating	:	IP-66
Output Contact Rating	:	250V @ 8 Amps
Transmitter Operating Voltage	:	DC 3.0V
Receiver Power Consumption	:	11.0 VA
Receiver Supply Voltage	:	Voltage Setting / Min ~ Max 24VAC (22 ~ 26VAC) 42VAC (38 ~ 46VAC) 48VAC (43 ~ 53VAC) 110VAC (104 ~ 126VAC) 220VAC (207 ~ 253VAC) 380VAC (351 ~ 429VAC) 410VAC (400 ~ 480VAC) 12/24VDC (9 ~ 36VDC)
Operating Temperature	:	-25°C -- 75°C / -13°F -- 167°F
Transmitter Dimension	:	184mm (L) x 69mm (W) x 34mm (H)
Receiver Dimension	:	165mm (L) x 125mm (W) x 75mm (H)
Transmitter Weight	:	242g / 8.5oz
Receiver Weight	:	1.8kg / 4.0 lb (include output cable)

9. DECLARATION OF CONFORMITY

MAGNETEK

EU Declaration of Conformity Certificate

For the following equipment:

Product	: Flex Series Radio Remote Control
Multiple Listee Model No.	: Flex 4ES/EX/EM, Flex 6EX, Flex 8ES/EX/EM, Flex 12ES/EX/EM, Flex 8/12 PRO
Product Receiver Models	: CAN-2, MHR, WIC-2402, Flex 4 RX, Flex 6 RX, Flex 8R X, Flex 12 RX
Transmitter Model Serial Number	:
Receiver Model Seral Number	:
Manufacturer's Name	: Magnetek, Inc.
Manufacturer's Address	: N49 W13650 Campbell Drive Menomonee Falls, WI 53051 USA

The undersigned hereby declares on behalf of Magnetek, that the above-referenced products, to which this declaration relates, is in conformity with the provisions of CE Mark Directive (93/68/EEC), Machinery Safety Directive (MD) 2006/42/EC, Low Voltage Directive (LVD) 2006/95/EC, and Radio and Telecommunications Equipment Directive (R&TTE) 1999/5/EC.

The standards relevant for the evaluation of the product referenced above conformity to the directive requirements are as follows:

EN 301 489-1
EN 301 489-3
EN 300 220-3
EN 60204-1
EN 60204-32

EN 60950-1
EN 60529
EN ISO 13849-1
EN 13557

The European contact for Magnetek is:

Brian Preston
Magnetek
Unit 3, Bedford Business Centre
Mile Road
Bedford
MK42 9TW
United Kingdom

Per Annex II.B of the Machinery Directive (2006/42/EC):

The machinery, product, assembly or sub-assembly covered by this Declaration of Conformity must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of the applicable Directive(s). This statement is only necessary where the product is to be incorporated into a machine or system (e.g. a safety component).

Signature of Authorized Person:

Ben Stoller / Director - Radio Controls
For Magnetek, Inc.
Menomonee Falls, WI USA

February 20, 2014
Date of Issuance

AJT Time-delay/Class J

SmartSpot® with maximum circuit protection

Amp-Trap 2000® SmartSpot AJT fuses now provide a visual open fuse indicator. With advanced material technology the AJT fuse provides IEC Type 2 No Damage protection to main, feeder, and branch circuits, for all types of loads — yet, they require only half the mounting space needed for 600VAC Class RK fuses. AJT's time-delay characteristics are ideal for handling typical motor and transformer inrush currents, while also providing superior current-limiting ability.



Features/Benefits:

- Solid state SmartSpot visual blown fuse indicator
- Time-delay for motor starting and transformer inrush
- 300kA interrupting rating - self-certified, UL witnessed tests
- Extremely current-limiting for low peak let-thru current
- Most current-limiting UL class fuse
- Recommended for Arc Flash energy reduction
- Small footprint requires less mounting space and allows smaller, more economical fuse blocks
- Easy 2-to-1 selectivity for prevention of nuisance shutdowns
- Unique Class J dimensions prevent replacement errors
- High-visibility orange label gives instant brand recognition
- Metal-embossed date and catalog number for traceability and lasting identification
- Fiberglass body provides dimensional stability in harsh industrial settings
- High-grade silica filler ensures fast arc quenching
- Optional EI indicator/switch mount for AJT70 to 600 open fuse indication

Ratings:

Volts : 600VAC or less
: 500VDC or less
Amps : 1 to 600A
IR : 200kA I.R. AC
: 100kA I.R. DC
(Self-certified for 600VAC, 300kA I.R., UL witnessed).

Highlights:

- SmartSpot indicator
- Time-delay
- Highly current-limiting
- Arc Flash mitigating
- DC ratings
- Optional mechanical indicator (70 to 600A fuses)

Applications:

- Motor circuits
- Mains
- Feeders
- Branch circuits
- Lighting, heating & general loads
- Transformers
- Control panels
- Circuit breaker back-up
- Bus duct
- Load centers

Note: See motor fuse applications tables on page P7

Approvals:

AJT (1-600):

- UL listed to standard 248-8 File E2137
- DC listed to UL standard 248
- CSA certified to standard C22.2 No. 248.8
- IEC 269-2-1

AJT (70-600) EI:

- UL listed
- DC tested to UL standard 248

AJT Time-delay/Class J

Catalog Numbers (amps)

AJT1	AJT4-1/2	AJT25	AJT125
AJT1-1/4	AJT5	AJT30	AJT150
AJT1-1/2	AJT5-6/10	AJT35	AJT175
AJT1-6/10	AJT6	AJT40	AJT200
AJT1-8/10	AJT6-1/4	AJT45	AJT225
AJT2	AJT7	AJT50	AJT250
AJT2-1/4	AJT8	AJT60	AJT300
AJT2-1/2	AJT9	AJT70	AJT350
AJT2-8/10	AJT10	AJT80	AJT400
AJT3	AJT12	AJT90	AJT450
AJT3-2/10	AJT15	AJT100	AJT500
AJT3-1/2	AJT17-1/2	AJT110	AJT600
AJT4	AJT20		

Note: SmartSpot visual indicator is not available (1-7A)

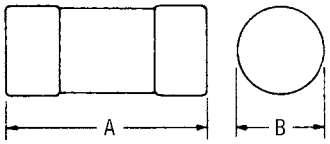
Recommended Fuse Blocks With Box Connectors for Amp-Trap® Class J Fuses

Fuse Ampere Rating	Catalog Number 600V or Less	
	1 Pole	3 Pole
0-30	US3J1I	US3J3I
31-60	US6J1I	US6J3I
61-100	61036J	61038J
101-200	62001J	62003J
201-400	64031J	64033J
401-600	6631J	6633J

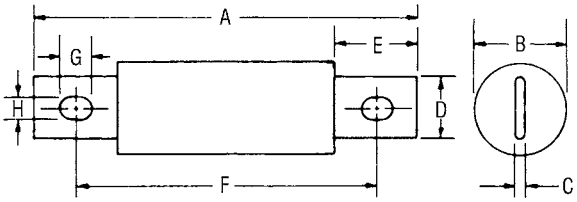
A variety of pole configurations and termination provisions are available, see section H.

Dimensions

Ampere Rating	A		B		C		D		E		F		G		H	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
1-30	2-1/4	57	13/16	21	-	-	-	-	-	-	-	-	-	-	-	-
31-60	2-3/8	60	1-1/16	27	-	-	-	-	-	-	-	-	-	-	-	-
61-100	4-5/8	117	1-1/16	27	1/8	3.2	3/4	19	1	25	3-5/8	92	3/8	10	9/32	7
101-200	5-3/4	146	1-5/8	41	3/16	4.8	1-1/8	29	1-3/8	35	4-3/8	111	3/8	10	9/32	7
201-400	7-1/8	181	2-1/8	54	1/4	6.3	1-5/8	41	1-7/8	48	5-1/4	133	17/32	14	13/32	10
401-600	8	203	2-1/2	64	3/8	9.5	2	51	2-1/8	54	6	152	11/16	18	17/32	13

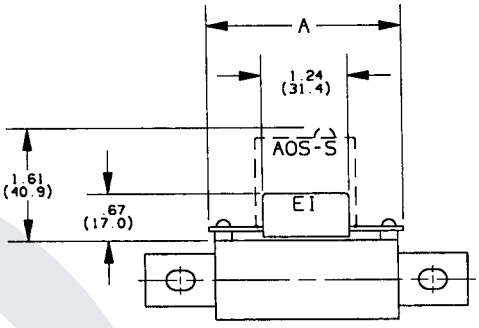


1-60A

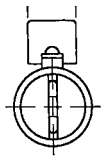


70-600A

Optional Indicator/Microswitch Mount (EI) Dimensions:



Note: Fuses with the EI option are designed to work with the AOS-S or AOS-Q add-on switch, which is ordered separately. See page J6 for details.



Catalog Number	A
AJT (70-100)-EI	2.8 (71.0)
AJT (110-200)-EI	3.22 (81.8)
AJT (225-400)-EI	3.24 (82.2)
AJT (450-600)-EI	3.61 (91.8)

Kay Industries
PHASEMASTER®
Rotary Phase Converters

INSTALLATION MANUAL

TYPE MA General Purpose Multi-motor Converter
TYPE MA-A Type MA Converter with automatic control
TYPE MA-R Type MA Converter with switch and fuses

CONTENTS

I. BEFORE YOU START 2
II. SIZING THE SINGLE-PHASE SERVICE - FUSE RATINGS AND WIRE SIZES 3
III. INSTALLATION 3
- SELECTING CONVERTER LOCATION 3
- GENERAL WIRING INSTRUCTIONS TYPE MA 4
- CONNECTING TYPE MA-R CONVERTER WITH BUILT-IN SWITCH 5
- CONNECTING TYPE MA-A AUTOMATIC CONVERTER 5,6
- 0302-MA CONNECTION DIAGRAM 7
- 0302-AUTO CONNECTION DIAGRAM 8
- 0302-MA-R CONNECTION DIAGRAM 9

IV. CONVERTER CHECKOUT 10
V. OPERATION & MAINTENANCE 11
- LUBRICATION 11
- INSPECTION 11
- MAINTENANCE SCHEDULE 11

VI. IN CASE OF TROUBLE 12

WARRANTY

Kay Industries, Inc. (the manufacturer) guarantees all products of our manufacture against faulty material or workmanship for a period of two years from date of installation or 25 months from date of shipment from factory, whichever period first expires.

Any part that you return to us within this warranty period showing unmistakable defect in material or workmanship will be renewed or replaced at our option F.O.B. factory without charge. The final decision that an original defect existed shall rest with the manufacturer.

The liability of the Company is limited to the renewal or replacement of the defective part. In no case will the Company be liable for damage or loss incurred because of interruption of service or for consequential damages, transportation, labor or expense required to repair or replace defective units.

Kay Industries will not be responsible if its products have been improperly installed in any way. This warranty shall not apply to any of the manufacturer's products that must be replaced because of normal wear, that have been subjected to misapplication, misuse, neglect, accident or that have been repaired or altered outside of the manufacturer's factory unless expressly authorized by the manufacturer.

I. BEFORE YOU START

Kay Industries has designed the **Phasemaster®** Rotary Phase Converter for ease of installation by anyone having basic electrical knowledge and mechanical skills. If you are unsure of how to proceed or do not thoroughly understand these instructions, we strongly recommend that you obtain the assistance of a licensed electrician.

These instructions are based upon Article 455 of the National Electric Code. Although we present a practical set of guidelines for converter installation, we do not intend to supersede or modify the requirements of the National Electric Code or any applicable local codes. We suggest that you consult these references to determine whether your particular installation complies with applicable regulations.

Verify that the load does not exceed the "Largest Motor" rating on the converter nameplate. We also suggest that you ***temporarily connect the phase converter and the load*** to verify performance before proceeding with the permanent installation.

Whether this is your first phase converter installation or your one-hundredth, there are a few do's and don'ts that you should observe:

DO:	DON'T:
DO: Fuse the converter separately from all other loads. Use only properly sized dual element time delay fuses sized according to the Selection Chart on Drawing 0302-MA.	**DON'T:** Use circuit breakers instead of a fused switch to protect the converter. They do not withstand the repeated inrush current required to start the phase converter. The breaker will either trip during starting, thus preventing the converter from reaching full speed, or it will cause a shutdown of the converter that could result in damage to the connected load. Increasing the size of the breaker will result in poor protection that could damage the converter and wiring. It is okay to use a circuit breaker in the single-phase panel that feeds the converter and load if that breaker is sized according to the procedures described in this instruction book.
DO: Always be certain that power is off before removing any covers or connecting any wires.	**DON'T:** Draw any other single-phase load through the converter fuses. Refer to installation drawing 0302-MA.
DO: Remove the converter from the skid	**DON'T:** Bolt the converter down.
DO: Use the ring terminals connected to the converter wires. Crimp only with an approved crimping tool of the correct size for the terminals.	**DON'T:** Use wire nuts or twist type connectors to connect the converter.
DO: Connect all single-phase loads, including controls, only to L1 and L2.	**DON'T:** Connect the manufactured leg T3 to any control circuits or to any single-phase loads.
DO: Insulate all connections with rubber and plastic tape or heat shrinkable tubing.	**DON'T:** Use plastic tape only. It does not have the required mechanical strength to protect the electrical connection.

Failure to observe these basic precautions accounts for the majority of converter system failures.

READ THIS SECTION CAREFULLY!
MORE THAN HALF OF ALL "CONVERTER" PROBLEMS RESULT FROM INADEQUATE SINGLE-PHASE SERVICE SIZE AND/OR UNDERSIZED BRANCH CIRCUIT BREAKERS

II. SIZING THE SINGLE-PHASE SERVICE - FUSE RATINGS AND WIRE SIZES

It is extremely important to verify that you have adequate single-phase service for the total planned load. The maximum 3-phase current that you can draw is about 50% of the single-phase service. That means a 200A single-phase service will give you approximately 100A of 3-phase through the converter. You must also select the proper size single-phase branch circuit to supply your converter and load.

The converter consumes very little energy when running under load. The service size and branch circuit rating are determined ***only*** by the amount of connected three-phase load.

To determine your total three-phase load demand:

- Add the total 3-phase full load currents for every load that will operate simultaneously. As a rule you can estimate that every motor will draw 2.5 amps per horsepower at 230 volts. For example, if you plan to run 20 HP simultaneously, your 3-phase full load current will be 50 amps. If you are operating at 208 or 460 volts you must adjust the current accordingly. Use 2.8 amps/HP for 208 volts and 1.25 amps/HP for 460 volts.

To determine the required single-phase branch circuit to feed the converter and load:

- Multiply the total 3-phase full load current by 1.73. This is the exact single-phase current which will you will draw. It is also the ***absolute minimum single-phase service*** you will need to operate the load. However, the National Electric Code requires that you multiply the 3-phase current by 2.5 (instead of 1.73) to allow for an adequate overload and safety margin. This is a conservative way to select your wire and branch circuit size and will assure your compliance with code. **If you use a breaker of smaller rating than called for by this calculation, it may trip when the converter starts or may be too small to handle the entire planned load.**

To determine the single and 3-phase wire size required, disconnect switch and fuse ratings:

- Refer to the table and diagram on drawing 0302-MA, 0302-AUTO or 0302-MAR

Check the nameplate and note the type of your converter for the proper connection drawing:

Type **MA** converters (Model number format MA-2) require a separately mounted fused switch to turn the converter on and to provide short circuit protection for the converter. Refer to drawing 0302-MA.

Type **MA-A** converters (Model number format MA-2-A) contain fuses and magnetic controls and **do not** require a separate fused switch. Refer to drawing 0302-AUTO

Type **MA-R** converters (Model number format MA-2-R) include a manually operated built-in and switch and fuses. Refer to drawing 0302-MAR

III. INSTALLATION

BEFORE YOU CONNECT ANY WIRES
Be sure all POWER IS OFF at the main panel.

SELECTING A CONVERTER LOCATION

Pick a location as close as practical to the incoming single-phase service panel or if preferred, near the 3-phase load. It must be a dry location with adequate ventilation free of dirt, filings, chips, sawdust and other debris that could enter the converter through the ventilation intakes. The converter warranty does not cover failure caused by water or foreign material ingress. Kay Industries also offers weatherproof enclosures for outdoor installation.

GENERAL WIRING INSTRUCTIONS

1. Remove the converter from the skid and set it in place on the mounting pads included in the package. **Do not bolt the converter to the floor or any other mounting surface.** Rigid mounting amplifies noise, increases internal vibrations that can loosen terminals and can distort the frame causing the rotor to lock. Kay Industries recommends making a temporary connection to verify the converter is adequate for the load before finalizing the installation. This can be done quickly and may save a great deal of time and labor if an exchange is necessary.

2. Type MA converters are pre-wired to operate on 230 volts unless ordered otherwise. Do not reconnect the leads in the junction box unless you need to operate the converter on 460 volts input. The 460-volt option is only available if indicated on the nameplate. The reconnection diagram is inside the junction box cover. The input voltage of Type MA-A and MA-R converters cannot be changed without additional modifications. Consult Kay Industries if this change is necessary. All phase converters produce three-wire delta output only. ***For four-wire wye output, consult the factory for an appropriate transformer.***

3. For Type MA Converters, mount the fused disconnect switch as close as practical to the converter. Connect the disconnect switch to the single-phase branch circuit wire at the service with wire size not less than shown on Drawing 0302-MA. If the location of the converter is more than 50 feet from the service panel or if using aluminum wire, then increase the wire size appropriately.

4. Connect the load side of your fused disconnect to the converter leads marked L1 and L2 in the junction box. Lead T3 is the manufactured phase. If you are using a three-pole fused disconnect, connect T3 to the third pole on the load side of the switch. If you are using a two-pole disconnect, run T3 directly to the line side of the load disconnect or other load switching device.

5. Connect the single-phase power supply from the line side of your fused disconnect to the L1 and L2 terminals of the load disconnect switch.

6. Ground the converter by attaching the system ground wire to the ground lug in the converter junction box. If you have not grounded your load, do so before proceeding.

Label all wires "L1", "L2" and "T3" uniformly throughout the entire system. This will avoid confusion in wire tracing should any troubleshooting become necessary later.

CONNECTING THE TYPE MA-R CONVERTER WITH BUILT-IN SWITCH AND FUSES

The Type MA-R converter includes built-in switch and fuses which have been appropriately sized for the load. Installation is very simple. Determine the proper single and three-phase wire size from the table in drawing 0302-MAR.

After setting the converter in place, route the three-phase output power cables and ground conductor in properly sized conduit from the phase converter control enclosure to the load and from the service panel to the converter. Make the necessary penetrations in the converter enclosure and secure the conduits at both ends. If you are using flexible multi-conductor cable instead of wiring in rigid or flexible conduit, be certain to use a suitable strain relief fitting where the cables enter and leave the converter enclosure.

Connect the single-phase supply lines L1, L2, and Ground to the input terminal blocks on the converter connection panel. Connect the output cables to the output terminals labeled T1, T2 and T3.

CONNECTING THE TYPE MA-A AUTOMATIC PHASEMASTER CONVERTER

The Phasemaster Automatic rotary phase converter (Type MA-A) is identical in operation and performance to the non-automatic converter (Type MA) except that it is equipped with built-in time delay fuses to protect the converter and controls which allow the converter

- To be remotely started before starting the load
- To shut down when the load is off
- To prevent the load from starting unless the converter is running.

Before proceeding with the installation we suggest you review drawing 0302-AUTO to become familiar with how the converter is connected and electrically interlocked with the load equipment. The Type MA-A converter is designed to turn on and off as required by the load. This control arrangement is accomplished using an adjustable time-delay relay and magnetic contactor that are built into a side mounted pre-wired enclosure.

Type **MA-A** converter connections are divided into three groups. Group 1 supplies single-phase power to the converter. Group 2 controls the starting and stopping of the phase converter. Group 3 wiring coordinates the starting of the converter with the load.

Group 1: Single-phase power connections to the converter
Determine the proper size single-phase branch circuit for the load. This calculation is described in detail in Section II. Route the single-phase input power cables and ground conductor in properly sized conduit from your branch circuit and/or disconnect to the phase converter control enclosure. Use the existing knock-out provided or make a new penetration in the enclosure appropriate to conduit size and secure the conduit at both ends.

Group 2: Three-phase power connections from the converter to the load
Route the three-phase output power cables and ground conductor in properly sized conduit from the phase converter control enclosure to the load. If required, make a new penetration in the enclosure appropriate to your installation and secure the conduit at both ends.

Group 3: Control power connections between the converter and the load
Wire these circuits with an appropriate length of 4 or 5 conductor cable or individual conductors within a conduit. (Four conductors are actually required, but it doesn't hurt to have a spare when dealing with control wiring.) Wire size AWG 14 is adequate for all control wiring. Route this wire between the load and the phase converter control enclosure.

Group 1 & 2 Wiring:
With conduits and cables in place, you are ready to make the power connections.

1. Connect the Group 1 input power leads to L1 and L2 on the input terminal block in the converter enclosure. Connect the ground (NOT NEUTRAL) wire to the terminal marked "Ground". Make the corresponding connections in your branch circuit panel.

2. Connect the ground cable from your load to the terminal marked "Ground".

3. Connect the Group 2 load cables to the output terminal block to the output terminals designated T1, T2, and T3 in the starter panel enclosure. Tighten the terminal blocks and label the cables at both ends T1, T2, and T3 to correspond with the connections within the converter enclosure. Later, you may change these connections at the load to obtain the correct rotation, but keep the labels on the cables so that they are marked consistently throughout the system.

4. Be sure that T3 is not supplying power to any relays or other control components inside the load.

Group 3 Wiring: Connecting the type MA-A converter with the load controller

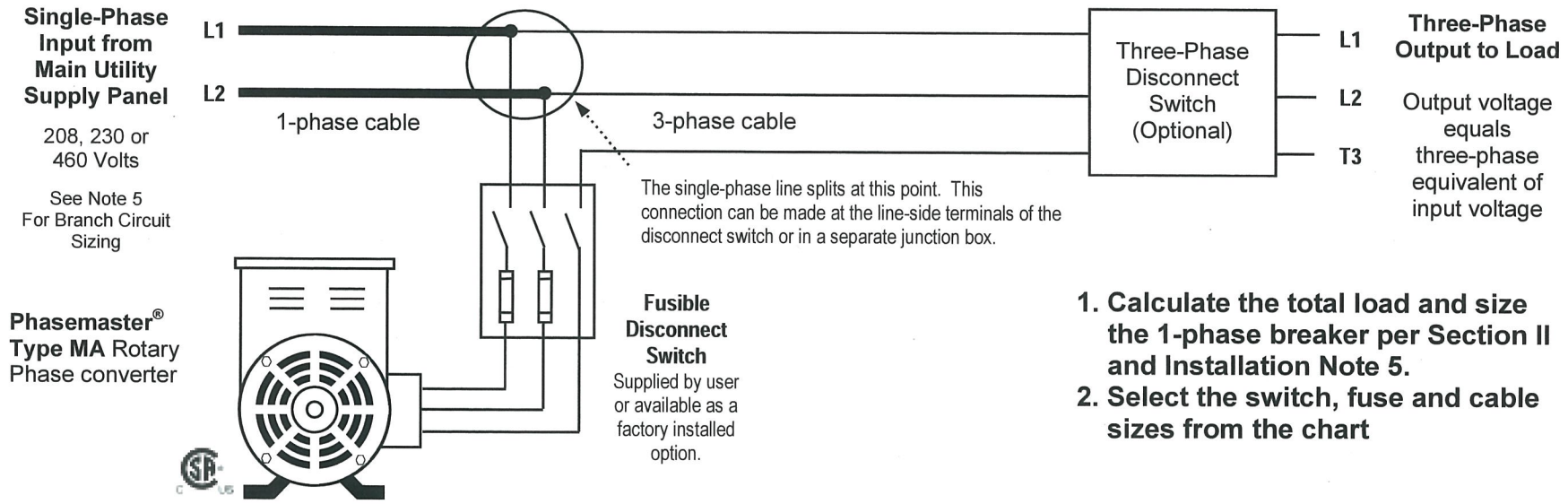
Generally, the load is equipped with a stop-start switch or some other type of pilot control or actuator switch. This actuator could be a pressure switch on a compressor, a thermostat on an air conditioner, or a float switch on a pump. Each of these pilot switches is connected to the starter circuit of the load equipment. Since these start-stop arrangements differ widely among equipment types and manufacturers, there is no single method of connecting them all. However the following information will aid you in connecting the control circuits.

The phase converter must be operating before the load can be turned on. To accomplish this, the pilot control (actuator switch) of the load must be connected to the converter. The converter contains a timing relay that will close an output control contact after a short time delay. This will assure that the converter is started and 3-phase power is available at the load terminals.

1. Using two (2) of the Group 3 control wires installed, connect the load's start-stop switch or normally open starting contact across the terminals marked "Actuator Contacts From Load Controller" in the converter enclosure. Note, unless you have specified a low voltage control for the converter, there will be 230 volts present across these contacts. The actuator contacts from your pilot control (PLC, float switch, pressure switch, etc.) which turn the converter on and off must be rated for 230 volts.

2. The remaining two (2) Group 3 control wires will be connected inside the converter control enclosure to the terminals marked "Output to Load Controller." This is a timed contact which will close when the converter is up to speed. Connect the opposite end of these wires in series with the load contactor circuit between the contactor coil and the control voltage source. Consult the load controller wiring diagram if necessary to determine the best point to break into the control circuit. The "dry contact" from the time-delay relay of the converter will now make and break the load contactor voltage as the converter is turned on and off whenever the load is called for by the load actuator switch.

After tightening all terminals and checking wiring, adjust the time-delay relay to approximately 10 seconds, start the converter and observe that the load does not become energized until after the converter has reached full speed. If the converter does not reach full speed within ten seconds, there may be problem of excessive utility line voltage drop or inadequate transformer capacity. Refer to the section of the main manual titled **In Case of Trouble**. If the load starts before the converter reaches full speed, increase the time on the time-delay relay. Once the time delay relay is set up, turn off all power and replace all covers.



1. Calculate the total load and size the 1-phase breaker per Section II and Installation Note 5.
2. Select the switch, fuse and cable sizes from the chart

DISCONNECT SWITCH AND WIRE SIZE SELECTION CHART

Model No.	Start HP	230 Volts				460 Volts			
		Switch	Fuse	1-Ph Cable	3-Ph Cable	Switch	Fuse	1-Ph Cable	3-Ph Cable
SD-60	1.5	30	10	#12	#12	30	5	#12	#12
MA-00	2	30	15	10	12	30	7.5	12	12
MA-0	3	30	20	8	10	30	10	10	12
MA-1	5	30	30	8	10	30	15	10	12
MA-1B	7.5	60	35	6	8	30	15	8	12
MA-2	10	60	40	4	8	30	20	8	10
MA-3	15	60	60	1	6	30	30	6	10
MA-4	20	100	80	1/0	4	60	40	4	8
MA-5	25	100	100	3/0	4	60	50	2	6
MA-6	30	200	125	4/0	2	60	60	1/0	6
MA-7	40	200	150	2-1/0	1/0	100	75	2/0	4
MA-8	50	200	175	2-2/0	2/0	100	80	2/0	4
MA-9	60	200	200	2-2/0	3/0	100	100	3/0	2
MA-10	75	N/A	N/A	N/A	N/A	200	150	N/A	1/0

INSTALLATION NOTES

1. This diagram does not replace or supersede any requirements of local, state or national electric codes.
2. Use only dual element time delay fuses to protect the phase converter.
3. Do not bolt converter to floor. Use vibration pads supplied with unit.
4. Do not connect control circuits to manufactured phase, T3.
5. National Electric Code (NEC) requires single-phase cable and branch circuit to be rated for 250% of three-phase load current.
6. The 3-pole converter switch is used to provide electrical isolation when the converter is off. But it is only necessary to fuse converter input lines L1 & L2. T3 is not fused. A 2-pole fusible switch may be substituted if the optional 3-pole load disconnect is used.
7. No-load output voltage L2-T3 will exceed L1-L2 by 12-15%. Voltages will balance when load is connected.

Wiring Notes:
- Conductor sizes are based on type THHN, 90° C, copper conductors in 30° C max. ambient.
- These are minimum recommended sizes for the load motor HP rating indicated.
- For larger loads refer to installation note 5 and increase conductor size accordingly.
- Increase wire size for Aluminum conductors or runs in excess of 50 feet.
- Consult National Electric Code for runs in excess of 50 feet or for aluminum conductors.
- Do not use circuit breakers. See Installation Note 2.

Connection Diagram for **Phasemaster** Rotary Phase Converter with Field Mounted Manual Controls

0302-MA

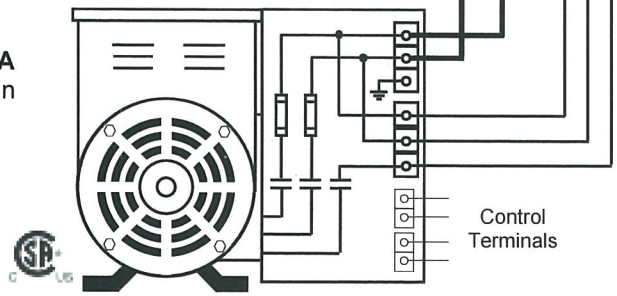
Single-Phase Input from Main Utility Supply Panel

L1
L2

T1
T2
T3

Three-Phase Output to load

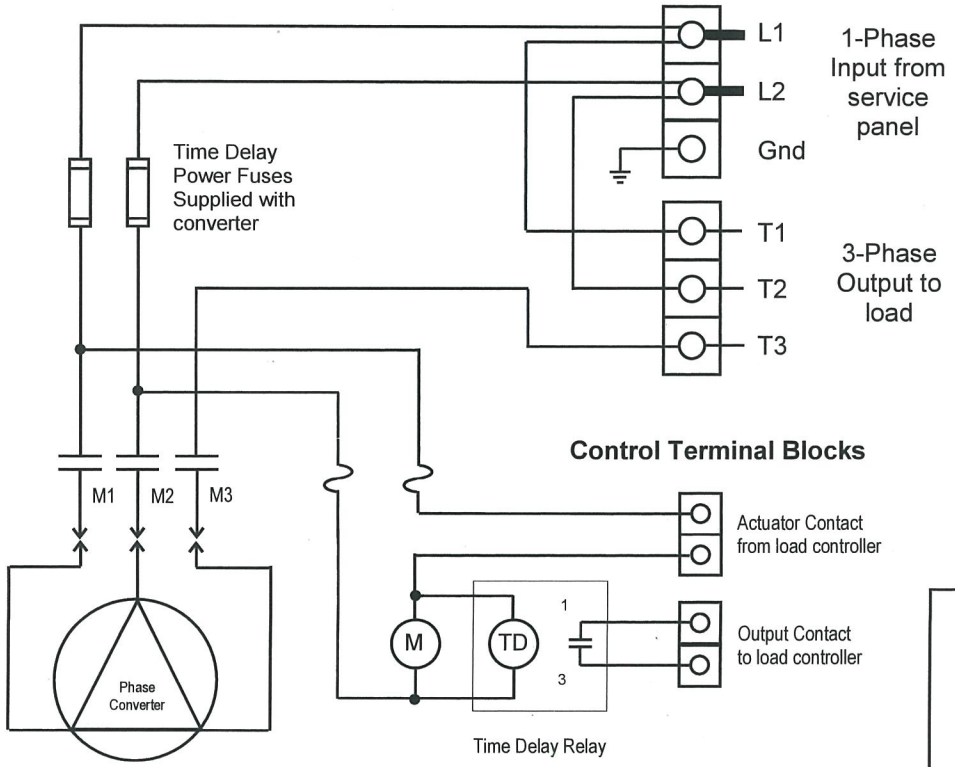
Phasemaster® Type **MA-A or DP-A** Rotary Phase Converter with built-in fuses and automatic magnetic contols for remote actuation.



Sequence of Operation

1. Input actuator contact from load controller closes magnetic starter M and energizes timing relay TD.
2. Converter starts and the adjustable timing relay waits 1-5 seconds until converter reaches full speed.
3. Output contacts 1-3 then close allowing the load to start.

Control Panel Connection Detail



WIRE SIZE SELECTION CHART							
Model No.	Start HP**	230 Volts			460 Volts		
		Fuse*	1-Ph Cable	3-Ph Cable	Fuse*	1-Ph Cable	3-Ph Cable
SD-60-A	1.5	10	#12	#12	5	#12	#12
MA-00-A	2	15	10	12	7.5	12	12
MA/DP-0-A	3/2	20	8	10	10	10	12
MA/DP-1-A	5/3	30	8	10	15	10	12
MA/DP-1B-A	7.5/5	35	6	8	15	8	12
MA/DP-2-A	10/7.5	40	4	8	20	8	10
MA/DP-3-A	15/10	60	1	6	30	6	10
MA/DP-4-A	20/15	80	1/0	4	40	4	8
MA/DP-5-A	25/20	100	3/0	4	50	2	6
MA/DP-6-A	30/25	125	4/0	2	60	1/0	6
MA/DP-7-A	40/30	150	2-1/0	1/0	75	2/0	4
MA/DP-8-A	50/40	175	2-2/0	2/0	80	2/0	4
MA/DP-9-A	60/50	200	2-2/0	3/0	100	3/0	2
MA/DP-10-A	75/60	N/A	N/A	N/A	150	4/0	1/0

* Supplied with converter
** MA-A Start HP/DP-A Start HP

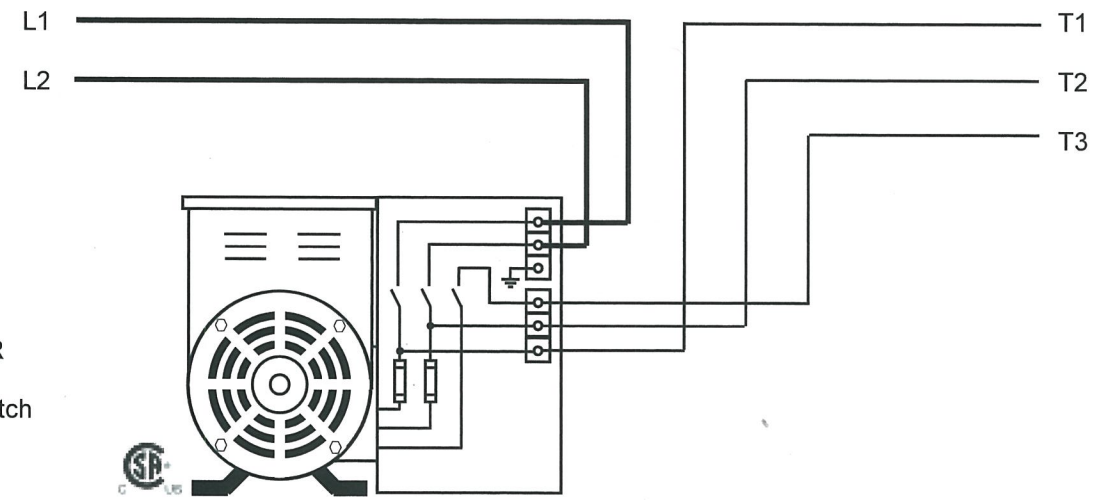
Connection Diagram for Type MA-A and DP-A **Phasemaster** Rotary Phase Converter with automatic controls

0302-AUTO

Single-Phase Input from Main Utility Supply Panel

208, 230 or 460 Volts

See Note 5 For Branch Circuit Sizing



Three-Phase Output to Load

Output voltage equals 3-phase equivalent of input voltage

See Note 4

Phasemaster® Type **MA-R** Rotary Phase Converter with built-in disconnect switch and fuses

WIRE SIZE SELECTION CHART

Model No.	Start HP	230 Volts				460 Volts			
		Switch*	Fuse*	1-Ph Cable	3-Ph Cable	Switch*	Fuse*	1-Ph Cable	3-Ph Cable
SD-60-R	1.5	30	10	#12	#12	30	5	#12	#12
MA-00-R	2	30	15	10	12	30	7.5	12	12
MA-0-R	3	30	20	8	10	30	10	10	12
MA-1-R	5	30	30	8	10	30	15	10	12
MA-1B-R	7.5	60	35	6	8	30	15	8	12
MA-2-R	10	60	40	4	8	30	20	8	10
MA-3-R	15	60	60	1	6	30	30	6	10
MA-4-R	20	100	80	1/0	4	60	40	4	8
MA-5-R	25	100	100	3/0	4	60	50	2	6
MA-6-R	30	200	125	4/0	2	60	60	1/0	6

* Supplied with converter

INSTALLATION NOTES

1. This diagram does not replace or supersede any requirements of local, state or national electric codes.
2. Fuses are supplied with converter. Use only dual element time delay fuses as replacements.
3. Do not bolt converter to floor. Use vibration pads supplied with unit.
4. Do not connect control circuits to manufactured phase, T3.
5. National Electric Code (NEC) requires single-phase cable and branch circuit to be rated for 250% of three-phase load current.
6. No-load output voltage L2-T3 will exceed L1-L2 by 12-15%.

Wiring Notes:

- Conductor sizes based on type THHN, 90° C, copper in 30° C max. ambient.
- These are minimum recommended sizes for the load motor HP rating indicated.
- For larger loads refer to installation note 5 and increase conductor size accordingly.
- Increase wire size for Aluminum conductors or runs in excess of 50 feet.
- Consult National Electric Code for runs in excess of 50 feet or for aluminum conductors.

Connection Diagram for **Phasemaster** Rotary Phase Converter with built-in Switch and Fuses

0302-MAR

IV. CONVERTER CHECKOUT

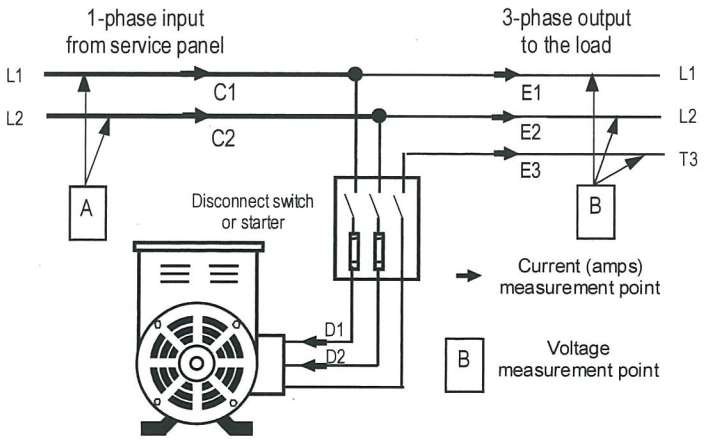
1. Start the converter. Small converters (10 HP and below) should reach full speed in about two seconds. Larger units may require up to seven seconds. Every converter is factory tested prior to shipment and is well within these time limits. If the converter takes longer to reach full speed, your line voltage is dropping which means your service may be inadequate.

2. Check the single-phase utility input supply voltage between L1 and L2 with a voltmeter. It should be 220 to 240 volts on a nominal 230 volt system. In general you should not allow the input voltage to exceed 240 volts on a 230 volt system or 480 volts on a 460 volt system. If the input voltage is too high, the result could be excessive manufactured phase voltage accompanied by load current imbalance.

3. IF YOUR **INCOMING** LINE VOLTAGE EXCEEDS 240 VOLTS, you may need to have the utility company reduce the incoming voltage or install a buck-boost transformer to drop the voltage to an acceptable level. Consult Kay Industries on this subject if you have questions about how to proceed.

4. Refer to the diagram below and measure the voltages between L1-L2, L1-T3, and L2-T3 at points A and B with the converter running but with the load equipment turned off. These are the no load idle voltages. The L2-T3 voltage is the manufactured phase voltage. It will be higher than the other voltages. All voltage measurements should be taken line-to-line. Line-to-ground voltages **are not** significant measurements of converter performance.

5. The normal output voltage measured between L2 and T3 will range from 260 to 290 volts on a 230 volt system and 490 to 525 volts on a 460 volt system depending upon the input voltage between L1 and L2. This is a **normal** idle condition. There is no danger to the load from the L2-T3 voltage. Although it is somewhat high when there is no load, this voltage will drop when the converter begins to supply power to a load and will balance within 2-5% of the other phase voltages as the converter approaches full load.



Voltage Measurements			
Meter Point	Lines measured	Converter on Load off	Converter on Load running
A	L1-L2		
B	L1-L2		
B	L1-T3		
B	L2-T3		
Current (Amperage) Measurements			
	Amps Measured	No Load	Load Running
C1	Total		
C2	Total		
D1	Converter		
D2	Converter		
E1	Load	0	
E2	Load	0	
E3	Load	0	

6. Make a record of all voltages at each measurement point and retain these readings in a log for future reference. Large deviations could indicate problems with either the utility supply voltage or the load conditions.

7. If load motors rotate the backwards, reverse the L-1, L-2 connections at the load.

V. OPERATION & MAINTENANCE

The **Phasemaster®** converter may operate continuously with or without a load. However, the converter operating temperature and noise level will be higher at no-load than under loaded conditions. The converter will not be damaged nor will it overheat if operated unloaded.

1. **Never start the Phasemaster® converter under load.**
2. Wait until the converter reaches full speed before turning on any load.
3. Whenever possible, avoid applying more than one load at the same time.

MAINTENANCE

The converter requires very little maintenance other than periodic lubrication, cleaning and inspection.

LUBRICATION

Phasemaster® converter bearings are pre-packed with a heat, moisture, and rust resisting polyurea based lubricant rated to operate in the temperature range of -35 to +350° F. This initial charge plus a generous additional amount placed in the bearing housing during manufacturing is normally enough to last the lifetime of the bearing. Converters exposed to severe operating conditions of high heat, moisture, dirt or limited ventilation require periodic lubrication. To grease the bearings in a smaller converter not having grease fittings, remove the end-bells and remove the excess grease. Replace it with a generous supply of a compatible lubricant such as Chevron SRI. To lubricate a larger converter, inject a small amount of grease slowly into the grease fittings. Do not use high-pressure equipment. Take care not to saturate the windings with grease over an extended time. Remember, this grease goes somewhere when it leaves the bearing. **Lithium based lubricants are incompatible and may cause bearing failure.**

INSPECTION

Inspect the converter periodically to verify the ventilation slots are clear. In dusty or dirty environments, remove the end-bells and clean the windings of excess grease, dust and debris. On Type MA-A or MA-R converters, inspect all power and control components for loose connections and damaged or pitted contacts. Clean, tighten or replace as necessary.

MAINTENANCE SCHEDULE

Action	Monthly	Semi-Annual	Annual	Bi-Annual
Grease Bearings with Chevron SRI or an equivalent lubricant.			X	
Check voltage L2-T3 and record in log.	X			
Listen for abnormal noise or excessive vibration. Tighten rods and bolts if needed.	X			
Shut down converter and blow out dust and debris from stator.		X		
Open control compartment and inspect power and control connections and contacts. Clean and tighten terminals.			X	
Remove end bells and rotor. Clean Stator. Check bearings for wear. Reassemble using 40 Ft-Lb. torque on all bolts and nuts.				X

This is a suggested maintenance schedule. Your particular application may require more or less frequent attention. We suggest that you begin with this schedule and modify it as needed over time. The **Phasemaster®** rotary converter is a highly reliable machine. With this equipment, as with all electromechanical devices, problems do occur. If you experience difficulty, our factory engineers will be happy to assist you by telephone.

VI. IN CASE OF TROUBLE

Condition	What to look for	Corrective action
Converter does not start. No sound.	Check power source with a voltmeter. L-1 to L-2 should read 230 volts (or 460 volts in a 460 volt system.	Restore power. Reset main breaker and replace with correct size if too small.
	Check the fuses by removing them and testing with a continuity checker or ohmmeter.	Replace fuses if needed.
	Check for loose terminals. Be sure lugs are not crimped on cable insulation.	Tighten or re-terminate as required.
Converter hums but does not start.	Be sure that no load device is starting with the Phasemaster. The converter should be running before any load is placed on it	Turn off all loads and re-start the Phasemaster.
	Be sure that the incoming single-phase lines (L-1 and L-2) are properly connected to L-1 and L-2 in the converter junction box. Do not connect either incoming line to T-3 of the converter.	Connect the power source to L-1 and L-2 in the converter. Connect T-3 to the load only.
	Make sure the rotor moves freely by moving it with a screwdriver or other tool with power off.	Loosen bolts and re-tighten to free rotor. If rotor does not turn freely after doing this, call factory.
Converter starts and breakers trip	Check to be certain of the time-delay characteristics of the breakers. They should have similar characteristics to time delay fuses. Ordinary household type breakers are not suitable.	Replace with delay type breakers or time delay fuses. Do not oversize the breakers.
Load(s) always trip overloads during or shortly after startup	Check the line voltage (L-1 to L-2) with an analog voltmeter during start and determine the amount of line voltage drop. Check transformer capacity. If the line voltage drops more than 10% of no load line voltage, take corrective action.	Increase supply line cable size and transformer size if required. Your power company can usually help with transformer problems.
A loud humming noise or chatter comes from the load starting relay.	Check voltage between L-2 and T-3. If voltage remains below 200 volts (for a 230 volt system) or 185 volts (for a 208 volt system)after the motor starts, the converter is too small for the application.	Contact factory for further assistance or possible exchange.
	The manufactured phase T-3 could be connected to the motor starting relay. Check to ensure correct voltage on this relay coil.	Rewire the control coil circuit so that T-3 does not energize the starter coil.
The voltage measured between L-2 and T-3 is about 30-40 volts higher than the line voltage (L-1 to L-2) with no load applied to the Phasemaster.	This is a normal condition and verifies correct operation of the Phasemaster. When the load is applied, this voltage will be reduced as the load increases. No damage will occur to properly connected equipment.	This condition requires no action.
Load does not start or run properly.	Check the converter output voltages under load conditions. L1 to L2 should remain within a few volts of 230 or 460. L2 to T3 may drop momentarily below 180 (or 400) but recover to 220 (440) or above.	If the L2 to T3 voltage remains below 210 (420) volts, the converter may be too small for the application. Contact factory for recommendations or possible exchange.
Excessive noise or vibration.	Noise and vibration are usually the result of a resonance caused by a mounting surface that does not support the converter well. These problems also occur when the converter is bolted tightly to any surface.	Be sure to remove the converter from the shipping skid and place it on a substantial floor using the shock absorbing pads supplied with the converter. Do not bolt the converter to any surface.
The three-phase currents are not equal.	If the load comes up to its rated load and none of its three legs exceeds its nameplate F.L.A. rating, there is no problem. If the L1 and L2 legs are significantly higher than the T3 leg (measured at the load input, not the converter input) then a larger converter or correction capacitors may be required.	Consult with factory to review application.

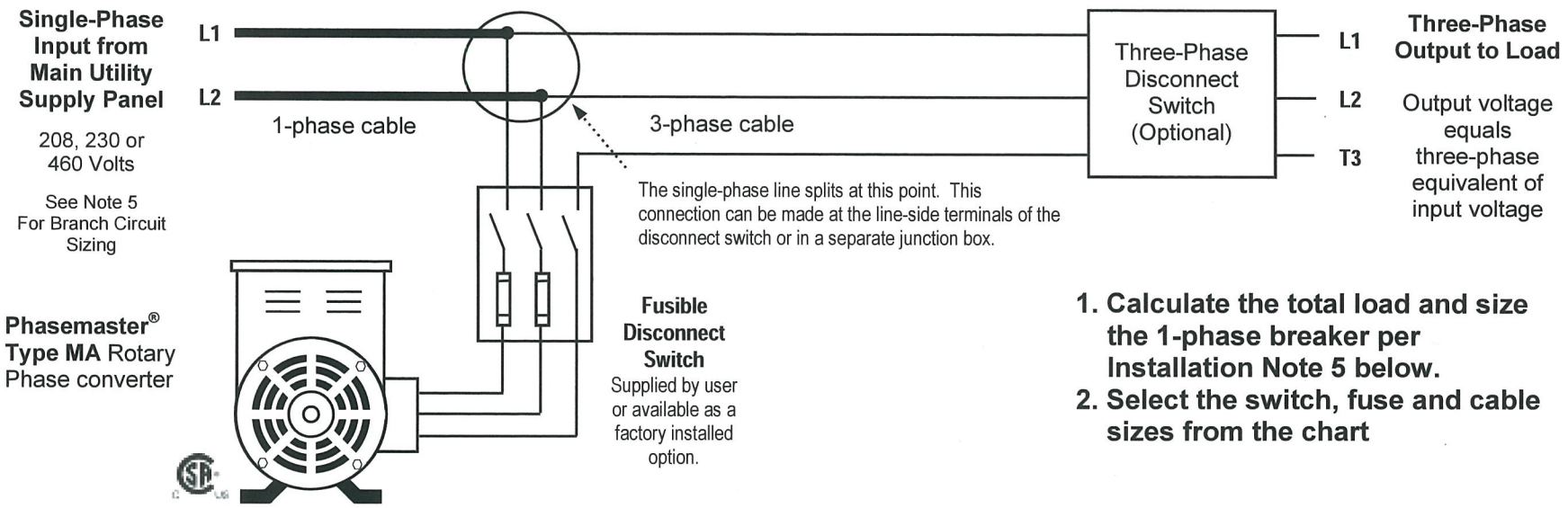
Kay Industries
PHASEMASTER®
Rotary Phase Converters

Corporate Office
604 N. Hill St.
South Bend, IN 46617
800-348-5257 • 574-289-5932(fax)
www.kayind.com

Western Region Office
4127 Bay St. Suite 6
Fremont, CA 94538
510-656-8766 • 510-657-7283 (fax
info@kayind.com

© Kay Industries, Inc. 2002

Effective 6-1-02



1. Calculate the total load and size the 1-phase breaker per Installation Note 5 below.
2. Select the switch, fuse and cable sizes from the chart

DISCONNECT SWITCH AND WIRE SIZE SELECTION CHART

Model No.	Start HP	230 Volts				460 Volts			
		Switch	Fuse	1-Ph Cable	3-Ph Cable	Switch	Fuse	1-Ph Cable	3-Ph Cable
SD-60	1.5	30	10	#12	#12	30	5	#12	#12
MA-00	2	30	15	10	12	30	7.5	12	12
MA-0	3	30	20	8	10	30	10	10	12
MA-1	5	30	30	8	10	30	15	10	12
MA-1B	7.5	60	35	6	8	30	15	8	12
MA-2	10	60	40	4	8	30	20	8	10
MA-3	15	60	60	1	6	30	30	6	10
MA-4	20	100	80	1/0	4	60	40	4	8
MA-5	25	100	100	3/0	4	60	50	2	6
MA-6	30	200	125	4/0	2	60	60	1/0	6
MA-7	40	200	150	2-1/0	1/0	100	75	2/0	4
MA-8	50	200	175	2-2/0	2/0	100	80	2/0	4
MA-9	60	200	200	2-2/0	3/0	100	100	3/0	2
MA-10	75	N/A	N/A	N/A	N/A	200	150	4/0	1/0

INSTALLATION NOTES

1. This diagram does not replace or supersede any requirements of local, state or national electric codes.
2. Use only dual element time delay fuses to protect the phase converter.
3. Do not bolt converter to floor. Use vibration pads supplied with unit.
4. Do not connect control circuits to manufactured phase, T3.
5. National Electric Code (NEC) requires single-phase cable and branch circuit to be rated for 250% of three-phase load current.
6. The 3-pole converter switch is used to provide electrical isolation when the converter is off. But it is only necessary to fuse converter input lines L1 & L2. T3 is not fused. A 2-pole fusible switch may be substituted if the optional 3-pole load disconnect is used.
7. No-load output voltage L2-T3 will exceed L1-L2 by 12-15%. Voltages will balance when load is connected.

Wiring Notes:

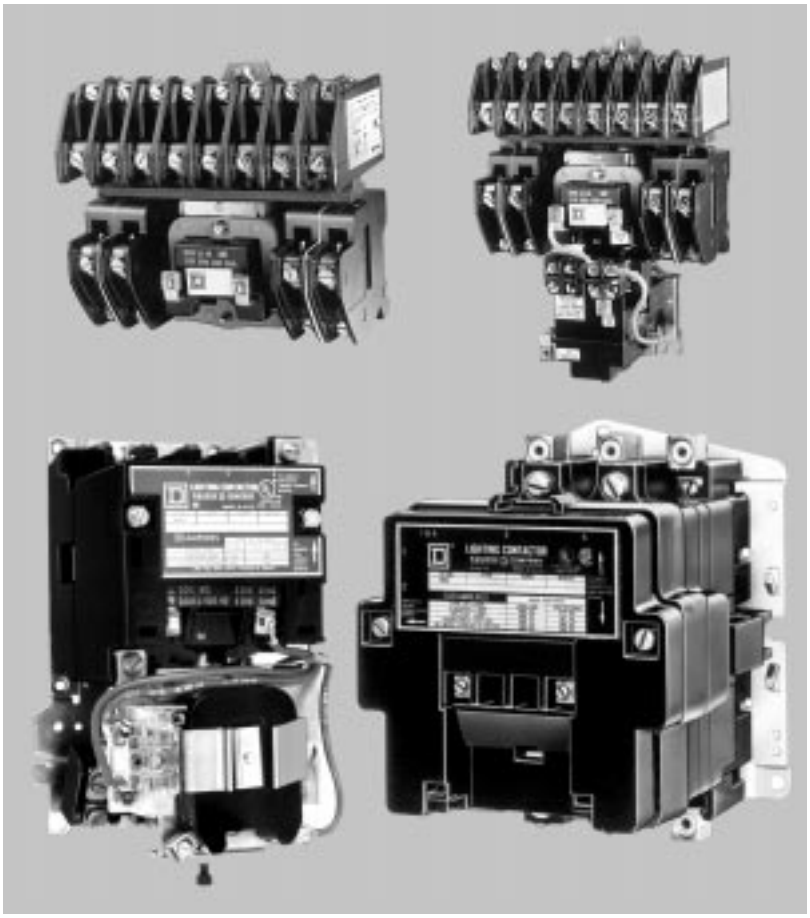
- Conductor sizes are based on type THHN, 90° C, copper conductors in 30° C max. ambient.
- These are minimum recommended sizes for the load motor HP rating indicated.
- For larger loads refer to installation note 5 and increase conductor size accordingly.
- Increase wire size for Aluminum conductors or runs in excess of 50 feet.
- Consult National Electric Code for runs in excess of 50 feet or for aluminum conductors.
- Do not use circuit breakers. See Installation Note 2.

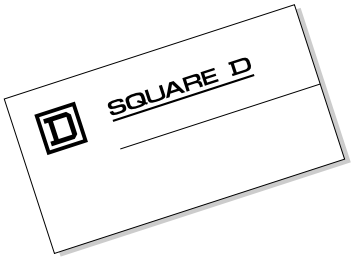
Connection Diagram for **Phasemaster** Rotary Phase Converter with Field Mounted Manual Controls

0302-MA

Lighting Contactors

Class 8903



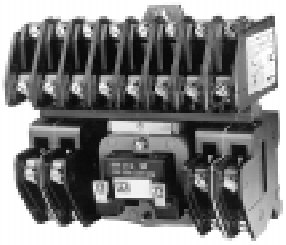


CONTENTS

Description . . . . . Page
Product Descriptions. 2
modifications (Forms) 8
Application Data 11
Specifications 13
Approximate Dimensions 14

SQUARE D
GROUPE SCHNEIDER

Lighting Control
Class 8903 – Multipole Lighting Contactors, Type L & LX



Type L



Type LX

Features

- 30 Amp ballast lighting rating, 20 Amp tungsten lighting rating
- Electrically and mechanically held
- 2 thru 12 pole versions
- Field-convertible contacts with N.O. and N.C. indicators (8 N.C. contacts maximum▼)
- Silver-Cadmium-Oxide double break contacts

File E78427
CCN NRNT

File LR60905 (Open Devices Only)
Class 3211 07

Multipole Lighting Contactors (50-60 Hz)

Contact Ampere Ratings	No. of Poles	NEMA Type 1 General Purpose Enclosure	NEMA Type 1 Flush Mounting General Purpose Enclosure with Plaster Adjustment	NEMA Type 3R Rainproof Enclosure	NEMA Type 4 & 4X Watertight, Dusttight and Corrosion-Resistant Glass-Polyester Enclosure	▲NEMA Type 4 & 4X Watertight, Dusttight Brushed Stainless Steel Enclosure	NEMA Type 12‡ Dusttight and Driptight Industrial Use Enclosure	Open Type●
		Type	Type	Type	Type	Type	Type	Type
Electrically Held■								
30▼	2 3 4	LG20∗ LG30∗ LG40∗	LF20∗ LF30∗ LF40∗	LH20∗ LH30∗ LH40∗	LWW20∗ LWW30∗ LWW40∗	LW20∗ LW30∗ LW40∗	LA20∗ LA30∗ LA40∗	LO20∗ LO30∗ LO40∗
	6 8 10	LG60∗ LG80∗ LG1000∗	LF60∗ LF80∗ LF1000∗	LH60∗ LH80∗ LH1000∗	LWW60∗ LWW80∗ LWW1000∗	LW60∗ LW80∗ LW1000∗	LA60∗ LA80∗ LA1000∗	LO60∗ LO80∗ LO1000∗
	12	LG1200∗	LF1200∗	LH1200∗	LWW1200∗	LW1200∗	LA1200∗	LO1200∗
Mechanically Held■								
30▼	2 3 4	LXG20∗ LXG30∗ LXG40∗	LXF20∗ LXF30∗ LXF40∗	....	LXWW20∗ LXWW30∗ LXWW40∗	LXW20∗ LXW30∗ LXW40∗	LXA20∗ LXA30∗ LXA40∗	LXO20∗ LXO30∗ LXO40∗
	6 8 10	LXG60∗ LXG80∗ LXG1000∗	LXF60∗ LXF80∗ LXF1000∗	....	LXWW60∗ LXWW80∗ LXWW1000∗	LXW60∗ LXW80∗ LXW1000∗	LXA60∗ LXA80∗ LXA1000∗	LXO60∗ LXO80∗ LXO1000∗
	12	LXG1200∗	LXF1200∗	....	LXWW1200∗	LXW1200∗	LXA1200∗	LXO1200∗

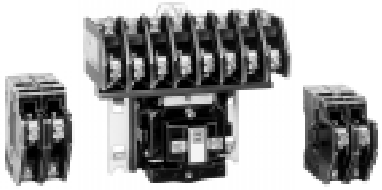
‡ NEMA Type 12 enclosures may be field modified for outdoor applications. For details, see the Class 9991 section in Catalog 9999CT9701.
● Separate enclosures are available for these devices. It may be possible to improve delivery by ordering an open type contactor and separate Class 9991 enclosure.
▲ For electropolished finish, specify Form **G16**.
∗ Coil voltage code must be specified to order this product. Refer to standard voltage codes listed below.
▼ Factory conversion of N.O. contacts to N.C., order by description. There is a maximum of eight N.C. poles for Type L and a maximum of six N.C. poles for Type LX contactors (field conversion only). Versions are available with up to 12 N.C. poles (factory only).
■ All lighting contactors are provided with separate control as standard.

Power Poles for Type L or LX

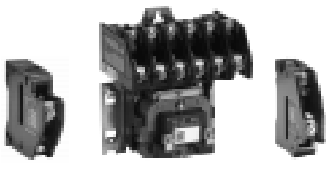
The kits below are used to add 30 Ampere power poles to existing Type L contactors when additional circuits are required. Type L lighting contactors are supplied with mounting brackets, so that adder poles may be mounted from the front by a single captive screw. Adder poles are supplied standard with N.O. contacts which are convertible to N.C.

Power Pole Adder Kit Class 8903 Type Single Pole	Can Only Be Added to Contactor Type	Power Pole Adder Kit Class 8903 Type Double Pole	Can Only Be Added to Contactor Type
L1L	LO60 LO80 LXO60	L3L	LO80 LO1000★ LXO80
L1R	LXO80	L3R	LXO1000★

★ Single-pole power pole must be removed before double-pole power pole can be installed.



Type L3L Type LO80 Type L3R

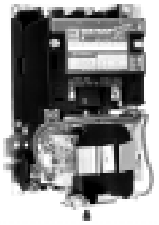


Type L1L Type LO60 Type L1R

Coil Voltage Codes

Voltage		Code
60 Hz	50 Hz	
24	...	V01
120	110	V02
208	...	V08
240	220	V03
277	...	V04
480	440	V06
Specify	Specify	V99

© 1998 Square D All Rights Reserved

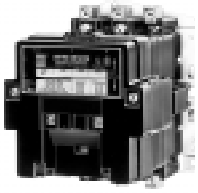


Features

- Electrically and mechanically held
- 30 - 800 Amp lighting ratings
- 2 thru 5 pole versions (5 poles thru 200 Amps)
- UL Listed short-circuit rating up to 100,000 Amperes
- Mixed load ratings (lighting and motor)
- Factory wired controls and clearly marked termination points
- Quick ship on most items in 5-7 days

File E78427
CCN NRNT

File LR60905
(Open Devices Only)
Class 3231 01



Multipole Lighting Contactors – Type S (50-60 Hz)

Contact Ampere Ratings	No. of Poles	NEMA Type 1 General Purpose Enclosure	NEMA Type 1 Flush Mounting General Purpose Enclosure with Plaster Adjustment	NEMA Type 3R Rainproof Enclosure	NEMA Type 4 & 4X Watertight, Dusttight and Corrosion-Resistant Glass-Polyester Enclosure	NEMA Type 4 & 4X▲ Watertight and Dusttight Enclosure	NEMA Type 12‡ Dusttight and Driptight Industrial Use Enclosure	Open Type
		Type	Type	Rainproof Enclosure Type	Type	Type	Type	Type
Electrically Held▼								
30	2	SMG1∗	SMF1∗	SMH1∗	SMW21∗	SMW1∗	SMA1∗	SMO1∗●
	3	SMG2∗	SMF2∗	SMH2∗	SMW22∗	SMW2∗	SMA2∗	SMO2∗●
	4	SMG3∗	SMF3∗	SMH3∗	SMW23∗	SMW3∗	SMA3∗	SMO3∗●
	5	SMG4∗	SMF4∗	SMH4∗	SMW24∗	SMW4∗	SMA4∗	SMO4∗●
60	2	SPG1∗	SPF1∗	SPH1∗	SPW21∗	SPW1∗	SPA1∗	SPO1∗●
	3	SPG2∗	SPF2∗	SPH2∗	SPW22∗	SPW2∗	SPA2∗	SPO2∗●
	4	SPG3∗	SPF3∗	SPH3∗	SPW23∗	SPW3∗	SPA3∗	SPO3∗●
	5	SPG4∗	SPF4∗	SPH4∗	SPW24∗	SPW4∗	SPA4∗	SPO4∗●
100	2	SQG1∗	SQF1∗	SQH1∗	SQW21∗	SQW1∗	SQA1∗	SQO1∗●
	3	SQG2∗	SQF2∗	SQH2∗	SQW22∗	SQW2∗	SQA2∗	SQO2∗●
	4	SQG3∗	....	SQH3∗	....	SQW3∗	SQA3∗	SQO3∗●
	5	SQG4∗	....	SQH4∗	....	SQW4∗	SQA4∗	SQO4∗●
200	2	SVG1∗	....	SVH1∗	....	SVW1∗	SVA1∗	SVO1∗
	3	SVG2∗	....	SVH2∗	....	SVW2∗	SVA2∗	SVO2∗
	4	SVG3∗	....	....	....	SVW3∗	SVA3∗	SVO3∗
	5	SVG4∗	....	....	....	SVW4∗	SVA4∗	SVO4∗
300	2	SXG1∗	....	....	....	SXW1∗	SXA1∗	SXO1∗
	3	SXG2∗	....	....	....	SXW2∗	SXA2∗	SXO2∗
400■	2	SYG1∗	....	....	....	SYW1∗	SYA1∗	SYO1∗
	3	SYG2∗	....	....	....	SYW2∗	SYA2∗	SYO2∗
600■	2	SZG1∗	....	....	....	SZW1∗	SZA1∗	SZO1∗
	3	SZG2∗	....	....	....	SZW2∗	SZA2∗	SZO2∗
800■	2	SJG1∗	....	....	....	SJW1∗	SJA1∗	SJO1∗
	3	SJG2∗	....	....	....	SJW2∗	SJA2∗	SJO2∗
Mechanically Held▼								
30	2	SMG10∗	SMF10∗	....	SMW31∗	SMW10∗	SMA10∗	SMO10∗●
	3	SMG11∗	SMF11∗	....	SMW32∗	SMW11∗	SMA11∗	SMO11∗●
	4	SMG12∗	SMF12∗	....	SMW33∗	SMW12∗	SMA12∗	SMO12∗●
	5	SMG13∗	SMF13∗	....	SMW34∗	SMW13∗	SMA13∗	SMO13∗●
60	2	SPG10∗	SPF10∗	....	SPW31∗	SPW10∗	SPA10∗	SPO10∗●
	3	SPG11∗	SPF11∗	....	SPW32∗	SPW11∗	SPA11∗	SPO11∗●
	4	SPG12∗	SPF12∗	....	SPW33∗	SPW12∗	SPA12∗	SPO12∗●
	5	SPG13∗	SPF13∗	....	SPW34∗	SPW13∗	SPA13∗	SPO13∗●
100	2	SQG10∗	SQF10∗	....	SQW31∗	SQW10∗	SQA10∗	SQO10∗●
	3	SQG11∗	SQF11∗	....	SQW32∗	SQW11∗	SQA11∗	SQO11∗●
	4	SQG12∗	....	....	....	SQW12∗	SQA12∗	SQO12∗●
	5	SQG13∗	....	....	....	SQW13∗	SQA13∗	SQO13∗●
200	2	SVG10∗	....	....	....	SVW10∗	SVA10∗	SVO10∗
	3	SVG11∗	....	....	....	SVW11∗	SVA11∗	SVO11∗
	4	SVG12∗	....	....	....	SVW12∗	SVA12∗	SVO12∗
300	2	SXG13∗	....	....	....	SXW13∗	SXA13∗	SXO13∗
	3	SXG14∗	....	....	....	SXW14∗	SXA14∗	SXO14∗
400	2	SYG16∗	....	....	....	SYW16∗	SYA16∗	SYO16∗
	3	SYG17∗	....	....	....	SYW17∗	SYA17∗	SYO17∗
600	2	SZG18∗	....	....	....	SZW18∗	SZA18∗	SZO18∗
	3	SZG19∗	....	....	....	SZW19∗	SZA19∗	SZO19∗
800	2	SJG10∗	....	....	....	SJW10∗	SJA10∗	SJO10∗
	3	SJG11∗	....	....	....	SJW11∗	SJA11∗	SJO11∗

‡ **NEMA Type 12** enclosures may be field modified for outdoor applications or **NEMA Type 3R** separate enclosures can be ordered. See the Class 9991 Section in Catalog 9999CT9701.
● Separate enclosures are available for these devices. It may be possible to improve delivery by ordering an open type contactor and separate Class 9991 enclosure.
▲**NEMA Type 4 & 4X** enclosures are brush finished stainless steel for contactors sized 30 Amp thru 300 Amp. Sizes 400 Amp thru 800 Amp are painted sheet steel. For electropolished finish, specify **Form G16**.
■ **Form F4T** is provided as standard; include line voltage when ordering. Control voltage is 120-60.
∗ Voltage code must be specified to order this product. Refer to standard voltage codes below.
▼ All lighting contactors are provided with separate control as standard.

Coil Voltage Codes

Voltage		Code
60 Hz	50 Hz	
24♦	...	V01
120	110	V02
208	...	V08
240	220	V03
277	...	V04
480	440	V06
Specify	Specify	V99

♦ 24 volt coils are not available for 200 Amp thru 800 Amp devices. Contact local Square D Field Sales Office for additional information.

Poles for Type S Only

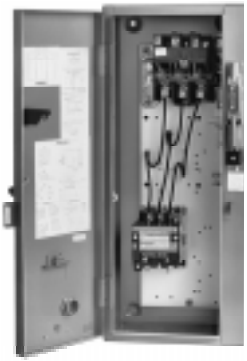
A single-pole or double-pole kit can be added to any 2 or 3 pole 30 or 60 Ampere Type S lighting contactor to make a 4 or 5 pole device. Factory assembled 4 and 5 pole contactors utilize the basic 3 pole device with a single or double-pole kit installed. Only one power pole can be added per contactor. Sufficient room is provided in all enclosure styles for the addition of a power pole kit.

Ampere Rating	Description	Class 9999 Type
30	One N.O.	SB6
	One N.C.	SB7
	One N.O. and One N.C.	SB8
	Two N.O.	SB9
	Two N.C.	SB10
60	One N.O.	SB21
	One N.C.	SB22★
	One N.O. and One N.C.	SB23★
	Two N.O.	SB24★
	Two N.C.	SB25★

★ When power pole is added to 60 A contactor, a 4-pole coil is also required. Order from Coil Table in Catalog 9999CT9701. 60 A power poles are suitable for use with copper or aluminum wire.

© 1998 Square D All Rights Reserved

Lighting Control
Class 8903 – Combination Lighting Contactors, Type S



It is desirable to install the branch-circuit protective device and lighting contactor, combining switching and over-current protection, in one enclosure. Combination lighting contactors are well suited for industrial, highway and area lighting applications, or where a lighting circuit may have to be disconnected for periodic maintenance. They may also be used for resistance heating loads.

Features

The features include: disconnect switch and circuit breaker versions; rugged flange-mounted handle; easy installation; occupation of less space; increased operator protection; room to spare for modifications; Class R fuse clips standard; electrically and mechanically held; 30–600 Amperes.

Fusible or Non-Fusible Disconnect Switch (3-Pole, 50-60 Hz)

Contactor Ampere Rating	Fuse Clip Size (Amps)	Fuse Clip Spacing (Volts)	NEMA Type 1 General Purpose Enclosure Type	NEMA Type 4 & 4X ▲ Watertight and Dusttight Enclosure Stainless Steel Type	NEMA Type 12‡ Dusttight, Oiltight Driptight, Industrial Use Enclosure Type
Electrically Held■					
30	None 30 30	.... 600 250	SMG60✱ SMG61✱ SMG62✱	SMW60✱ SMW61✱ SMW62✱	SMA60✱ SMA61✱ SMA62✱
60	None 60 60	.... 600 250	SPG60✱ SPG61✱ SPG62✱	SPW60✱ SPW61✱ SPW62✱	SPA60✱ SPA61✱ SPA62✱
100	None 100 100	.... 600 250	SQG60✱ SQG61✱ SQG62✱	SQW60✱ SQW61✱ SQW62✱	SQA60✱ SQA61✱ SQA62✱
200	None 200 200	.... 600 250	SVG60✱ SVG61✱ SVG62✱	SVW60✱ SVW61✱ SVW62✱	SVA60✱ SVA61✱ SVA62✱
300	None 400 400	.... 600 250	SXG60✱ SXG61✱ SXG62✱	SXW60✱ SXW61✱ SXW62✱	SXA60✱ SXA61✱ SXA62✱
Mechanically Held■					
30	None 30 30	.... 600 250	SMG70✱ SMG71✱ SMG72✱	SMW70✱ SMW71✱ SMW72✱	SMA70✱ SMA71✱ SMA72✱
60	None 60 60	.... 600 250	SPG70✱ SPG71✱ SPG72✱	SPW70✱ SPW71✱ SPW72✱	SPA70✱ SPA71✱ SPA72✱
100	None 100 100	.... 600 250	SQG70✱ SQG71✱ SQG72✱	SQW70✱ SQW71✱ SQW72✱	SQA70✱ SQA71✱ SQA72✱
200	None 200 200	.... 600 250	SVG70✱ SVG71✱ SVG72✱	SVW70✱ SVW71✱ SVW72✱	SVA70✱ SVA71✱ SVA72✱
300	None 400 400	.... 600 250	SXG70✱ SXG71✱ SXG72✱	SXW70✱ SXW71✱ SXW72✱	SXA70✱ SXA71✱ SXA72✱

Circuit Breaker (3-Pole, 50-60 Hz)

Contactor Ampere Rating	Circuit Breaker		NEMA Type 1 General Purpose Enclosure	NEMA Type 4 & 4X▲ Watertight and Dusttight Enclosure Stainless Steel (30-300 Amp)	NEMA Type 12‡ Dusttight, Oiltight, Driptight, Industrial Use Enclosure
	Ampere Rating	Maximum Volts	Type	Type	Type
Electrically Held■					
30	30 30	600 240	SMG81✱ SMG82✱	SMW81✱ SMW82✱	SMA81✱ SMA82✱
60	60 60	600 240	SPG81✱ SPG82✱	SPW81✱ SPW82✱	SPA81✱ SPA82✱
100	100	600	SQG81✱	SQW81✱	SQA81✱
200	200	600	SVG81✱	SVW81✱	SVA81✱
300	300	600	SXG81✱	SXW81✱	SXA81✱
400♦	400	600	SYG81✱	SYW81✱	SYA81✱
600♦	600	600	SZG81✱	SZW81✱	SZA81✱
Mechanically Held■					
30	30 30	600 240	SMG91✱ SMG92✱	SMW91✱ SMW92✱	SMA91✱ SMA92✱
60	60 60	600 240	SPG91✱ SPG92✱	SPW91✱ SPW92✱	SPA91✱ SPA92✱
100	100	600	SQG91✱	SQW91✱	SQA91✱
200	200	600	SVG91✱	SVW91✱	SVA91✱
300	300	600	SXG91✱	SXW91✱	SXA91✱
400	400	600	SYG91✱	SYW91✱	SYA91✱
600	600	600	SZG91✱	SZW91✱	SZA91✱

♦ **Form F4T** is standard; Include line voltage when ordering. Control voltage is 120V/60 Hz.

▲ For **NEMA Type 4 & 4X** Watertight, Dusttight and Corrosion-Resistant Glass-Polyester enclosure pricing, multiply stainless steel enclosed price by 1.25 and add **Form G18** (limited to 100 Amp max.). 400 & 600 Amp enclosures are painted sheet steel **(NEMA Type 4 & 4X)**.

‡ **NEMA Type 12** enclosures may be field modified for outdoor applications. See the Class 9991 section in Catalog 9999CT9701.

■ All lighting contactors are provided with separate control as standard.

✱ Coil voltage codes must be specified to order this product. Refer to standard voltage codes shown to the left.

File E16151
CCN NRNT

and

Coil Voltage Codes

Voltage		Code
60 Hz	50 Hz	
24◑	...	V01
120	110	V02
208	...	V08
240	220	V03
277	...	V04
480	440	V06
Specify	Specify	V99

◑ 24 volt coils are not available for 200 Amp devices. Contact local Square D Field Sales Office for additional information.

© 1998 Square D All Rights Reserved



Long Version

NIGHT-MASTER Outdoor Combination Lighting Contactors offer disconnecting means, overcurrent protection and a lighting contactor in one NEMA Type 3R Rainproof enclosure. These combination units satisfy requirements of the National Electrical Code and UL 508 for service entrance equipment.

Features:

- Solid neutral standard
- Grounding lug standard
- Padlocking provisions
- Short and long versions available
- Electrically held Type S lighting contactor
- Eliminates the need for separate time clocks and safety switches

NIGHT-MASTER™

Disconnect Switch Type▼ (3-Pole)

Contactor Ampere Rating	Fuse Clip Size (Amperes)	Fuse Clip Spacing (Volts)	Short Version	Long Version
			Class 8903 Type	Class 8903 Type
30	30 30	600 250	SMC61✱ SMC62✱	SMC63✱ SMC64✱
60	60 60	600 250	SPC61✱ SPC62✱	SPC63✱ SPC64✱
100	100 100	600 250	SQC61✱ SQC62✱	SQC63✱ SQC64✱
200	200 200	600 250	SVC61✱ SVC62✱	SVC63✱ SVC64✱



Short Version

Circuit Breaker Type▼ (3-Pole)

Contactor Ampere Rating	Circuit Breaker		Short Version	Long Version
	Ampere Rating	Maximum Volts	Class 8903 Type	Class 8903 Type
30	30	600	SMC81✱	SMC83✱
60	60	600	SPC81✱	SPC83✱
100	100	600	SQC81✱	SQC83✱
200	200	600	SVC81✱	SVC83✱

▼ All lighting contactors are provided with separate control as standard.

✱ Coil Voltage codes must be specified to order this product. Refer to standard voltage codes listed below.

UL Approved for Service Entrance

File E16151
CCN NRNT

and

C

NIGHT-MASTER Combination Lighting Contactors

The Class 8903 NIGHT-MASTER Outdoor Combination Lighting Contactor is the only product on the market that is UL Listed for Service Entrance. This allows the contactor to be pole mounted when used to control lighting in remote locations such as parks, monuments, group sports facilities, and streets and highways.

Factory modifications such as photocells, time switches, key operated selector switches, and the combination of photocells and time switches (photocell on, time switch off) allow the NIGHT-MASTER to be located in applications where manual operation of lights is not practical.

NIGHT-MASTER comes in long and short versions in sizes 30 through 200 Amperes. Most common modifications can be provided from the factory, or added in the field to pre-drilled and pre-tapped panels.

Coil Voltage Codes

Voltage		Code
60 Hz	50 Hz	
24▲	...	V01
120	110	V02
208	...	V08
240	220	V03
277	...	V04
480	440	V06
Specify	Specify	V99

▲ 24 volt coils are not available for 200 Amp devices. Contact local Square D Field Sales Office for additional information.

© 1998 Square D All Rights Reserved



File E78427
CCN NRNT

LR 60905
Class 3231 01

General Information

Panelboard Lighting Contactors, sometimes called remote control switches, are designed for use with lighting panelboards and motor control centers where either panel or bus mounting is desirable. Type PB lighting contactors can be used in a retrofit or new project without increasing the panelboard depth. They can be used to directly replace many inoperative existing switches.

The features include: mechanically held; compatible with Square D panelboards; short-circuit ratings to 100 KA; compact arc suppression; bus or panel mounted; fits in standard-depth lighting panelboards; easy manual operation; standard coil clearing contacts; and the ability to operate in any position.

Class 8903 Type PB Lighting Contactors

Description		Bus Mount	Panel Mount
Amp Size	Poles	Type	Type
30	2 3	PBM 10B∗ PBM 11B∗	PBM 10∗ PBM 11∗
60	2 3	PBP 10B∗ PBP 11B∗	PBP 10∗ PBP 11∗
75	2 3	PBN 10B∗ PBN 11B∗	PBN 10∗ PBN 11∗
100	2 3	PBQ 10B∗ PBQ 11B∗	PBQ 10∗ PBQ 11∗
150	2 3	PBR 10B∗ PBR 11B∗	PBR 10∗ PBR 11∗
200	2 3	PBV 10B∗ PBV 11B∗	PBV 10∗ PBV 11∗
225	2 3	PBW 10B∗ PBW 11B∗	PBW 10∗ PBW 11∗

∗ Voltage code must be specified to order this product. Refer to standard voltage codes listed below.

AC Coil Voltage Codes

60 Hz	Voltage Code
120/208 240/277 480	V38 V39 V28

Maximum Wire Size

Current Range	Power Wire (CU/AL)	Control Wire (CU Only)
30-100 Amps 150-225 Amps	1/0 Max. 350 MCM Max.	#18 - #10 #18 - #10

Factory Modifications

Form	Description
X11 X22	(1) Auxiliary Contacts SPDT (2) Auxiliary Contacts SPDT

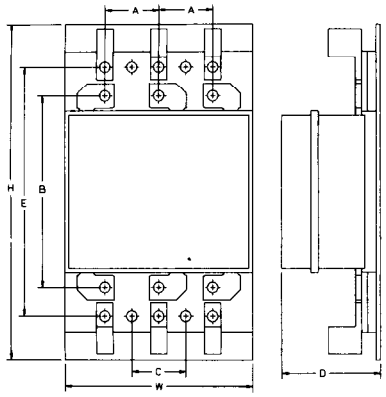
Short-Circuit Ratings

RMS Sym. Current (Amp)	Max. Volts	Short Circuit Protection Device Recommended
100,000 22,000 65,000	600 600 240	Class J Fuses Circuit Breaker - Square D - Type LHL Circuit Breaker - Square D - Type LHL

Wire Gauge AWG	Distance (feet)				
	120V	208V	240V	277V	480V
#14 #12 #10	550 900 1425	1650 2700 4275	2200 3600 5700	2925 4700 7550	8800 14400 22800

Dimensions (Panel Mount)

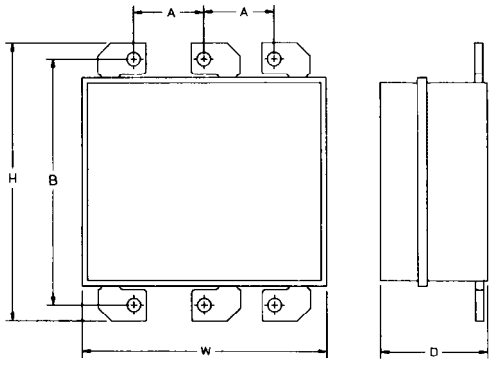
Amps	Dimensions Inches (mm)						
	H	W	D	A	B	C	E
30-100	11.75 (298)	7.50 (191)	3.88 (98)	2.25 (57)	7.38 (187)	2.25 (57)	9.25 (234)
150-225	14.50 (368)	7.50 (191)	3.88 (98)	2.88 (73)	8.50 (216)	3.00 (76)	10.50 (266)



Dimensions (Bus Mount)

Amps	Dimensions Inches (mm)				
	H	W	D	A	B
30-100	8.31 (211)	7.50 (191)	3.38 (86)	2.25 (57)	7.38 (187)
150-225	9.50 (241)	7.50 (191)	3.38 (86)	2.88 (73)★	8.50 (216)

★ Slotted mounting holes suitable for 2.88 to 3.19 in. (73 to 81 mm) mounting centers.



© 1998 Square D All Rights Reserved



REQ 2815-G2

Open Type Only

File E78401
CCN WPWR 2

Electrically Held ♦

Amperes	Poles	Open Type Catalog Number	NEMA Type 1 † Enclosed Catalog Number
30	2 pole / 2 pole 3 pole / 3 pole 4 pole / 4 pole	8903REQ2814-G1 8903REQ2814-G2 8903REQ2814-G3	8903REQ2814-G7 8903REQ2814-G8 8903REQ2814-G9
60	2 pole / 2 pole 3 pole / 3 pole 4 pole / 4 pole	8903REQ2815-G1 8903REQ2815-G2 8903REQ2815-G3	8903REQ2815-G7 8903REQ2815-G8 8903REQ2815-G9
100	2 pole / 2 pole 3 pole / 3 pole 4 pole / 4 pole	8903REQ2816-G1 8903REQ2816-G2 8903REQ2816-G3	8903REQ2816-G7 8903REQ2816-G8 8903REQ2816-G9
150	2 pole / 2 pole 3 pole / 3 pole 4 pole / 4 pole	8903REQ2817-G1 8903REQ2817-G2 8903REQ2817-G3	8903REQ2817-G7 8903REQ2817-G8 8903REQ2817-G9

♦ UL Recognized as "Components – Automatic Transfer Switches For Use In Option Stand – By Systems" only.
† NEMA Type 1 devices are not UL1008 Recognized.

Mechanically Held ▲

Amperes	Poles	Open Type Catalog Number	NEMA Type 1 † Enclosed Catalog Number
30	2 pole / 2 pole 3 pole / 3 pole 4 pole / 4 pole	8903REQ2814-G4 8903REQ2814-G5 8903REQ2814-G6	8903REQ2814-G10 8903REQ2814-G11 8903REQ2814-G12
60	2 pole / 2 pole 3 pole / 3 pole 4 pole / 4 pole	8903REQ2815-G4 8903REQ2815-G5 8903REQ2815-G6	8903REQ2815-G10 8903REQ2815-G11 8903REQ2815-G12
100	2 pole / 2 pole 3 pole / 3 pole 4 pole / 4 pole	8903REQ2816-G4 8903REQ2816-G5 8903REQ2816-G6	8903REQ2816-G10 8903REQ2816-G11 8903REQ2816-G12
150	2 pole / 2 pole 3 pole / 3 pole 4 pole / 4 pole	8903REQ2817-G4 8903REQ2817-G5 8903REQ2817-G6	8903REQ2817-G10 8903REQ2817-G11 8903REQ2817-G12
225	2 pole / 2 pole 3 pole / 3 pole	8903REQ2818-G1 8903REQ2818-G2	8903REQ2818-G3 8903REQ2818-G4
260	2 pole / 2 pole 3 pole / 3 pole	8903REQ2819-G1 8903REQ2819-G2	8903REQ2819-G3 8903REQ2819-G4
400	2 pole / 2 pole 3 pole / 3 pole	8903REQ2820-G1 8903REQ2820-G2	8903REQ2820-G3 8903REQ2820-G4
600	2 pole / 2 pole 3 pole / 3 pole	8903REQ2821-G1 8903REQ2821-G2	8903REQ2821-G3 8903REQ2821-G4
800	2 pole / 2 pole 3 pole / 3 pole	8903REQ2822-G1 8903REQ2822-G2	8903REQ2822-G3 8903REQ2822-G4

▲ UL Recognized as "Components – Automatic Transfer Switches For Use In Option Stand – By Systems".
† NEMA Type 1 devices are not UL1008 Recognized.

© 1998 Square D All Rights Reserved

Description	Form Letter	NEMA Enclosure Type	Used On				
			Std.		Combo		NIGHT-MASTER® ①
			Elec. Held	Mech. Held	Elec. Held	Mech. Held	
"On-off" (momentary contact) push button	A3	1		✱		✱	
	A3	3R, 4, 12		✱		✱	
"On-off" push button (with holding circuit interlock)	A12	Any	✱		✱		✱
"HAND-OFF-AUTO" selector switch. For key operator, add Form C33, i.e. CC33	C	1	✱	✱	✱	✱	
	C	3R, 4, 12	✱	✱	✱	✱	✱
"On-off" selector switch. For key operator, add Form C33, i.e. C6C33	C6	1	✱	✱	✱	✱	
	C6	3R, 4, 12	✱	✱	✱	✱	✱
Control circuit fuse (1 fuse)	F	Any	✱	✱	✱	✱	✱
Control circuit fuses (2 fuses)	F4	Any	✱	✱	✱	✱	✱
Control circuit transformer standard capacity 50/60 Hz Primary (Fuses) Secondary 2 100 Cap. 0 ③, ④ for 300 A	F4T	Any	✱	✱	✱	✱	✱
2 100 Cap. 1 ③, ④ for 300 A	FF4T	Any	✱	✱	✱	✱	✱
2 100 VA Add. Cap. 1 ④ for 200 and 300 A	FF4T11	Any	✱	✱	✱	✱	✱
2 200 VA Add. Cap. 1 ④ for 100, 200 and 300 A	FF4T12	Any	✱	✱	✱	✱	✱
2 300 VA Add. Cap. 1 ④ for 30 to 300 A	FF4T13	Any	✱	✱	✱	✱	✱
Noise reduced enclosure and shock mounted panel	G4	Any		✱		✱	
Addition of photoelectric receptacle	G10	1, 3R, 12	✱		✱		✱
Addition of photoelectric receptacle with photo-cell	G101	1, 3R, 12	✱		✱		✱
Addition of photoelectric receptacle and relay (R6)	G10R6	1, 12		✱		✱	
With photo-cell installed	G101R6	1, 12		✱		✱	
Addition of terminal blocks (other than standard). "xx" Represents the number of terminals needed.	G50xx	Any					
(PER TERMINAL PRICE) WIRED			✱	✱	✱	✱	✱
(PER TERMINAL PRICE) UNWIRED			✱	✱	✱	✱	✱
Bracketing for internally mounted pilot device	G53	Any	✱	✱	✱	✱	✱
Addition of 24 hour time clock (120-277v only)	K14	1, 4, 12	✱	✱	✱	✱	
Addition of 24 hour time clock w/day omission (120-277v)	K141	1, 4, 12	✱	✱	✱	✱	
Addition of 7 day time clock (120-277v)	K142	1, 4, 12	✱	✱	✱	✱	
Addition of 8865 TC12 lighting controller to lighting contactors of any size. REQUIRES A 24V 60 Hz CONTROL CIRCUIT.	K143	1, 4, 12	✱	✱			
Addition of 24 hour time clock (120-277v only)	K14	3R					✱
Addition of 24 hr time clock w/skip day (120-277v)	K141	3R					✱
Addition of 7 day time clock (120-277v)	K142	3R					✱
Addition of solid neutral terminal block	N	1, 4, 12	✱	✱	✱	✱	Std.
Red Pilot Light	P1	Any	✱	✱	✱	✱	✱
Two or more lights ⑥ (each)	P	Any	✱	✱	✱	✱	✱
Red Push To Test Pilot Light	P21	Any	✱	✱	✱	✱	✱
Interlock necessary for pilot light one needed for each additional pilot light	②, ⑦	Any	✱	✱	✱	✱	✱
Two Wire Interface for Mechanically held	R6	Any		✱		✱	
Three wire control for long distance applications.	R62	Any		✱		✱	
Auxiliary contacts (specify number of N.O. + N.C.)	X ⑦	Any	✱	✱	✱	✱	✱
Addition of DC coil to Type L (7 poles max)	Y48	Any	✱				
Auxiliary electrical interlock installed on disconnect switch or circuit breaker operating mechanism	Y74	Any			✱	✱	✱
Coil Transient suppressor (120Vac Only)	Y145	Any	✱		✱		✱
Coil Transient suppressor (120Vac Only)	Y145	Any		✱		✱	
Addition of lightning arrestor	Y1532	3R, 4, 12	✱	✱	✱	✱	✱
Substitute copper only lugs for standard	Y157	Any	✱	✱	✱	✱	✱
Substitute Anderson VC crimp style lugs for standard – per lug adder – specify lug	Y1574	Any	✱	✱	✱	✱	✱
Addition of under and overvoltage relay	Y449	Any	✱	✱	✱	✱	✱
Multiple contactors in common enclosure "xx" = number of contactors needed ⑤	Y10XX	1, 4, 12	✱	✱			

✱ Available.

① NIGHT-MASTER maximum 200 Amps, minimum 30 Amps.

② DO NOT use Form X for any interlock which is wired in series with pilot light, but DO specify how pilot light and interlock are to be wired into the circuit.

③ Not required on 400 A through 800 A electrically held versions only, which have a control circuit requiring a 120V secondary; therefore, a transformer is supplied. The transformer comes wired to L1 and L2 unless Form "S" is called for. It is supplied with two primary and one secondary fuse.

④ Single primary voltage must be specified using the codes shown below:

Voltage 60 Hz	Code
120-24	V89
208-120	V84
240-24	V82
240-120	V80
277-120	V85
480-24	V83
480-120	V81
480-240	V87
600-120	V86

⑤ Limited to 16 contactors thru 60 Amps, 4 contactors thru 200 Amps.

⑥ For electrically-held enclosed devices, the first pilot is wired in parallel with the coil. Operating interlocks are required for all additional pilot lights. Mechanically held devices require operating interlocks for all pilot lights.

⑦ Electrically held 20 Amp multipole contactors cannot add interlocks. Additional poles can be used for the same function, however. Mechanically held (Type LX) provide one double throw auxiliary (or status) contact as standard.

Order Example

You have previously selected a Class 8903SMG2V02. V02 means that you need a coil voltage of 120-60/110-50 wired for separate control. You would like to add form FF4T with the transformer voltages being 480 volt primary, 120 volt secondary.

The new and complete Class, Type, Voltage Code and Form number:

Class	Type	VoltageCode	Form♦
8903	SMG2	V81	FF4T

♦ Form numbers should always be shown in alphabetical order.

© 1998 Square D All Rights Reserved

Description	Types L & LX	Type S						
	30 Amp	30 Amp	60 Amp	100 Amp	200 Amp	300 Amp	400, 600, 800 Amp	Form No.
	Kit	Kit	Kit	Kit	Kit	Kit	Kit	
AUXILIARY CONTACTS 1 N.O. LH or RH Mounting 1 N.C. LH or RH Mounting 1 N.C. & 1 N.O. Isolated LH or RH 1 N.O. Overlapping LH or RH 1 N.C. Overlapping LH or RH		 9999 SX6 9999 SX7 9999 SX8 9999 SX9 9999 SX10	 9999 SX6 9999 SX7 9999 SX8 9999 SX9 9999 SX10	 9999 SX6 9999 SX7 9999 SX8 9999 SX9 9999 SX10	 9999 SX6 9999 SX7 9999 SX8 9999 SX9 9999 SX10	 9999 SX6 9999 SX7 9999 SX8 9999 SX9 9999 SX10	 9999 SX6 9999 SX7 9999 SX8 9999 SX9 9999 SX10	X
CONTROL CIRCUIT FUSE HOLDER Single Fuse Unit Two Fuse Unit	9999 LLX and 9999 SFR3 9999 LLX and 9999 SFR4	9999 SFR3 9999 SFR4	9999 SFR3 9999 SFR4	9999 SFR3 9999 SFR4	9999 SFR3 9999 SFR4	9999 SFR3 9999 SFR4	9999 SFR3 9999 SFR4	F F4
TRANSFORMERS (For Prices See Class 9070 Section)	9070 T50	9070 T100	9070 T100	9070 T300	9070 T300	9070 T500	9070 T750	T
OVERSIZED ENCLOSURES (Non-Combo) NEMA 1 NEMA 4 NEMA 12	 9991 SDG3 9991 SDW3 9991 SDA3	 9991 SDG3 9991 SDW3 9991 SDA3	 9991 SDG3 9991 SDW3 9991 SDA3					 ....
STANDARD ENCLOSURES NEMA 1 – Surface Mount NEMA 3R NEMA 4 – Standard NEMA 4 – With 2 Cover Mtd. Closing Plates NEMA 4X – Glass Polyester NEMA 12 NEMA 1 – Flushmount – Complete NEMA 1 – Flush Mount Parts FLUSH PARTS Standard – Elec. held – Mech. held Mounting Strap Pull Box	 9991 LXG1 9991 SDH1 9991 SDW1 9991 SDW11 9991 SDW20 9991 SDA11 .... 9991 SDF13 9991 SDF13 9991 SDF2 9991 SDF1	 9991 SCG7① 9991 SCH2 9991 SCW1 9991 SCW11 9991 SCW20 9991 SCA11 .... 9991 SCF11 9991 SCF13 9991 SCF2 9991 SCF1	 9991 SDG7① 9991 SDH1 9991 SDW1 9991 SDW11 9991 SDW20 9991 SDA11 .... 9991 SDF11 9991 SDF13 9991 SDF2 9991 SDF1	 9991 SFG8 9991 SEH1 ..... 9991 SEW11 ..... 9991 SEA11 9991 SEF11	 ..... 9991 SFH1	 9991 SGG8		 ....
Internal Operator Mounting Bracket	30102-159-01	30102-159-01	30102-159-01	30102-159-01	30102-159-01	30102-159-01	30102-159-01	G53
Solid Neutral	9999 SN1	9999 SN1	9999 SN1	9999 SN1	9999 SN2	9999 SN2	9999 SN3③	N
(Combination Lighting Contactor Disconnect Interlock Kit)								
Breaker Type 1 Pole 2 Pole		 9999 R26 9999 R27	 9999 R26 9999 R27	 9999 R26 9999 R27	 9999 R26 9999 R27	 9999 R26 9999 R27	 9999 R26 9999 R27	Y74
Disconnect Type 1 Pole 2 Pole		 9999 R45 9999 R46	 9999 R43 9999 R44	 9999 R41 9999 R42	 9999 R8 9999 R9	 9999 R35 9999 R36	 9999 R26 9999 R27	
Lightning Arrestor 175Vac to Ground Max 2 or 3 wire Grounded	J9200-10	J9200-10	J9200-10	J9200-10	J9200-10	J9200-10	J9200-10	
650Vac to Ground Max 3 or 4 wire Grounded	J9200-9A	J9200-9A	J9200-9A	J9200-9A	J9200-9A	J9200-9A	J9200-9A	
Hardware 2 Pole 3 Pole 4 Pole	....	....	....	 Not Needed	9999 AL 13 9999 AL 14 9999 AL 15	 9999 AL 11 9999 AL 11	 9999 AL 12 9999 AL 12	
Versa Crimp Lugs Range #8-1/0 AL/CU #1-2/0 AL/CU 2/0-4/0 AL/CU 4-300 MCM AL/CU 2/0-500 MCM AL/CU 400-600 MCM AL 400-500 MCM CU 500-750 MCM AL 500 MCM CU 400-600 MCM AL 400-500 MCM CU 500-750 MCM AL 500 MCM CU	....	....	....	..... VCEL02114S1	.... VCEL022516H1 VCEL024516H1 VCEL030516H1	.... VCEL05012H1 VCEL06012H1 VCEL06012H1 VCEL07512H1 VCEL07512H1	.... VCEL06012H2 ② VCEL06012H2 ② VCEL07512H2 ② VCEL07512H2 ②	Y1532
Relay Under and Over Voltage	8430 DWU	8430 DWU	8430 DWU	8430 DWU	8430 DWU	8430 DWU	8430 DWU	Y449

① For electrically held only.

② One or two lugs may be mounted on each terminal. Limited to 400 and 600 Amp versions. 800 Amp is factory modification only.

③ Limited to 400 and 600 Amp versions. 800 Amp is a factory modification only.

© 1998 Square D All Rights Reserved

	Description	TYPE L & LX	TYPE S						
		30 Amp	30 Amp	60 Amp	100 Amp	200 Amp	300 Amp	400, 600, 800 Amp	Form No.
		Kit	Kit	Kit	Kit	Kit	Kit	Kit	
Mechanically-Held	**PUSH BUTTON (ON-OFF)** NEMA Type 1 Enclosure	9999BLX & 9999LXPB	✱	9001KA2 & 9999SA3▲	9001KA2 & 9999SA3▲	9001KA2 & 9999SA3▲	9001KA2 & 9999SA3▲	9001KA2 & 9999SA3▲	A3
	NEMA Type 3R, 4 or 12 Enclosure	9001KA2 9999SA3▲	9001KA2 9999SA3▲	9001KA2 9999SA3▲	9001KA2 9999SA3▲	9001KA2 9999SA3▲	9001KA2 9999SA3▲	9001KA2 9999SA3▲	
	SELECTOR SWITCH (2 POSITION) NEMA Type 1 Enclosure	9999BLX & 9999LXS	9001KN244 & 9001KS11BH1	9001KN244 & 9001KS11BH1	9001KN244 & 9001KS11BH1	9001KN244 & 9001KS11BH1	9001KN244 & 9001KS11BH1	9001KN244 & 9001KS11BH1	C6
	NEMA Type 3R, 4 or 12 Enclosure	9001KN244 9001KS11BH1	9001KN244 9001KS11BH1	9001KN244 9001KS11BH1	9001KN244 9001KS11BH1	9001KN244 9001KS11BH1	9001KN244 9001KS11BH1	9001KN244 9001KS11BH1	
	SELECTOR SWITCH (3 POSITION) NEMA 1 Enclosure (MUST INCLUDE TWO WIRE CONTROL RELAY (Form R6)	9999BLX & 9999SC2	–	–	–	–	–	–	C
	NEMA Type 3R, 4 or 12 Enclosure	9001KN260 & 9001KS46BH2	9001KN260 & 9001KS46BH2	9001KN260 & 9001KS46BH2	9001KN260 & 9001KS46BH2	9001KN260 & 9001KS46BH2	9001KN260 & 9001KS46BH2	9001KN260 & 9001KS46BH2	
	TWO WIRE CONTROL RELAY (Form R6)	9999RLX CA2SK11_	8501X011	8501X011	8501X011	8501X011	8501X011	8501X011	R6
Electrically-Held	**PILOT LIGHTS (RED)** NEMA Type 1 Enclosure NEMA Type 3R, 4 or 12 Enclosure	9999SP28R	9999SP2R 9999SP28R	9999SP3R 9999SP28R	♦ 9999SP14R 9999SP28R	★ 9999SP28R 9999SP28R	★ 9999SP28R 9999SP28R	9999SP28R 9999SP28R	P1
	PUSH BUTTONS● NEMA Type 1 Enclosure	9999BLX & 9999SA10	9999SA10	9999SA10	9999SA3	9999SA3	9999SA3	9999SA3	A12
	NEMA Type 3R, 4 or 12 Enclosure	9999SA3	9999SA3	9999SA3	9999SA3	9999SA3	9999SA3	9999SA3	
	SELECTOR SWITCH (2 POSITION) NEMA Type 1 Enclosure	9999BLX & 9999SC22	9999SC22	9999SC22	9999SC22	9001KN244 & 9001KS11BH1	9001KN244 & 9001KS11BH1	9001KN244 & 9001KS11BH1	C6
	NEMA Type 3R, 4 or 12 Enclosure	9001KN244 & 9001KS11BH1	9001KN244 & 9001KS11BH1	9001KN244 & 9001KS11BM1	9001KN244 & 9001KS11BH1	9001KN244 & 9001KS11BH1	9001KN244 & 9001KS11BH1	9001KN244 & 9001KS11BH1	
	SELECTOR SWITCH (3 POSITION) NEMA Type 1 Enclosure	9999BLX & 9999SC2	9999SC2	9999SC2	9999SC2	9999SC8	9999SC8	9999SC8	C
	NEMA Type 3R, 4 or 12 Enclosure	9999SC8	9999SC8	9999SC8	9999SC8	9999SC8	9999SC8	9999SC8	

✱ No field installed kit available.
▲ Mechanically-held contactors need two distinct signals to operate. If is necessary to add a N.O. contact block to the Class 9999 Type SA3 push button kit.
♦ Selection for 2 or 3 pole only; for 4 or 5 pole use Class 9999 SP15R.
★ The coil voltage must be the same as the pilot light rating. Kit contains one (1) Class 9001, Type KP1R6 120V/60Hz red pilot light control unit. For other voltages, refer to the Class 9001, Type KP Control Section.
● Requires holding circuit interlock or additional power pole on 20 Amp size.

© 1998 Square D All Rights Reserved

Application of Lighting Contactors

Lighting contactors have evolved from the need for more than just simple on-off manual control of lights. Today's requirements call for the development of new and varied types of control. Often the application will call for remote control of lighting from some distant location. This control may or may not be in addition to a master control station at a central location. Certain applications include the use of automatic control by time clocks or photelectric cells. Whatever the need may be, applications are increasing, and lighting contactors are designed to meet the ever-changing requirements.

Square D lighting contactors offer a time-proven design for better electrical and mechanical performance. They are used wherever reliable, convenient and economical control of indoor and outdoor lighting is required. Typical installations include:

- parking lots
- industrial plants
- office buldings
- theaters and auditoriums
- hospitals and institutions
- shopping centers
- stadiums
- airports

Tungsten Lamp Loads

Tungsten lamps have a positive resistance characteristic (resistance to the flow of electric current increases as its operating temperature increases), thus exhibiting an increase in resistance when the lamp is energized. Therefore, these lamps have a high inrush current of up to 18 times normal current resulting from the low cold resistance of the tungsten. Examples of tungsten lamps include incandescent lamps, iodine lamps, quartz-iodine lamps and infrared lamps.

Ballast Lighting Loads

A ballast lighting load consists of electric discharge (vapor) lamps. All types of vapor lamps possess a negative resistance characteristic. The resistance within the lamp decreases with an increase in current and vice-versa. Without some form of current limiting device in the electric circuit, the current would rise quickly until lamp failure occured. This current limiting element is known as the ballast. A ballast is an impedance used to stabilize the current in a vapor lamp. It has the property of increasing in resistance as current through it increases and decreasing in resistance as current decreases. Thus it tends to maintain a constant current through it. Types of ballast lighting include high intensisty discharge (HID) lamps – mercury vapor, metal halide and high pressure sodium – and flourescent lamps.

Resistance Loads

Square D lighting contactors are fully rated for resistance loads up to 600 volts. They can be used on resistance-type boilers, electric furnaces, electric water heaters and snow melting cables and panels.

Motor Loads

These loads consist of motors having an inrush current, or locked-rotor current, of approximately six times the full-load current. Square D Type S lighting contactors are fully rated for motor loads and have a horsepower rating equal to the equivalent NEMA-Size motor contactor.

Lighting Contactors for Energy Management

Lighting contactors should be an integral part of any Energy Management System. They help conserve energy consumption and reduce utility bills by providing three types of control.

Lighting contactors offer both centralized and remote control of lighting. Cirucits can be turned on and off from a number of remote locations in addition to a master control station.

They also offer selective switching of lights. Selective switching is the control of one or more individual lighting circuits, independent of the other circuits. This design allows the potential for turning on only the amount of lighting that is actually needed.

Lighting contactors can provide automatic control to insure that lights will be turned off when not needed. There are a number of devices that, when used with lighting contactors, offer a convenient and reliable method of automatically controlling lighting loads: program time clock, photoelectric cell, programmable controller and demand controller.

Installation of Lighting Contactors

For new installations, lighting contactors can either be installed right in the lighting panelboard, or in their own enclosure next to or remote from the panelboard.

In existing applications where the lighting control system is being updated, lighting contactors can be installed in their own enclosure next to a lighting panelboard.

Compression Lugs

Square D Versa-Crimp® compression lugs for Type S lighting contactors, 100–800 ampers, are available factory installed (Form Y157-4) or as a field modification kit (see table on page 9). They are suitable for both copper and aluminum wire.



One VCEL lug (one or two on the 400 and 600 amperes devices) is required for each line or load terminal. Each Class 9999 Type AL hardware kit includes mounting hardware for 3 terminals, line or load side.

EXAMPLE: To install compression lugs on a 300 ampere 3 pole device, line and load sides, order six (6) VCEL-060-12H1 lugs and two (2) Class 9999 Type AL11 hardware kits.

© 1998 Square D All Rights Reserved

Maximum Voltage Rating

When selecting lighting contactors, the maximum voltage rating of the device must be considered in addition to its current rating. The table below lists the maximum ac voltage ratings of the Types L and S lighting contactors for ballast, tungsten and resistance loads. Lighting contactors also have dc ratings which are shown below.

Current Ratings

All Class 8903 lighting contactors are fully rated for tungsten, ballast and resistance loads. This means that a contactor can be used to control a load up to its full nameplate rating. Derating of the contactor is not necessary, as is the standard practice with circuit breakers and fuses.

AC Voltage Ratings

Type of Load	Types L & LX 30 Amperes		Type SM 30 Amperes		Types SP, SQ, SV & SX 60-300 Amperes		Types SY, SZ & SJ 400-800 Amperes	
	When Connected 1 Pole to Load	When Connected 2 Poles to Load on 1PH and 3 Poles to Load on 3PH	When Connected 1 Pole to Load	When Connected 2 Poles to Load on 1PH and 3 Poles to Load on 3PH	When Connected 1 Pole to Load	When Connected 2 Poles to Load on 1PH and 3 Poles to Load on 3PH	When Connected 1 Pole to Load	When Connected 2 Poles to Load on 1PH and 3 Poles to Load on 3PH
Tungsten	20 Amp 277 Vac	480 Vac	277 Vac	480 Vac	277 Vac	480 Vac	....	....
Ballast	277 Vac▲	480 Vac▲	347 Vac	600 Vac	347 Vac	600 Vac	347 Vac	600 Vac
Resistance	600 Vac	600 Vac	600 Vac	600 Vac	600 Vac	600 Vac	600 Vac	600 Vac
Control Circuit (Coil) Voltage	Type L 12-600 Vac; 24, 32, 48, 115/125, 230/250 Vdc Type LX 24-600 Vac		6-600 Vac		6-600 VacType SP 24-600 VacTypes SQ & SV 120-600 VacType SX		120-600 Vac	

▲ Types L and LX contactors also have a ballast lamp rating of 15 Amperes 347 Vac when connected 1 Pole to Load and 600Vac when connected 2 Poles to Load on 1PH and 3 Poles to Load on 3PH.
NOTE: 600 Ampere devices are derated to 540 Amperes for resistance heating loads when aluminum wire is used.

DC Voltage Ratings for Tungsten Lamp or Resistance Loads Only

Type of Load	Types L &LX 20 Amperes	Type SM 30 Amperes	Types SP, SQ, SV & SX 60-300 Amperes	Types SY, SZ, & SJ 400-800 Amperes
DC with 2 Poles in Series	125 Vdc	125 Vdc	250 Vdc	....
DC with 3 Poles in Series	250 Vdc	250 Vdc	250 Vdc	....

UL Listed Short-Circuit Rating

Contactors Protected by Fusible Disconnect Switches

Contactor Continuous Rating Amps	Maximum Class RK5 Fuse Rating	Maximum Voltage	Available Amperes (RMS Sym.)
20, 30	30	600	100,000
60	60	600	100,000
100	100	600	100,000
200	200	480	100,000
300	400	600	100,000
400	400	600	100,000

Contactors Protected by Circuit Breakers

Contactor Continuous Rating Amps	Maximum Circuit Breaker Rating Amps	Recommended Square D Circuit Breaker Types	Maximum Voltage	Available Amperes (RMS Sym.)
20	25	EH-EHB, FH-FHL	240	22,000
20	25	EH-EHB, FA-FAL, FH-FHL	480	14,000
30	40	FA-FAL, FH-FHL	600	10,000
30	40	IF-IFL	480	100,000
60	80	FH-FHL	600	18,000
60	90	IF-IFL	480	100,000
100	125	KA-KAL, KH-KHL	600	10,000
100	125	IK-IKL	480	100,000
200	250	LA-LAL, LH-LHL	600	14,000
200	225	IK-IKL	480	100,000
300	400	LA-LAL, LH-LHL	600	22,000
400	800	MA-MAL, MH-MHL	600	22,000
600	800	MA-MAL, MH-MHL	600	22,000

Table 1 — Kilowatt Ratings∗

Voltage	Lighting Contactor Size							
	30 Amp	60 Amp	100 Amp	200 Amp	300 Amp	400 Amp	600 Amp	800 Amp
200 Vac	10.3	20.7	34.6	69.2	103.9	138.5	207.8	277.1
230 Vac	11.9	23.9	39.8	79.6	119.5	159.3	239.0	318.7
380 Vac	19.7	39.4	65.8	131.6	197.4	263.2	394.9	526.5
460 Vac	23.9	47.8	79.6	159.3	239.0	318.6	478.0	637.4
575 Vac	30.0	60.0	99.0	199.0	299.0	398.4	597.6	796.7

∗ Resistance heating only (three phase system).

Table 2 — Motor Load Ratings

Lighting Contactor Size	Has Same HP Ratings As Equivalent NEMA Size Contactor
30 Amperes	NEMA Size 1
60 Amperes	NEMA Size 2
100 Amperes	NEMA Size 3
200 Amperes	NEMA Size 4
300 Amperes	NEMA Size 5
400 Amperes	—
600 Amperes	NEMA Size 6
800 Amperes	NEMA Size 7

Table 3 — Mixed Load Ratings

Motor Voltage and PH ▼	Contactor Ampere Rating	Percent Lighting (and/or Resistive) Load							
		0%		25%		50%		75%	
		Max. Non-Motor Amp	Max. Motor HP	Max. Non-Motor Amp	Max. Motor HP	Max. Non-Motor Amp	Max. Motor HP	Max. Non-Motor Amp	Max. Motor HP
200 V 3PH	30	0	7 1/2	7.5	5	15	3	22.5	1 1/2
	60	0	10	15	10	30	7 1/2	45	3
	100	0	25	25	20	50	15	75	5
	200	0	40	50	40	100	30	150	15
	300	0	75	75	75	150	50	226	20
	400	0	125	100	100	200	60	300	30
	600	0	150	150	150	300	100	450	50
	800	0	250	200	200	400	125	600	60
230 V 3PH	30	0	7 1/2	7.5	7 1/2	15	3	22.5	2
	60	0	15	15	10	30	10	45	3
	100	0	30	25	25	50	15	75	7 1/2
	200	0	50	50	50	100	30	150	15
	300	0	100	75	75	150	50	226	25
	400	0	150	100	100	200	75	300	30
	600	0	200	150	150	300	100	450	50
	800	0	300	200	200	400	150	600	75
380 V 3PH	30	0	10	7.5	7 1/2	15	7 1/2	22.5	3
	60	0	25	15	20	30	15	45	7 1/2
	100	0	50	25	40	50	30	75	10
	200	0	75	50	75	100	60	150	30
	300	0	150	75	150	150	100	226	40
	400	0	250	100	200	200	125	300	60
	600	0	300	150	250	300	150	450	75
	800	0	400	200	350	400	250	600	125
460-575 V 3PH	30	0	10	7.5	7 1/2	15	7 1/2	22.5	3
	60	0	25	15	20	30	20	45	10
	100	0	50	25	40	50	30	75	15
	200	0	100	50	100	100	75	150	30
	300	0	200	75	150	150	100	226	50
	400	0	300	100	200	200	150	300	75
	600	0	400	150	350	300	200	450	100
	800	0	600	200	500	400	300	600	150
115 V Single PH	30	0	2	7.5	1 1/2	15	3/4	22.5	1/2
	60	0	3	15	3	30	2	45	3/4
	100	0	7 1/2	25	5	50	3	75	2
230 V Single PH	30	0	3	7.5	2	15	2	22.5	3/4
	60	0	7 1/2	15	5	30	5	45	2
	100	0	15	25	15	50	10	75	3

▼ Select lighting contactor on basis of rated motor voltage, whether non-motor load is connected line-to-line or line-to-neutral.

© 1998 Square D All Rights Reserved

Coil Information (120 Volts, 60 Hertz)

Amperes	Poles	Ohms	Inrush			Sealed		
			Henries	VA	Power Factor	Henries	VA	Power Factor
30 to 60	3	17.80	0.110	311	0.46 ▼	1.000	37	0.28 ▼
100	3	8.48	0.048	700	0.46 ▼	0.764	46	0.33 ▼
200	3	3.57	0.032	1185	0.37	0.490	85	0.23
300	3	0.95	0.013	2970	0.23	0.187	212	0.13

▼ Worst case; all others are mean values.

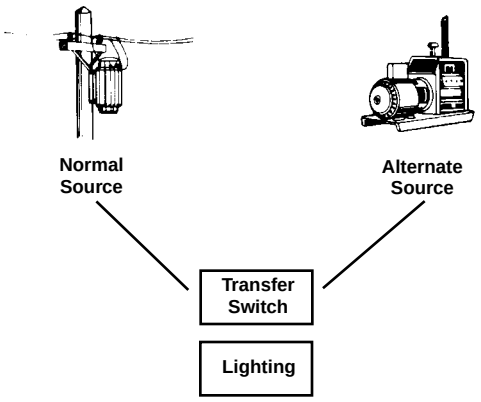
Maximum Voltage Ratings

30 - 300 Amperes

Type of Load	When connected 1ϕ pole to load	When connected 2ϕ poles to load on 1ϕ and 3ϕ poles to load on 3ϕ
Tungsten	277 Vac	480 Vac
Ballast	277 Vac	480 Vac

400 - 800 Amperes

Type of Load	When connected 1ϕ pole to load	When connected 2ϕ poles to load on 1ϕ and 3ϕ poles to load on 3ϕ
Tungsten	277 Vac	480 Vac
Ballast	277 Vac	480 Vac



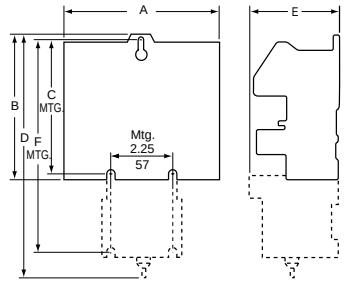
The automatic transfer switch, as part of the emergency lighting system, provides the important function of switching an essential electrical load from the normal source of lighting supply to an alternate source of supply.

Wiring Terminals

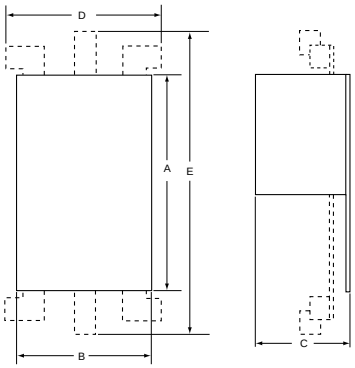
Ampere Rating	Power Terminals On Contactor		Control Terminals On All Contactors	
	Type of Lug	Wire Size Min. - Max.	Type of Lug	Wire Size Min. - Max.
30	Screw Lug	#14 - #8 copper or aluminum	Clamp	#16 - #12 copper
60		#14 - #2 copper or aluminum		#16 - #12 copper
100		#14 - #2/0 copper or aluminum		#16 - #12 copper
200		#6 -350KCMIL copper or aluminum		#16 - #12 copper
300		one #4 - 600 KCMIL or Two #0 - 250 KCMIL or aluminum		#16 - #12 copper
400		One or two #6 - 250 KCMIL copper or aluminum		Elec. Held: #16 - #14 copper Mech. held: #16 - #12 copper
600		One or two #6 - 600 KCMIL copper or aluminum		Elec. Held: #16 - #14 copper Mech. held: #16 - #12 copper
800		One, two or three #3/0 - 750 KCMIL copper or aluminum		Elec. Held: #16 - #14 copper Mech. held: #16 - #12 copper

© 1998 Square D All Rights Reserved

Lighting Control
Class 8903 – Approximate Dimensions



Open Type L & LX



Open Type S

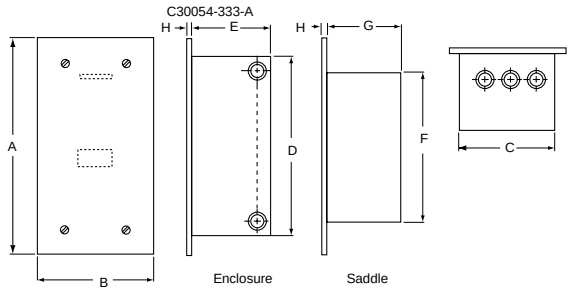
Open Type

Electrically Held									Mechanically Held						
Ampere Rating	Type	Number of Poles	Dimensions▼					Type	Dimensions▼						
			A	B	C	D	E		A	B	C	D	E	F	
30	LO	2-4	2.88 (73)	5 (127)	4.62 (117)	....	3.12 (79)	LXO	2.88 (73)	....	....	8.81 (224)	3.25 (83)	7.70 (196)	
		6	4.25 (108)	5 (127)	4.62 (117)	....	3.12 (79)		4.25 (108)	....	....	8.81 (224)	3.25 (83)	7.70 (196)	
		8-12	5.63 (143)	5 (127)	4.62 (117)	....	3.12 (79)		5.63 (143)	....	....	8.81 (224)	3.25 (83)	7.70 (196)	
30	SMO	2-3	4.34 (110)	3.22 (82)	4.22 (107)	....	....	....	7.15 (182)	3.79 (96)	4.68 (119)	....	....	....	
		4-5	4.34 (110)	4.25 (108)	4.22 (107)				7.15 (182)	4.54 (116)	4.68 (119)				
60	SPO	2-3	5.33 (135)	4.31 (110)	4.94 (125)	....	....	....	8.25 (210)	4.61 (117)	5.23 (133)	....	....	....	
		4-5	6.22 (158)	5.61 (143)	4.94 (125)				8.70 (221)	5.90 (150)	5.23 (133)				
100	SQO	2-3	7.09 (180)	5.45 (139)	6.50 (165)	....	....	....	10.13 (257)	5.94 (151)	6.72 (171)	....	....	....	
		4-5	7.82 (199)	9.75 (248)	6.50 (165)				10.56 (268)	9.75 (248)	6.72 (171)				
200	SVO	2-3	9.14 (232)	6.00 (152)	6.50 (165)	....	....	SVO	11.35 (293)	6.00 (152)	6.72 (171)	....	....	....	
		4 & 5■	9.14 (232)	9.75 (248)	6.50 (165)				11.55 (293)	9.75 (248)	6.72 (171)				
300	SXO	2-3	12.31 (313)	8.66 (220)	8.74 (222)	....	....	SXO	12.31 (313)	8.66 (220)	10.50 (267)	....	....	....	
400	SYO	2-3	....	12.33 (313)	9.00 (229)	....	27.78 (706)	SYO	....	8.66 (220)	10.50 (267)	....	21.00 (533)	....	
600	SZO							SZO							
800	SJO	2-3	....	12.33 (313)	11.94 (303)	....	42.70 (1085)	SJO	....	8.66 (220)	11.94 (303)	....	35.35 (898)	....	

■ 5 pole, electrically-held only.
▼ Dimensions are in inches (millimeters).

NEMA Type 1 Flush Mounted

Ampere Rating	Type	Form(s)		Dimensions in inches (millimeters)						
				A	B	C	D	E	F	G
30	LF LXF	Standard, F, Y48, R6		15.19 (386)	8.94 (227)	7.63 (194)	12.88 (327)	5.44 (138)	10.94 (278)	5.13 (130)
		A3, A12, C, C6, T, P		24.00 (610)	17.50 (445)	15.00 (381)	19.25 (489)	7.12 (181)	...	...
30	SMF	Electrically Held	Std., A12, C, C6, P, X	13.44 (341)	7.19 (183)	5.88 (149)	11.13 (283)	4.75 (121)	9.19 (233)	4.50 (114)
		Mechanically Held	Std., X							
		Electrically Held	T, N	24.00 (610)	17.50 (445)	15.00 (381)	19.25 (489)	5.75 (146)	...	...
		Mechanically Held	A3, C, C6, T, N, P, R6							
60	SPF	Electrically Held	Std., A12, C, C6, P, X	15.19 (386)	8.94 (227)	7.63 (194)	12.88 (327)	5.44 (138)	10.94 (278)	5.13 (130)
		Mechanically Held	Std., X							
		Electrically Held	T, N	24.00 (610)	17.50 (445)	15.00 (381)	19.25 (489)	5.75 (146)	...	...
		Mechanically Held	A3, C, C6, T, N, P, R6							
100	SQF	With or without any forms		31.00 (787)	16.75 (425)	14.25 (362)	26.25 (667)	8.00 (203)	...	...



NEMA Type 1 Enclosure (Non-Combination) Electrically and Mechanically Held

Ampere Rating	Type	Number of Poles	Form(s)		Dimensions▼		
					Width	Height	Depth
30	LG, LXG	Any	Standard, A3, A12, C, C6, F, R6, Y48		7.81 (198)	12.69 (322)	6.03 (153)
			P, T		11.88 (302)	11.88 (302)	7.44 (189)
30			K14, K141, K142		16.00 (406)	22.00 (559)	7.13 (181)
30	SMG	2-5	Electrically Held	Std., A12, C, C6, P, X	6.00 (152)	10.00 (254)	5.28 (134)
			Mechanically Held	Std., X			
			Electrically Held	T	6.34 (161)	15.88 (403)	5.19 (132)
				N	14.88 (378)	14.12 (359)	7.56 (192)
			Mechanically Held	T, N, R6			
				A3, C, C6, P	8.12 (206)	14.12 (359)	9.73 (247)
60	SPG	2-5	Electrically Held	Std., A12, C, C6, P, X	7.81 (198)	12.69 (322)	6.03 (153)
		2-5	Electrically Held & Mechanically Held	T, N, R6	14.88 (378)	14.12 (359)	7.56 (192)
		2-5	Mechanically Held	Std., A3, C, C6, P, X	8.12 (206)	14.12 (359)	9.73 (247)
100	SQG	2 & 3	Electrically Held	Std., A12, C, C6, F, P, X, T	11.25 (286)	25.15 (639)	8.99 (288)
			Mechanically Held	Std., F, X, T			
			Electrically Held	N, R6, T, T10-T13,✱	18.15 (461)	29.15 (740)	9.24 (234)
			Mechanically Held	A3, C, C6, N, R6, T, T10-T13,✱			
		4 & 5	Electrically Held	Std., A12, C, C6, F, P, X	11.25 (286)	25.15 (639)	8.99 (288)
			Mechanically Held	Std., F, X			
			Electrically Held	✱	18.15 (461)	29.15 (740)	9.24 (234)
			Mechanically Held	A3, C, C6, ✱			
			Electrically Held	N, R6, T, T10-T13	22.15 (563)	39.15 (994)	10.24 (260)
			Mechanically Held	N, R6, T, T10-T13			
200	SVG	All	Electrically and Mechanically Held	Standard and All Forms	22.15 (563)	39.15 (994)	10.24 (260)
300	SXG	All	Electrically and Mechanically Held	Standard and All Forms	17.21 (437)	44.21 (1123)	12.83 (325)
400 and 600	SYG & SZG	All	Electrically and Mechanically Held	Standard and All Forms	20.21 (513)	65.75 (1670)	13.10 (333)
800	SJG	2-3	With or without any forms		34.50 (876)	93.00 (2362)	23.50 (597)

✱ All "Type K" Forms.
▼ Dimensions are in inches (millimeters).

© 1998 Square D All Rights Reserved

NEMA Type 3R

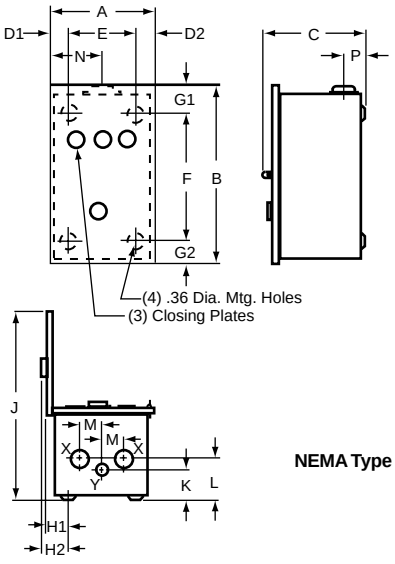
Amps	Type	Number of Poles	A	B	C	D1	D2	E	F	G1	G2	H1	H2	J	K	L	M	N	P	K.O. X	K.O. Y
30	SMH	All	8.83 (224)	12.30 (312)	7.12 (181)	1.39 (35)	1.44 (37)	6.00 (152)	7.50 (191)	2.64 (67)	2.16 (55)	2.08 (53)	2.62 (66)	14.28 (363)	1.37 (35)	1.37 (35)	1.88 (48)	4.38 (111)	1.83 (46)	1/2 3/4 1	1/2 3/4 1
30 60	LH SPH	All	9.83 (250)	16.30 (414)	8.62 (219)	1.39 (35)	1.44 (37)	7.00 (178)	11.50 (292)	2.64 (67)	2.16 (55)	2.08 (53)	2.62 (66)	16.78 (426)	1.31 (33)	1.75 (44)	2.13 (54)	4.88 (124)	1.83 (46)	1 1 1/4 1 1/2	1/2 3/4
100	SQH	All	12.83 (326)	25.30 (643)	8.62 (219)	1.39 (35)	1.44 (37)	10.00 (254)	20.50 (521)	2.64 (67)	2.16 (55)	2.08 (53)	2.62 (66)	19.78 (502)	1.31 (33)	1.94 (49)	2.44 (62)	6.38 (162)	1.83 (46)	1 1 1/4 2 2 1/2	1/2 3/4
200	SVH	All	12.83 (326)	40.30 (1024)	9.12 (232)	1.39 (35)	1.44 (37)	10.00 (254)	35.50 (902)	2.64 (67)	2.16 (55)	2.08 (53)	2.62 (66)	20.28 (515)	1.31 (33)	2.31 (59)	2.69 (68)	6.38 (162)	1.83 (46)	1 1 1/4 2 2 1/2	1/2 3/4

NEMA Type 4 and 4X

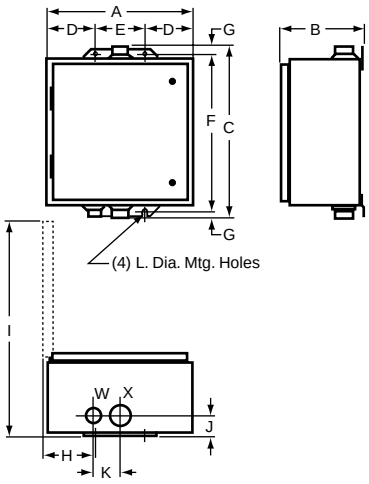
Ampere Rating	Type	Number of Poles	Form(s)		Dimensions in inches (millimeters)												Bottom Hub Only	Top & Bottom Hub
					A	B	C	D	E	F	G	H	I	J	K	L	W	X
30	LW LXW	Any	Standard, F, R6, Y48		8.13 (206)	7.88 (200)	16.19 (411)	1.56 (40)	5.00 (127)	15.00 (381)	0.60 (15)	1.94 (49)	14.75 (375)	2.00 (51)	2.63 (67)	0.31 (8)	3/4 in.	1 1/2 in.
			A3, A12, C, C6, P, T		12.62 (321)	7.81 (198)	14.69 (373)	2.56 (65)	7.50 (191)	13.50 (343)	0.63 (16)	3.38 (86)	18.44 (468)	1.69 (43)	2.31 (59)	0.31 (8)	3/4 in.	1 in.
30	SMW	2-5	Electrically Held	Std., A12, C, C6, P, X	6.38 (162)	7.13 (181)	13.19 (351)	1.56 (40)	3.25 (83)	12.00 (305)	0.63 (16)	1.91 (30)	11.81 (300)	1.63 (41)	2.31 (59)	0.31 (8)	3/4 in.	1 in.
			Mechanically Held	Std., F, X														
			Electrically Held	T	12.63 (321)	7.11 (181)	14.69 (373)	2.56 (65)	7.50 (191)	13.50 (343)	0.63 (16)	3.19 (81)	18.50 (470)	1.64 (42)	2.31 (59)	0.31 (8)	3/4 in.	1 in.
			Electrically Held	N, R6	14.88 (378)	7.25 (184)	16.31 (414)	2.56 (65)	9.75 (248)	15.00 (381)	0.63 (16)	3.19 (81)	20.88 (530)	2.06 (52)	2.63 (67)	0.31 (8)	3/4 in.	1 1/2 in.
			Mechanically Held	A3, C, C6, T, N, P, R6														
60	SPW	2-5	Electrically Held	Std., A12, C, C6, P, X	8.13 (206)	7.88 (200)	16.19 (411)	1.56 (40)	5.00 (127)	15.00 (381)	0.60 (15)	1.94 (49)	14.75 (375)	2.00 (51)	2.63 (67)	0.31 (8)	3/4 in.	1 1/2 in.
			Mechanically Held	Std., A3, C, C6, P, X														
			Electrically Held	T, N, R6	14.88 (378)	7.25 (184)	16.31 (414)	2.56 (65)	9.75 (248)	15.00 (381)	0.63 (16)	3.88 (98)	20.88 (530)	2.06 (52)	2.63 (67)	0.31 (8)	3/4 in.	1 1/2 in.
			Mechanically Held	A3, C, C6, T, N, P, R6														
100	SQW	2 & 3	Electrically Held	Std., A12, C, C6, F, N, R6, P, T, T10-13, X	18.15 (461)	8.77 (223)	32.21 (818)	3.08 (78)	12.00 (305)	30.50 (775)	0.61 (15)	3.67 (93)	26.71 (678)	2.58 (66)	3.19 (81)	0.44 (11)	3/4 in.	2 1/2 in.
			Mechanically Held	Std., A3, C, C6, F, N, P, R6, T, T10-13, X														
		4 & 5	Electrically Held	Std., A12, C, C6, F, P, ★	18.15 (461)	8.77 (223)	32.21 (818)	3.08 (78)	12.00 (305)	30.50 (775)	0.61 (15)	3.67 (93)	26.71 (678)	2.58 (66)	3.19 (81)	0.44 (11)	3/4 in.	2 1/2 in.
			Mechanically Held	Std., A3, C, C6, P, ★														
			Electrically Held	N, R6, T, T10-13	22.15 (563)	9.77 (248)	42.21 (1072)	3.08 (78)	16.00 (406)	40.50 (1029)	0.61 (15)	3.67 (93)	31.71 (805)	2.33 (59)	2.88 (73)	0.44 (11)	3/4 in.	2 1/2 in.
			Mechanically Held	N, R6, T, T10-13														
200	SVW	All	Electrically and Mechanically Held	Standard and All Forms	22.15 (563)	9.77 (248)	42.21 (1072)	3.08 (78)	16.00 (406)	40.50 (1029)	0.61 (15)	3.67 (93)	31.71 (805)	2.33 (59)	2.88 (73)	0.44 (11)	3/4 in.	2 1/2 in.
300	SXW	All	Electrically and Mechanically Held	Standard and All Forms	17.21 (437)	12.63 (321)	47.21 (1199)	4.11 (104)	9.00 (229)	46.00 (1168)	0.61 (15)	4.59 (117)	28.32 (719)	3.11 (79)	5.75 (146)	0.56 (14)	3/4 in.	3 1/2 in.
400 & 600	SYW & SZW	All	Electrically and Mechanically Held	Standard and All Forms	20.21 (513)	12.13 (308)	65.21 (1656)	4.11 (104)	12.00 (305)	64.00 (1626)	0.61 (15)	4.59 (117)	30.82 (783)	2.67 (68)	4.50 (114)	0.56 (14)	3/4 in. ■	Two 3 in. ■
800	SJW	2-3	With or without any forms		34.50 (876)	23.50 (597)	101.00 (2565)	Floor Mounting										

■ X hub is 1/4 in. left of center. W hub shown is another X hub. K dimension is distance between two X hubs. Actual W hub is located 3 3/16 in. to the right of X hub shown.

★ All "K" forms.



NEMA Type 3R



NEMA Type 4 and 4X

© 1998 Square D All Rights Reserved

Lighting Control
Class 8903 – Approximate Dimensions

NEMA Type 12

Ampere Rating	Type	Number of Poles	Form(s)		Dimensions in inches (millimieters) ▼									
					A	B	C	D	E	F	G	H	I	J
30	LA LXA	Any	Standard, F, R6, Y48		8.13 (206)	8.50 (216)	15.75 (400)	1.56 (40)	5.00 (127)	15.00 (381)	0.31 (8)	2.13 (54)	14.75 (375)	0.31 (8)
			A3, A12, C, C6, P, T		11.88 (302)	7.75 (197)	13.50 (343)	3.81 (97)	4.25 (108)	12.75 (324)	0.38 (10)	4.94 (125)	18.12 (460)	0.31 (8)
30	SMA	2-5	Electrically Held	Std., A12, C, C6, P, X	6.38 (162)	8.53 (217)	12.75 (324)	1.56 (40)	3.25 (83)	12.00 (305)	0.38 (10)	3.56 (90)	12.50 (318)	0.31 (8)
			Mechanically Held	Std., F, P, X										
			Electrically Held	T	11.88 (302)	7.75 (197)	13.50 (343)	2.56 (65)	6.75 (171)	12.75 (324)	0.38 (10)	3.66 (93)	18.12 (460)	0.31 (8)
			Electrically Held	N, R6	14.88 (378)	7.88 (200)	16.00 (406)	2.56 (65)	9.75 (248)	15.00 (381)	0.50 (13)	3.66 (93)	21.25 (540)	0.31 (8)
			Mechanically Held	A3, C, C6, T, N, P, R6										
60	SPA	2-5	Electrically Held	Std., A12, C, C6, P, X	8.13 (206)	9.28 (236)	16.00 (406)	1.56 (40)	5.00 (127)	15.00 (381)	0.50 (13)	3.66 (93)	15.38 (391)	0.31 (8)
			Mechanically Held	Std., A3, C, C6, P, X										
			Electrically Held	T, N, R6	14.88 (378)	7.88 (200)	15.75 (400)	2.56 (65)	9.75 (248)	15.00 (381)	0.38 (10)	3.66 (93)	21.25 (540)	0.31 (8)
			Mechanically Held	A3, C, C6, T, N, P, R6										
100	SQA	2 & 3	Electrically Held	Std., A12, C, C6, F, N, R6, P, T, T10-13, X	18.15 (461)	9.24 (234)	31.50 (800)	3.08 (78)	12.00 (305)	30.50 (775)	0.50 (13)	3.67 (93)	26.71 (678)	0.44 (11)
			Mechanically Held	Std., A3, C, C6, F, N, P, R6, T, T10-13, X										
		4 & 5	Electrically Held	Std., A12, C, C6, F, N, P, ★										
			Mechanically Held	Std., A3, C, C6, P, ★										
			Electrically Held	N, R6, T, T10-13, ★	22.15 (563)	10.24 (260)	41.50 (1054)	3.08 (78)	16.00 (406)	40.50 (1029)	0.50 (13)	3.67 (93)	31.71 (805)	0.44 (11)
			Mechanically Held	N, R6, T, T10-13, ★										
200	SVA	All	Electrically and Mechanically Held	Standard and All Forms	22.15 (563)	10.24 (260)	41.50 (1054)	3.08 (78)	16.00 (406)	40.50 (1029)	0.50 (15)	3.67 (93)	31.71 (805)	0.44 (11)
300	SXA	All	Electrically and Mechanically Held	Standard and All Forms	17.21 (437)	13.33 (339)	47.00 (1193)	4.11 (104)	9.00 (229)	46.00 (1168)	0.50 (13)	4.59 (117)	28.32 (719)	0.56 (14)
400 & 600	SYA & SZA	All	Electrically and Mechanically Held	Standard and All Forms	20.21 (513)	13.00 (330)	65.00 (1651)	4.11 (104)	12.00 (305)	64.00 (1625)	0.50 (13)	5.31 (135)	30.87 (784)	0.69 (18)
800	SJA	2-3	With or without any forms		93.00 (2362)	34.50 (876)	23.50 (597)	Floor Mounting						

▼ See Figure 1 for all dimensions except 800A; for 800A dimensions, see Figure 2.

★ All Type "K" Forms using Class 9001 Type K Control Units.

NIGHT-MASTER Outdoor Lighting Contactors (Short Version) – NEMA Type 3R

Ampere Rating	Description	Type Number	A	B	C	D	E	F	G	H	Cond. J	K	L	M	Knockouts N	Knockouts P	Knockouts Q
30	Disconnect Switch & Circuit Breaker Types	SMC61, 62 & 81	23.50 (597)	15.00 (381)	8.42 (214)	10.50 (267)	19.00 (483)	22.38 (568)	7.00 (178)	2.18 (55)	1.50 (38)	2.13 (54)	2.13 (54)	2.13 (54)	0.50-0.75	1.-1.25 1.50	0.50-0.75
60	Disconnect Switch & Circuit Breaker Types	SPC61, 62 & 81															
100	Disconnect Switch & Circuit Breaker Types	SQC61, 62 & 81	34.53 (877)	20.00 (508)	8.42 (214)	10.50 (267)	30.04 (763)	33.41 (849)	7.00 (178)	2.18 (55)	2.0 (2.50)	2.68 (68)	2.68 (68)	3.44 (87)	0.50-0.75	1.-1.25 2.-2.50	1.-1.25 1.5-2.0
200	Disconnect Switch Type Circuit Breaker Type	SVC61 & 62 SVC81	48.37 (1229)	19.00 (483)	9.12 (232)	10.53 (267)	44.00 (1118)	47.25 (1200)	7.00 (178)	2.18 (55)	2.50 (64)	2.68 (68)	2.68 (68)	3.44 (87)	0.50-0.75	1.-1.25 2.-2.50	1.-1.25 1.5-2.0

NIGHT-MASTER Outdoor Lighting Contactors (Long Version) – NEMA Type 3R

Ampere Rating	Description	Type Number	A	B	C	D	E	F	G	H	Cond. J	K	L	M	Knockouts N	Knockouts P	Knockouts Q
30	Disconnect Switch & Circuit Breaker Types	SMC63, 64 & 83	38.88 (987)	15.00 (381)	8.42 (214)	10.42 (265)	34.38 (873)	37.76 (959)	7.00 (178)	2.18 (55)	1.50 (38)	2.13 (54)	2.13 (54)	2.13 (54)	0.50-0.75	1.-1.25 1.50	0.50-0.75
60	Disconnect Switch & Circuit Breaker Types	SPC63, 64 & 83															
100	Disconnect Switch & Circuit Breaker Types	SQC63, 64 & 83	42.53 (1080)	20.00 (508)	8.42 (214)	10.42 (265)	38.04 (966)	41.41 (1052)	7.00 (178)	2.18 (55)	2.0 (2.50)	2.68 (68)	2.68 (68)	3.44 (87)	0.50-0.75	1.-1.25 2.-2.50	1.-1.25 1.5-2.0
200	Disconnect Switch Type Circuit Breaker Type	SVC63 & 64 SVC83	56.37 (1432)	19.00 (483)	9.12 (232)	10.53 (267)	52.00 (1321)	55.25 (1403)	7.00 (178)	2.18 (55)	2.50 (64)	2.68 (68)	2.69 (68)	3.44 (87)	0.50-0.75	1.-1.25 2.-2.50	1.-1.25 1.5-2.0

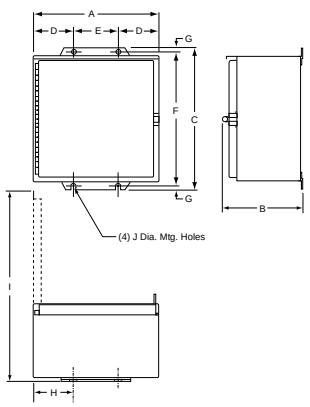


Figure 1: NEMA Type 12 (30-600A)

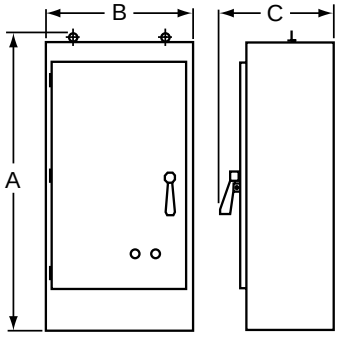


Figure 2: NEMA Type 12 (800A)

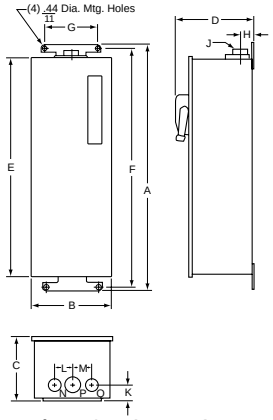


Figure 3: NIGHT-MASTER

© 1998 Square D All Rights Reserved

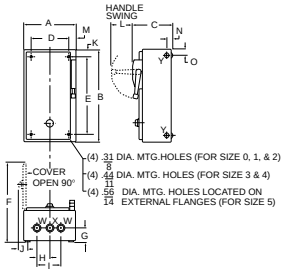


Figure 1
NEMA Type 1 Enclosure

Combination Lighting Contactors – NEMA Type 1 Enclosure

Ampere Rating	Type	Dimensions in inches (millimeters) ∗ (see Figure 1)															Top & Bot.		Sides
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	W	X	Y
30	SMG6– & 8–	9.50 (241)	22.50 (572)	8.37 (213)	6.38 (162)	20.50 (521)	14.68 (373)	1.81 (46)	1.69 (43)	3.37 (86)	3.38 (86)	1.06 (27)	3.25 (83)	2.18 (55)	1.25 (32)	0.87 (22)	0.50-0.75	0.50-0.75	.50
	SMG7– & 9–	13.75 (349)	23.00 (584)	8.36 (212)	10.63 (270)	21.00 (533)	20.07 (510)	1.87 (47)	1.88 (48)	3.76 (96)	2.06 (52)	1.06 (27)	3.25 (83)	2.18 (55)	1.25 (32)	0.87 (22)	0.50-0.75-1.0	0.50-0.75-1.0	.50
60	SPG6– & 8–	10.50 (267)	26.00 (660)	9.62 (244)	7.37 (187)	24.00 (610)	17.00 (432)	2.12 (54)	2.00 (51)	4.00 (102)	2.06 (52)	1.06 (27)	3.25 (83)	2.18 (55)	1.25 (32)	0.87 (22)	1.0-1.25	0.50-0.75	.50
	SPG7– & 9–	15.00 (381)	28.75 (730)	9.62 (244)	11.62 (295)	26.25 (667)	21.50 (546)	2.18 (55)	2.00 (51)	4.00 (102)	2.56 (65)	1.31 (33)	3.25 (83)	2.18 (55)	1.25 (32)	0.87 (22)	1.0-1.25	0.50-0.75	.50

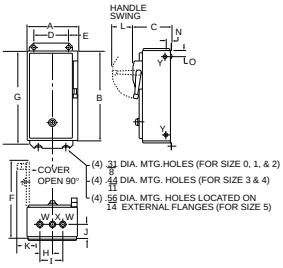


Figure 2
NEMA Type 1 Enclosure

NEMA Type 1 Enclosure

Ampere Rating	Type	Dimensions in inches (millimeters) ∗ (see Figure 2)															Top & Bot.		Sides
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	W	X	Y
100	SQG6– & 7– SQG81 & 91	15.25 (387)	39.50 (1003)	10.60 (269)	9.25 (235)	3.00 (76)	22.68 (576)	41.00 (1041)	2.69 (68)	5.38 (137)	2.83 (72)	3.74 (95)	5.00 (127)	...	1.21 (31)	0.90 (23)	1.-1.25 2.-2.50	0.50-0.75	.50
200	SVG6– & 7– SVG81 & 91	16.00 (406)	50.00 (1270)	10.68 (271)	10.00 (254)	3.00 (76)	23.68 (601)	51.50 (1308)	2.69 (68)	5.38 (137)	2.83 (72)	3.74 (95)	5.00 (127)	...	1.21 (31)	0.90 (23)	2.50	0.50-0.75	.50
200	SXG6– & 7–	20.00 (508)	75.00 (1905)	14.37 (365)	12.00 (305)	4.00 (102)	29.43 (748)	77.00 (1956)	3.19 (81)	...	3.52 (89)	7.00 (178)	9.25 (235)	...	...	...	0.50-0.75	3.00	...
	SXG81 & 91	20.00 (508)	63.00 (1600)	14.37 (365)	12.00 (305)	4.00 (102)	27.43 (697)	65.00 (1651)	3.19 (81)	...	3.52 (89)	7.00 (178)	5.00 (127)	...	...	...	0.50-0.75	3.00	...
400	SYG81 & 91	36.00 (914)	90.00 (2286)	17.00 (432)	Floor Mounting Enclosure												...	...	...
600	SZG81 & 91																		

NEMA Type 4 & 4X Enclosure

Ampere Rating	Type	Dimensions in inches (millimeters) ∗													
		A	B	C	D	E	F	G	H	I	J	K	L	W	X
30	SMW6–& 8–	9.50 (241)	8.36 (212)	24.76 (629)	3.25 (83)	2.50 (64)	4.50 (114)	23.50 (597)	0.63 (16)	3.00 (76)	1.62 (41)	2.31 (59)	14.31 (363)	0.75 Hub	1.0 Hub
	SMW7– & 9–	13.75 (349)	8.36 (212	25.26 (642)	3.25 (83)	4.75 (121)	4.25 (108)	24.00 (610)	0.63 (16)	5.25 (133)	1.62 (941)	2.31 (59)	20.14 (512)	0.75 Hub	1.0 Hub
60	SPW6– & 8–	10.50 (267)	9.61 (244)	28.26 (718)	3.25 (83)	2.50 (64)	5.50 (140)	27.00 (686)	0.63 (16)	3.00 (76)	2.00 (51)	2.63 (67)	16.56 (421)	0.75 Hub	1.50 Hub
	SPW7– & 9–	15.00 (381)	9.61 (244)	31.01 (788)	3.25 (83)	5.38 (137)	4.25 (108)	29.75 (756)	0.63 (16)	5.88 (149)	2.00 (51)	2.63 (67)	21.06 (535)	0.75 Hub	1.50 Hub
100	SQW6– & 7– SQW81 & 91	15.25 (387)	10.60 (269)	41.76 (1061)	5.00 (127)	2.50 (64)	10.25 (260)	40.50 (1028)	0.63 (16)	3.24 (82)	2.61 (66)	3.19 (81)	22.18 (563)	0.75 Hub	2.50 Hub
200	SVW6– & 7– SVW81 & 91	16.00 (406)	10.56 (268)	52.26 (1327)	5.00 (127)	2.50 (64)	11.00 (279)	51.00 (1295)	0.63 (16)	3.24 (82)	2.61 (66)	3.19 (81)	23.00 (584)	0.75 Hub	2.50 Hub
300	SXW6– & 7–	20.00 (508)	14.21 (361)	78.12 (1984)	9.25 (235)	4.00 (102)	12.00 (305)	77.00 (1956)	0.56 (14)	4.77 (121)	2.96 (75)	3.50 (89)	29.43 (748)	0.75 Hub	3.50 Hub
	SXW81 & 91	20.00 (508)	14.21 (361)	66.12 (1679)	5.00 (127)	4.00 (102)	12.00 (305)	65.00 (1651)	0.56 (14)	4.77 (121)	2.96 (75)	3.50 (89)	27.43 (697)	0.75 Hub	3.50 Hub
400	SYW81 & 91	36.00 (914)	17.71 (450)	98.00 (2489)	Floor Mounting Enclosure									...	...
600	SZW81 & 91														

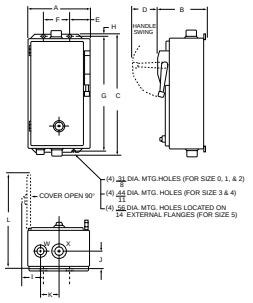


Figure 3
NEMA Type 4 Enclosure

∗ Dimensions are the same for Form F4T (standard control transformer), Form F4T11 (100 VA extra capacity) and Form F4T12 (200 VA extra capacity).

NEMA Type 12 Enclosure

Ampere Rating	Type	Dimensions in inches (millimeters) ∗									
		A	B	C	D	E	F	G	H	I	J
30	SMA6– & 8–	9.50 (241)	8.36 (212)	24.26 (616)	3.25 (83)	2.50 (64)	4.50 (114)	23.50 (597)	0.38 (10)	3.25 (83)	14.31 (363)
	SMA7– & 9–	13.75 (349)	10.10 (257)	24.76 (629)	3.25 (83)	4.75 (121)	4.25 (108)	24.00 (610)	0.38 (10)	5.50 (140)	22.00 (559)
60	SPA6– & 8–	10.50 (267)	9.61 (244)	27.76 (705)	3.25 (83)	2.50 (64)	5.50 (140)	27.00 (686)	0.38 (10)	3.25 (83)	16.56 (421)
	SPA7– & 9–	15.00 (381)	10.98 (279)	30.51 (775)	3.25 (83)	5.38 (137)	4.25 (108)	29.75 (756)	0.38 (10)	6.13 (156)	23.43 (595)
100	SQA6– & 7– SQA81 & 91	15.25 (387)	10.59 (259)	42.00 (1067)	5.00 (127)	3.00 (76)	9.25 (235)	41.00 (1041)	0.50 (13)	3.75 (95)	22.31 (567)
200	SVA6– & 7– SVA81 & 91	16.00 (406)	10.52 (267)	52.50 (1334)	5.00 (127)	3.00 (76)	10.00 (254)	51.50 (1308)	0.50 (13)	3.75 (95)	23.00 (584)
300	SXA6– & 7–	20.00 (508)	14.21 (361)	78.00 (1981)	9.25 (235)	4.00 (102)	12.00 (305)	77.00 (1956)	0.50 (13)	7.75 (197)	29.43 (748)
	SXA81 & 91	20.00 (508)	14.21 (361)	66.00 (1676)	5.00 (127)	4.00 (102)	12.00 (305)	65.00 (1651)	0.50 (13)	7.75 (197)	27.43 (697)
400	SYA81 & 91	36.00 (914)	17.71 (450)	90.00 (2286)	Floor Mounting Enclosure						
600	SZA81 & 91										

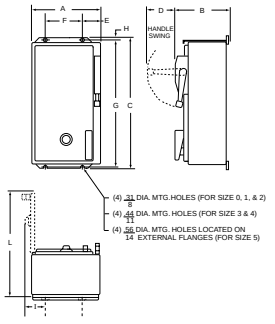


Figure 4
NEMA Type 12 Enclosure

∗ Dimensions are the same for Form F4T (standard control transformer), Form F4T11 (100 VA extra capacity) and Form F4T12 (200 VA extra capacity).

© 1998 Square D All Rights Reserved

Class 8903 REQ Open Type
Electrically Held

Figure	Device	Poles	Mounting	A	B	C	D	E	F	G	H	I	J
1	30 A	2P – 2P	(4) #10	12.13 (308)	6.75 (171)	6.03 (153)	11.63 (295)	6.25 (159)	–	–	0.50 (13)	0.25 (6)	0.25 (6)
		3P – 3P	(4) #10	12.13 (308)	6.75 (171)	6.03 (153)	11.63 (295)	6.25 (159)	–	–	0.50 (13)	0.25 (6)	0.25 (6)
		4P – 4P	(4) #10	13.27 (337)	6.75 (171)	6.03 (153)	11.63 (295)	6.25 (159)	–	–	0.50 (13)	0.25 (6)	0.25 (6)
	60 A	2P – 2P	(4) #10	12.13 (308)	6.75 (171)	6.03 (153)	11.63 (295)	6.25 (159)	–	–	0.50 (13)	0.25 (6)	0.25 (6)
		3P – 3P	(4) #10	12.13 (308)	6.75 (171)	6.03 (153)	11.63 (295)	6.25 (159)	–	–	0.50 (13)	0.25 (6)	0.25 (6)
		4P – 4P	(4) #10	13.27 (337)	6.75 (171)	6.03 (153)	11.63 (295)	6.25 (159)	–	–	0.50 (13)	0.25 (6)	0.25 (6)
	100 A	2P – 2P	(4) 5/16	12.72 (323)	7.97 (202)	7.00 (178)	11.75 (299)	7.00 (178)	–	–	0.48 (122)	0.48 (122)	0.49 (12.5)
		3P – 3P	(4) 5/16	12.72 (323)	7.97 (202)	7.00 (178)	11.75 (299)	7.00 (178)	–	–	0.48 (122)	0.48 (122)	0.49 (12.5)
		4P – 4P	(4) 5/16	21.71 (551)	8.96 (228)	7.00 (178)	20.75 (527)	8.00 (203)	–	–	0.48 (122)	0.48 (122)	0.48 (122)
	150 A	2P – 2P	(4) 5/16	14.21 (361)	8.96 (228)	7.00 (178)	13.25 (337)	8.00 (203)	–	–	0.48 (122)	0.48 (122)	0.49 (12.5)
		3P – 3P	(4) 5/16	14.21 (361)	8.96 (228)	7.00 (178)	13.25 (337)	8.00 (203)	–	–	0.48 (122)	0.48 (122)	0.49 (12.5)
		4P – 4P	(4) 5/16	21.71 (551)	8.96 (228)	7.00 (178)	20.75 (527)	8.00 (203)	–	–	0.48 (122)	0.48 (122)	0.48 (122)

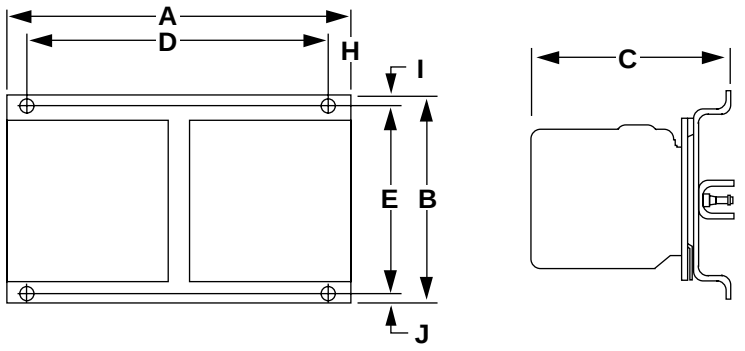


Figure 1

© 1998 Square D All Rights Reserved

Class 8903 REQ Open Type
Mechanically Held

Figure	Device	Poles	Mounting	A	B	C	D	E	F	G	H	I	J
2	30 A	2P – 2P	(4) #10	12.13 (308)	8.53 (217)	6.31 (160)	11.63 (295)	6.25 (159)	8.13 (207)	9.31 (237)	0.50 (13)	0.25 (6)	2.03 (51.6)
		3P – 3P	(4) #10	12.13 (308)	8.53 (217)	6.31 (160)	11.63 (295)	6.25 (159)	8.13 (207)	9.31 (237)	0.50 (13)	0.25 (6)	2.03 (51.6)
		4P – 4P	(4) #10	13.27 (337)	8.53 (217)	6.31 (160)	11.63 (295)	6.25 (159)	8.13 (207)	9.31 (237)	0.50 (13)	0.25 (6)	2.03 (51.6)
	60 A	2P – 2P	(4) #10	12.13 (308)	8.53 (217)	6.31 (160)	11.63 (295)	6.25 (159)	8.13 (207)	9.31 (237)	0.50 (13)	0.25 (6)	2.03 (51.6)
		3P – 3P	(4) #10	12.13 (308)	8.53 (217)	6.31 (160)	11.63 (295)	6.25 (159)	8.13 (207)	9.31 (237)	0.50 (13)	0.25 (6)	2.03 (51.6)
		4P – 4P	(4) #10	13.27 (337)	8.53 (217)	6.31 (160)	11.63 (295)	6.25 (159)	8.13 (207)	9.31 (237)	0.50 (13)	0.25 (6)	2.03 (51.6)
3	100 A	2P – 2P	(4) 5/16	12.98 (330)	10.50 (267)	7.22 (183)	11.75 (299)	7.00 (178)	–	–	0.48 (122)	0.48 (122)	3.02 (76.7)
		3P – 3P	(4) 5/16	12.98 (330)	10.50 (267)	7.22 (183)	11.75 (299)	7.00 (178)	–	–	0.48 (122)	0.48 (122)	3.02 (76.7)
		4P – 4P	(4) 5/16	21.71 (551)	10.93 (278)	7.22 (183)	20.75 (527)	8.00 (203)	–	–	0.48 (122)	0.48 (122)	2.45 (62.2)
	150 A	2P – 2P	(4) 5/16	14.21 (361)	10.93 (278)	7.22 (183)	13.25 (337)	8.00 (203)	–	–	0.48 (122)	0.48 (122)	2.45 (62.2)
		3P – 3P	(4) 5/16	14.21 (361)	10.93 (278)	7.22 (183)	13.25 (337)	8.00 (203)	–	–	0.48 (122)	0.48 (122)	2.45 (62.2)
		4P – 4P	(4) 5/16	21.71 (551)	10.93 (278)	7.22 (183)	20.75 (527)	8.00 (203)	–	–	0.48 (122)	0.48 (122)	2.45 (62.2)

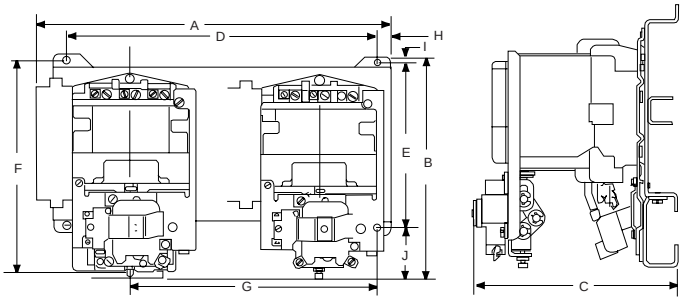


Figure 2

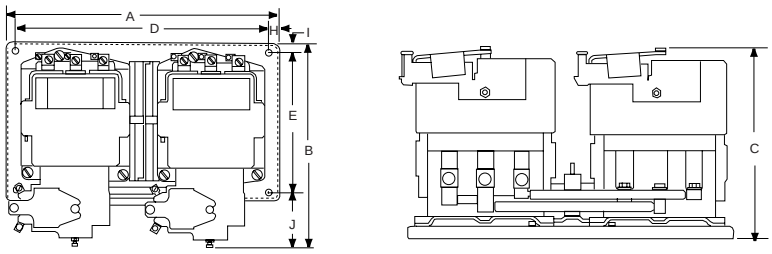


Figure 3

© 1998 Square D All Rights Reserved

Square D Company
8001 Hwy 64 East
Knightdale, NC 27545
(919) 266-3671

Square D and ◻ are registered trademarks of Square D Company.

UL is a registered trademark of Underwriter's Laboratories, Inc.

CSA is a registered trademark of Canadian Standard Association.
VERSA-CRIMP is a registered trademark of Hubbell Incorporated.
NIGHT-MASTER is a trademark of Square D Company

Catalog No. 8903CT9701 January 1998 © 1998 Square D All Rights Reserved.

Table of Contents

Page

Performance Parameters and Limited Warranty 2

Solenoid Actuated Brakes (SAB)

Introduction 3-7
Selection 8
Modifications-Descriptions and Prices 54-63

CLOSE COUPLED

NEMA Frame	Series	Torque (lb-ft)	Nm	Enclosure	
48C	48,100	1.5 - 6	2-8	IP 23	9
56C - 145TC	56,X00	1.5 - 25	2-34	IP 21, 23, 54, 55, 56, 57	10-15
182TC - 256TC/UC	56,600	10 - 25	14-34	IP 23, 54, 55	16
	87,000	6 - 105	8-142	IP 23, 54, 55	17-20
284TC/UC - 286TC/UC	87,100	50 - 105	68-142	IP 23, 54	21
324 - 405TC/TSC/UC/USC	81,000	125 - 230	169-312	IP 23, 54	22-23
	82,000	125 - 440	169-597	IP 23, 54	22, 24
444 - 445TC/TSC/UC/USC	86,000	500 - 1,000	678-1356	IP 23, 54	25-26
505TC/TSC/UC/USC	86,100	500 - 1,000	678-1356	IP 23, 54	25-26

DIVISION 1 HAZARDOUS LOCATION

Introduction 27-28

56C - 145TC	65,300	1.5 - 15	2-20	IP 23, 56	NEMA 7, 9	29-31
182TC - 256TC/UC	87,300	10 - 105	14-142	IP 23, 55	NEMA 7, 9	32-37
324 - 405 TC/TSC/UC/USC	82,300	125 - 330	169-447	IP 56	NEMA 7, 9	38-39
Foot Mounted	87,300	10 - 105	14-142	IP 23	NEMA 7, 9	36-37
Foot Mounted	82,300	125 - 330	169-447	IP 23	NEMA 7, 9	39

DIVISION 2 HAZARDOUS LOCATION

56C - 145TC	56,800	1.5 - 25	2-34	IP 55	40-41
182TC - 256TC/UC	87,800	6 - 105	8-142	IP 55	42-43

DOUBLE C-FACE COUPLER BRAKES

56C - 145TC	56,700	1.5 - 25	2-34	IP 23, 54, 55, 56	44-45
182TC - 256TC/UC	87,700	10 - 105	14-142	IP 23, 54, 55	46-47

FOOT MOUNTED WITH BEARING SUPPORTED THRU-SHAFT

Foot Mounted	56,700	1.5 - 25	2-34	IP 23	48
Foot Mounted	87,200	10 - 105	14-142	IP 23, 54	49

Special Application Brakes

MARINE/MARITIME/NAVY APPLICATIONS 50
MINING BRAKES - MSHA CERTIFIED 51
ENCODER BRAKES 52-53

Armature Actuated Brakes (AAB)

Introduction 64-65
Selection 66

Series	Description	Torque (lb-in)	*Nm*	
310	High Torque Holding Only-Servo Motor Brake	8 - 350 lb-in	*.9 - 39.5*	67-68
311	High Torque Holding Only-Servo Motor Brake	75 - 400 lb-in	*8 - 45*	69-70
320	Commercial Duty-Small Gear Motors	3 - 50 lb-in	*.34 - 5.6*	71-72
321/322	Totally-Enclosed Non-Ventilated (TENV) Commercial Duty	3 - 72 lb-in	*.34 - 8.1*	73-76
321 NEMA C	Totally-Enclosed Non-Ventilated (TENV) C-Face Mount	1.5 - 25 lb-ft	*2-34*	77-78
331 & 333	European Style Metric Mounting	3 - 300 lb-ft	*4 - 400*	79-81, 84
331 & 333	European Style-NEMA C-Face Mount	3 - 300 lb-ft	*4 - 400*	82-84
350	European Style Portal Crane Duty - Pressure Plate Mount	75 - 300 lb-ft	*102 - 400*	85-86
360	European Style Portal Crane Duty - Mag Body Mount	60 - 300 lb-ft	*80 - 400*	87-88

AAB Rectifiers 89-92
Electric Brake Release Indicator (Proving Switch) 93
AAB Modification - Descriptions and Pricing 94-96

Technical Data

Motor Frame Adapter Kits 97
Foot Mounting Kits 98
Dimensions for C-Face AC Motors/Mounting Tolerances 99-100
Set and Release Times 101
Conversions 102
Formulas 132

SINPAC - Electronic Centrifugal Switches 103-112
Super-Mod Clutches and Brakes 113-120
Application Engineering 121-131
Worldwide Sales and Service 133

BACK TO SAB, AAB SELECTION PAGE

 Copyright© 2014 Rexnord Corporation. All rights reserved.

Performance Parameters and Limited Warranty

BACK TO TABLE OF CONTENTS

The performance of Stearns brakes, clutches, clutch-brake combinations, solenoids, and controls depends upon the proper application of the product, adequate run in, installation and maintenance procedures, and reasonable care in operation.

All torque values listed in our bulletins are nominal and are subject to the variations normally associated with friction devices. The purchaser should take into consideration all variables shown in the applicable specification sheets. Although our application engineers are available for consultation, final selection and performance assurance on the purchaser's machine is the responsibility of the purchaser. Careful purchaser selection, adequate testing at time of installation, operation and maintenance of all products of Rexnord Industries, LLC, Stearns Division are required to obtain effective performance.

Stearns warrants to its purchasers that all its products will be free from defects in material and workmanship at the time of shipment to the purchaser for a period of one (1) year from the date of shipment. All warranty claims must be submitted in writing to Stearns within the warranty period, or shall be deemed waived. As to products or parts thereof which Stearns finds to have been defective at the time of shipment, its sole responsibility hereunder shall be to repair, correct or replace (whichever Stearns deems advisable) such defective products or parts without charge, FOB Stearns factory. In the alternative, Stearns may, at its option, either before or after attempting a different remedy, refund the purchase price upon return of the product or parts.

This warranty shall not apply to any product which has been subjected to misuse: misapplication: neglect (including but not limited to improper maintenance and storage); accident: improper installation; modification (including but not limited to use of other than genuine Stearns replacement parts or attachments); adjustment; or repair.

THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING THAT OF MERCHANTABILITY AND OF FITNESS FOR A PARTICULAR PURPOSE, AND OF ANY OTHER OBLIGATION OR LIABILITY ON OUR PART OF ANY KIND OR NATURE WHATSOEVER.

No Stearns representative has any authority to waive, alter, vary or add to the terms hereof without prior approval in writing, to our purchaser, signed by an officer of Rexnord Industries, LLC.

Stearns liability for its products, whether for breach of contract, negligence, strict liability in tort, or otherwise, shall be limited to the repair, correction, or replacement of the products or parts thereof, or to the refund of the purchase price of such products or parts. Stearns will not be liable for any other injury, loss, damage or expense, whether direct or consequential, including but not limited to loss of use, income, profit or production, or increased cost of operation, or spoilage of or damage to material, arising in connection with the sale, installation, use of, inability to use, or the repair or replacement of, or late delivery of, Stearns products.

Any cause of action for breach of the foregoing warranty must be brought within one (1) year from the date the alleged breach occurs.

Note on Special (Nuclear) Applications:

"Rexnord Industries, LLC, Stearns Division products are designed for standard industrial and commercial applications. Operating requirements, environments and required tolerances in nuclear and aircraft applications may be beyond the commercial standards of the Stearns Divisions products. Rexnord Industries, LLC, Stearns Division will assume absolutely no responsibility for the use of and/or resale of Rexnord Industries, LLC, Stearns Division products for such applications unless approved in writing in advance by Rexnord Industries, LLC, Stearns Division."

Introduction to Solenoid Actuated Brakes (SAB's)

BACK TO TABLE OF CONTENTS

Stearns Brakes Set the Standard for Excellence

Stearns offers the most comprehensive line of solenoid actuated brakes (SAB's) on the market today. We have earned the reputation as the industry's quality leader by working closely with you, our customers, understanding your needs and developing products with design features to handle your most challenging applications. We have installed millions of Stearns brakes worldwide since 1935. Many brakes operating today are 40 years old or more; evidence of our product quality and reliability.

Stearns motor brakes can be mounted directly to an electric motor or foot mounted. The compact design delivers high torque in a small size with fast, positive response and no residual drag when released. Our brakes can be mounted directly onto NEMA C-face motors without special alignment procedures. Many motor manufacturers offer a brake kit which will convert a stock fan-cooled motor into a brakemotor. Stearns Solenoid Actuated Brakes feature unitized construction which makes servicing friction discs easy using only a screwdriver and wrench. The Stearns SAB ensures automatic stopping and holding any time power to the brake is interrupted. And, as with ALL Stearns products, the friction material is non-asbestos.

We can produce a brake which meets your specifications, including metric mounting. Chances are, we've already manufactured similar requirements from a long list of pre-engineered options.

Enclosure Types

Stearns brakes, when properly installed, are provided in a variety of IP enclosure types.

IP 21 - intended for general purpose, indoor applications, as a ventilated enclosure. Protected against dripping water.

IP 23 - intended for indoor applications, as a non-ventilated enclosure. It provides protection against falling, non-corrosive dirt and liquid. Protected against spraying water.

IP 54 - intended for dust protected indoor and outdoor applications. Protected against splashing water.

IP 55 - intended for dust protected indoor and outdoor applications. Protected against water jets.

IP 56 - intended for dust protected indoor and outdoor applications. Protected against heavy seas or powerful jets.

IP 57 - intended for dust protected indoor and outdoor applications. Protected against the effects of immersion.

NOTE: IP 21, 23 & 54 - formerly referred to by Stearns as NEMA 1, 2 & 4 respectively.

IP 55, 56 & 57 - formerly referred to by Stearns as NEMA Type 4X (BISSC Certified with epoxy coating and stainless steel hardware on exterior, or with a stainless steel enclosure).

Self-Adjusting Disc Brakes



Remote inaccessible locations or high cycling applications require a specially designed, low-maintenance brake that will operate at peak efficiency and provide uniform braking for long periods of time. Stearns exclusive self-adjusting feature helps eliminate the major cause of brake maintenance - friction lining wear. Self-adjusting brakes are also well suited for applications where rapid cycling requires frequent resetting of solenoid air gap. Automatic adjustment also eliminates the errors that can occur with hand adjustment. They can be easily modified to suit your particular application. Depending upon the series you select, these brakes can be direct mounted on motors ranging in size from NEMA 182TC through NEMA 505C.

Manually Adjusted Disc Brakes with Automatic Reset

It's an unbeatable combination; the features you want most in spring-set disc brakes. Standard features now include: a unique spring design which allows for universal mounting, an air gap adjustment gauge for visual recognition that the brake needs adjustment, a new patented hub design, and genuine Stearns friction discs which are trademarked and patented. The 56 Series Brakes come in static torque ratings from 1.5 through 25 lb-ft with NEMA C-face mountings 56C, 143TC, 145TC, 182TFC and 184TFC. Ten different housing, endplate, and release configurations, with a wide variety of pre-engineered modifications, you can select from 120,000 possible combinations! In addition, for holding applications where friction disc wear is not a factor, Stearns 87,000 Series Brakes are available with an optional manual adjust. The 87,000 Series Brakes are available in static torque ratings from 6 lb-ft through 105 lb-ft, with NEMA C-face moutings, 182TC through 286TC.



Introduction to Stearns Solenoid Actuated Brakes (SAB's)

BACK TO TABLE OF CONTENTS

Brakes for Hazardous Locations



Although rugged Stearns Brakes are built to withstand rigorous industrial environments, many applications require additional protection from explosive gases or ignitable dusts. Stearns manufactures a complete line of disc brakes designed from the hazardous locations defined in the *National Electric Code (NEC)*. Each brake is labeled to show the Class, Group, and maximum operating temperature of the brake enclosure. We offer both motor-mounted and foot-mounted designs, and all Stearns Hazardous Location Brakes are UL Listed and CUL or CSA certified.

Double C-Face Disc Brake Couplers



Stearns Disc Brake Couplers provide maximum versatility, allowing you to add a brake to a C-face motor with a single shaft extension. Using these reliable products, you can couple a C-face motor to a C-face gear reducer.

Washdown Brakes

Stearns Washdown Brakes include the 56,000 and 87,000 Series brake models. These brakes meet BISSC Standards, AAA Dairy Standards, and other food industry washdown requirements. They feature stainless steel hardware, neoprene gasketing, and FDA-approved white epoxy paint or stainless steel enclosure.



Solenoid Actuated Brakes versus Armature Actuated Brakes

Solenoid Actuated Brakes	Armature Actuated Brakes
Simple wear adjustment	Complex wear adjustment
Easy coil exchange for different voltages	Difficult to change out complete magnet assembly
Maintained manual release with automatic reset for brake release during set-up	Non-maintained release (deadman) requires constant external force to operate
Add on options easily assembled to standard unit	Options require complete brake in most units
Rapid set and release times.	Response time is slower due to required magnetic field build-up in magnet-style coil
Connection can be made directly to AC power source	Direct connection to AC power source requires an optional electric control

Marine Applications

Brakes used in marine applications are customized to meet specific standards. These standards are established to provide various levels of corrosion resistance and performance standards under specific conditions.



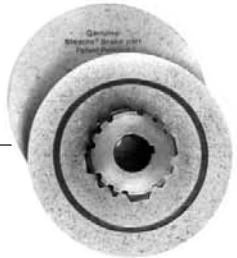
Maritime and Naval Brakes are designed for U.S. Navy and Coast Guard military specifications. These units conform to MIL-B-16392C or 46CFR 110.10-1 and IEEE Standard 45. Special material components help prevent corrosion due to shipboard environments. SAB's used in marine environments can be custom built to meet the specifications. In addition, all Stearns SAB's are "Type Approval Certified" by the American Bureau of Shipping.

Today, Stearns is focused on being your worldwide, value-added supplier. Our factory-trained field sales force is available to work with you in person to determine your application needs, as well as provide training and support to your engineers and maintenance staff. Our extensive network of more than 900 distributor branches is your assurance of quality service after the sale.

Stearns is a division of Rexnord Industries, LLC, a world leader in power transmission products. We have the resources, experience and dedication to meet your industrial brake, clutch and solid-state electronic centrifugal switch needs.

Trademarked and Patented Friction Discs

Now you can rely on identifying genuine Stearns Friction Discs which assure continuous, reliable performance backed by the Stearns name.
A molded ring in the Stearns friction discs makes it easy to visually identify a Stearns disc. The new splined discs are trademarked and patented by Stearns Division, Rexnord Industries, LLC.



Manually Adjusted Solenoid Actuated Brakes

BACK TO TABLE OF CONTENTS

Stearns manually-adjusted disc brakes are available from .5 to 105 lb-ft static torque. They feature spring-set, electrically released designs having simple adjustments to compensate for friction lining wear. All have simple 2-wire motor connection.

Series 48,100 Disc Brakes

Mount directly to NEMA 48C motor frames. Static torque ratings are 1½, 3 and 6 lb-ft.

Quality Design Features:

- Spring-set, electrically released
- Single-disc caliper design
- Simple wear adjustment for easy maintenance
- Knock-out plug on housing for through-shaft applications
- Maintained manual release with automatic reset
- Mount in any position without modification

All Series 56,X00 Disc Brakes

Mount directly to NEMA 56C, 143TC, 145TC, 182TC and 184TC motor frames. Static torque ratings from 1½ to 25 lb-ft.

The 56 Series family is an unbeatable combination: the features you want most in spring-set disc brakes, at a low price. We took a fresh look at the brake itself as well as your needs and designed a comprehensive line of spring-set brakes that set new standards for quality, reliability and customer convenience. Here's a sampling of the features we've built into the Stearns 56 Series brakes:

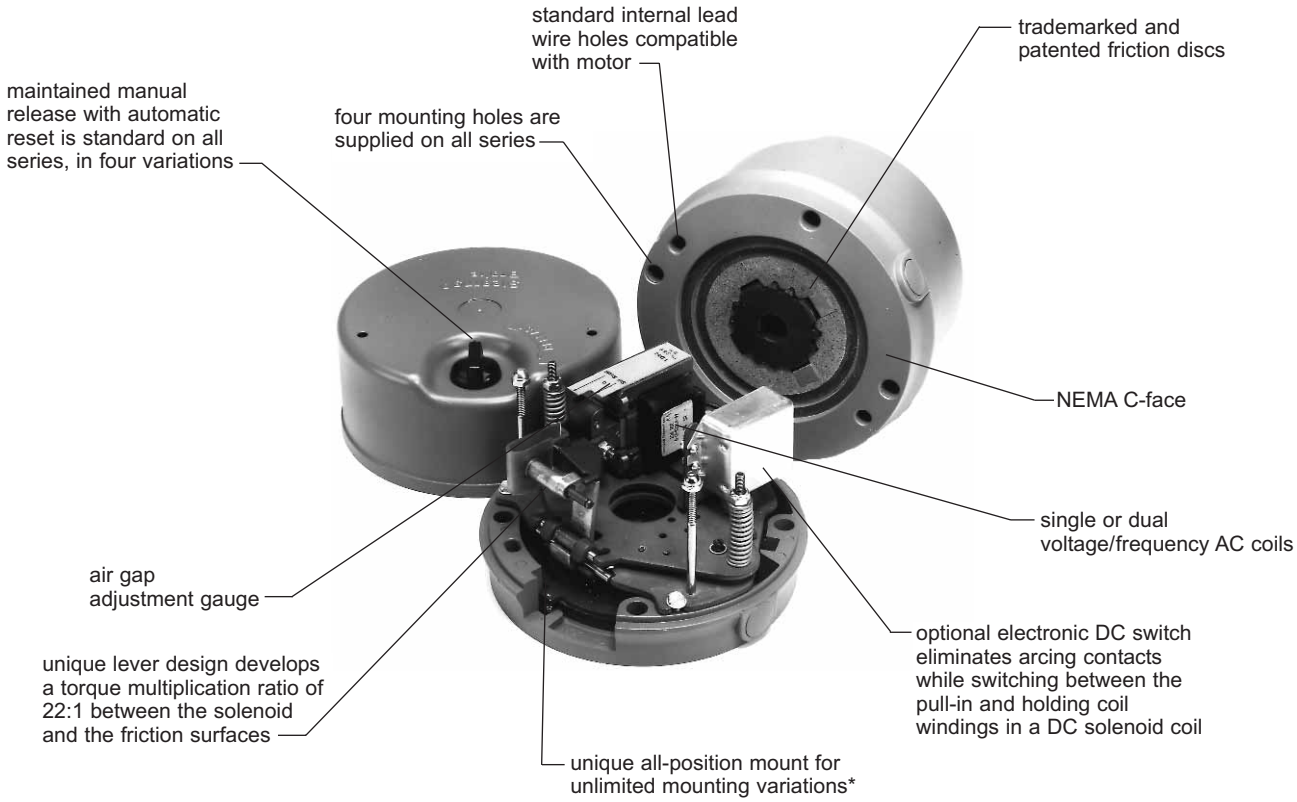
- A Stearns-exclusive spring design permits all-position mount for unlimited mounting possibilities.
- Trademarked and patented friction discs
- Patented splined hub that increases friction disc working area, runs quieter, and offers enhanced heat dissipating capability
- ABS Type Approval Certified

The 56 Series come in static torque ratings from 1.5 through 25 lb-ft with NEMA C-face mountings 56C, 143TC, 145TC, 182TFC, and 184TFC. Ten different housing, endplate, and release configurations accommodate IP 23, IP 54, IP 55, IP 56 and IP 57 enclosures. With a wide variety of pre-engineered modifications, you can select from 120,000 possible combinations!

87,000 Series Disc Brakes

An optional manual adjust mechanism can be provided on 87,000 Series Brakes (does not include 87,300 and 87,800 Series Brakes). Mounted directly to NEMA 182TC through 256TC frames. Includes all the other features of the Series 87,000.

Series 56,000 Design Features

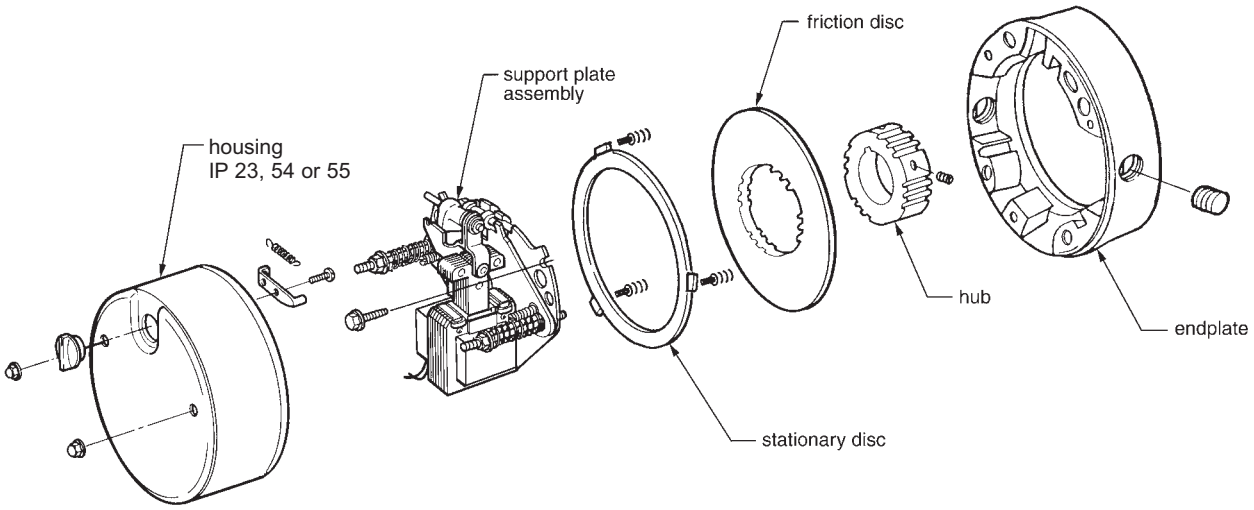


*20 and 25 lb-ft brakes are easily adapted for vertical applications (kit included)

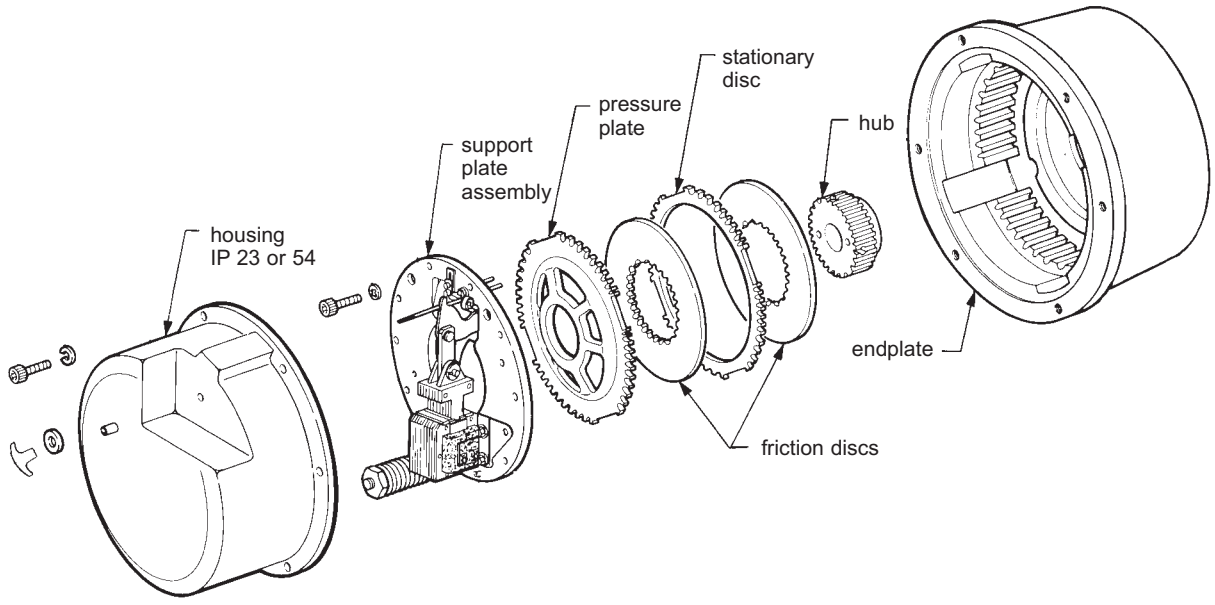
Exploded View- Part Indentification

BACK TO TABLE OF CONTENTS

Series 56,000 Manually-Adjusted Solenoid Actuated Brake



Self-Adjusting Disc Brakes - Main Components

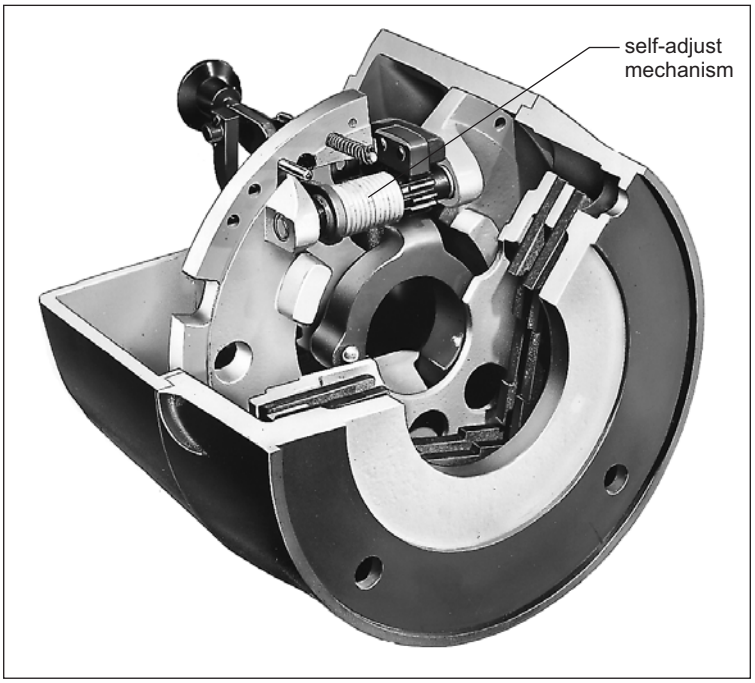


Self-Adjusting Solenoid Actuated Brakes

BACK TO TABLE OF CONTENTS

Stearns self-adjusting disc brakes feature an exclusive, automatic adjusting device that eliminates the major cause of brake maintenance – adjustment to compensate for friction lining wear. This feature makes Stearns self-adjusting brakes ideal for remote or inaccessible locations, and for applications where rapid cycling requires frequent wear adjustment of manual adjustable brakes.

The self-adjust mechanism is a simple wrap-spring clutch that automatically adjusts the brake's solenoid air gap to compensate for wear of the friction discs. Automatic adjustment occurs every time the brake is operated, eliminating the errors that can occur with hand adjustment. The self-adjust feature means Stearns motor brakes always operate at peak efficiency, providing more uniform braking, longer disc life, less maintenance time and smooth, quiet operation.



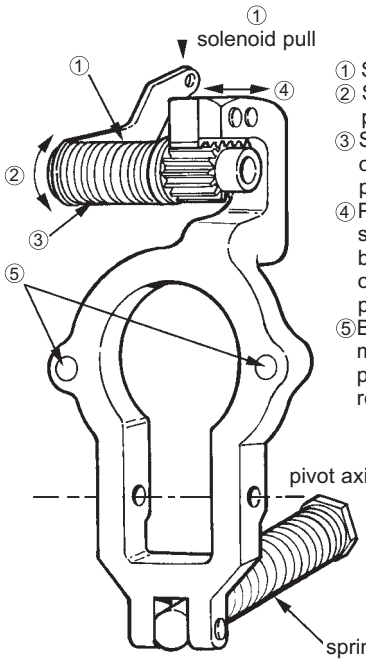
There are nine series of Stearns self-adjusting brakes to select from:

- Series 81,000 brakes for direct mounting to NEMA 324TC through 365TC motor frames. Static torque ratings from 125 to 230 lb-ft.
- Series 82,000 brakes for direct mounting to NEMA 324TC through 405TSC motor frames. Static torque ratings from 125 to 440 lb-ft.
- Series 86,X00 brakes for direct mounting to NEMA 444TSC through 505TSC motor frames. Static torque ratings from 500 to 1,000 lb-ft.
- Series 87,X00 brakes for direct mounting to NEMA 182TC through 286TC motor frames. Static torque ratings from 6 to 105 lb-ft.
- Series 87,200 for floor mounted, double shaft output with bearing support. Static torque ratings from 10 to 105 lb-ft.
- Series 87,300 hazardous location brakes for UL Listed Division I applications, which mount directly to NEMA 182TC through 256TC motor frames. Static torque ratings from 10 to 105 lb-ft.
- Series 82,300 hazardous location brakes for UL listed Division I applications, for mounting directly to NEMA 324TC through 405TSC. Static torque ratings 125 to 330 lb-ft.
- Series 87,700 brakes for in-line applications, to couple the motor and gear box. For direct mounting to NEMA 182TC through 256TC motor frames. Torque Rating of 10 to 105 lb-ft.
- Series 87,800 brakes hazardous location brake for UL Listed Division 2 applications, which mount directly to NEMA 182TC through 256TC motor frames. Static torque ratings of 10 to 105 lb-ft.

Quality Design Features

- Spring-set, electrically released.
- Self-adjusting mechanism minimizes maintenance by automatically compensating for lining wear.
- Unitized construction for easy friction disc replacement.
- Maintained manual release with automatic reset.
- Simple 2-wire motor connection.
- Standard or dust-tight, waterproof enclosures available.
- Many modifications for special application requirements.
- Models for marine and maritime applications.
- Models in accordance with Military Specification B16392-C for Navy applications.
- ABS Type Approval Certified.

Lever Arm and Self-Adjusting Mechanism



① Solenoid is energized.
② Solenoid arm and pinion rotate.
③ Spring clutch tightens on hubs and turns pinion.
④ Pinion moves rack section of lever arm back above pivot axis, overcoming force of pressure spring.
⑤ Buttons on lever arm move away from pressure plate, releasing brake.

SELECTION - Solenoid Actuated Brakes

BACK TO TABLE OF CONTENTS

NOTE: For overhauling/high inertia loads, to stop in a specified time/distance, or for brakes combined with variable frequency drives, please refer to *Application Engineering* Section.

Stearns Solenoid Actuated Brakes can be easily selected from Table 1 and 2.

Given motor data:
1. Horsepower (hp)
2. Speed (RPM)
3. NEMA C-face frame size

Determine:
1. Static torque rating of the brake (lb-ft)
2. Brake series

Step 1 – Given the motor horsepower and speed, select the brake torque from Table 1. Torque in table 1 is calculated using formula:

$$T_S = \frac{5{,}252 \times P}{N} \times SF$$

Where, T_S = Static torque, lb-ft

P = Motor horsepower, hp

N = Motor full load speed, rpm

SF = Service Factor

5,252 = constant

Example: Given a 5 hp, 1800 RPM motor, the selected brake is 20 or 25 lb-ft.

Step 2 – Given the NEMA C-face motor frame size, select the brake series from Table 2.

Example: Given the 5 hp, 1800 RPM motor in Step 1 with a NEMA 184TC frame, Series 87,000; 87,300 or 87,700 Brakes can be selected to mount directly to the motor.

Table 1 – Torque Selection

In this table, brake torque ratings are no less than 140% of the motor full load torque.

Motor hp	Brakemotor Shaft Speed (RPM)						
	700	900	1200	1500	1800	3000	3600
	Static Torque Rating of Brake (lb-ft)						
1/6	3	1.5	1.5	1.5	0.75	0.5	0.5
1/4	3	3	3	1.5	1.5	0.75	0.5
1/3	6	3	3	3	1.5	1.5	0.75
1/2	6	6	3	3	3	1.5	1.5
3/4	10	6	6	6	6	3	3
1	15	10	6	6	6	3	3
1-1/2	20	15	10	10	10	6	3
2	25	20	15	10	10	6	6
3	35	25	20	15	15	10	6
5	75	50	35	25	20 or 25	15	10
7-1/2	105	75	50	50	35	25	15
10	105	105	75	50	50	25	25
15	175	125	105	75	75	50	35
20	230	175	125	105	105	50	50
25	330	230	175	125	105	75	50
30	330	330	230	175	125	75	75
40	440	330	330	230	175	105	105
50	550	440	330	330	230	*	*
60	750	500	440	330	330	*	*
75	1000	750	500	440	330	*	*
100	—	1000	750	500	440	*	*
125	—	1000	1000	750	500	*	*
150	—	—	1000	750	750	*	*
200	—	—	—	1000	1000	*	*
250	—	—	—	—	1000	*	*

*See catalog pages for maximum rpm by series. Thermal capacity must be considered in load stops over 1800 rpm.

Table 2 – Brake Series Selection by NEMA Frame Size

Torque Range (lb-ft)	Brake Series	C-Face Motor Frame Size											
		48C	56C	143TC 145TC	182TC 184TC	213TC 215TC	254TC 254UC 256TC 256UC	284TC 284UC 286TC 286UC	324TC 324UC 326TC 326UC	364TC 364UC 365TC 365UC	404TC 404UC 405TC 405UC	444TC 444UC 445TC 445UC	504UC 504SC 505C 505SC
Manually-Adjusted Brakes (require periodic adjustment to compensate for friction disc wear)													
1.5-6	48,100	①											
1.5-25	56,X00		①	①	②	②	②						
10-25	56,500				①								
Self-Adjusting Brakes (automatically compensate for friction disc wear)													
6-105	87,X00		③	③	①	①	①	②	②	②	②		
50-105	87,100							①					
125-230	81,000				②	②	②	②	①	①	①	②	
125-440	82,000				②	②	②	②	①	①	①	②	
500-1000	86,000								②	②	②	①	
500-1000	86,100												①
Division I Hazardous Location Brakes (for atmospheres containing explosive gases or ignitable dusts) / Motor Mounted													
1.5-15	65,300		①	①	②	②	②						
10-105	87,300				①	①	①	②	②	②	②		
125-330	82,300				②	②	②	②	①	①	①	②	
Division I Hazardous Location Brakes (for atmospheres containing explosive gases or ignitable dusts) / Foot Mounted													
10-105	87,300				④	④	④						
125-330	82,300								④	④	④		
Division 2 Hazardous Location Brakes													
1.5-25	56,800		①	①	②	②	②						
6-105	87,800		③	③	①	①	①	②	②	②	②		
Double C-Face Brake Couplers (for direct coupling a C-face motor to a C-face gear reducer)													
1.5-25	56,700		①	①									
10-105	87,700				①	①	①						

① Brake mounts directly to motor C-face.
② Adapter required to mount brake to motor C-face. Refer to brake specifications for adapter information.
③ Brake endplate modified for direct mounting to motor C-face without an adapter.
④ Brake is foot mounted for coupling to a hazardous-location motor.

Series 48,100 (1-048-1XX)
Mounting Face: 48C
3.0” AK, 3.75” AJ

Static Torque: 1.5 through 6 lb-ft

Enclosure: IP23 (formerly referred to by Stearns as NEMA 2), Stamped Steel Housing

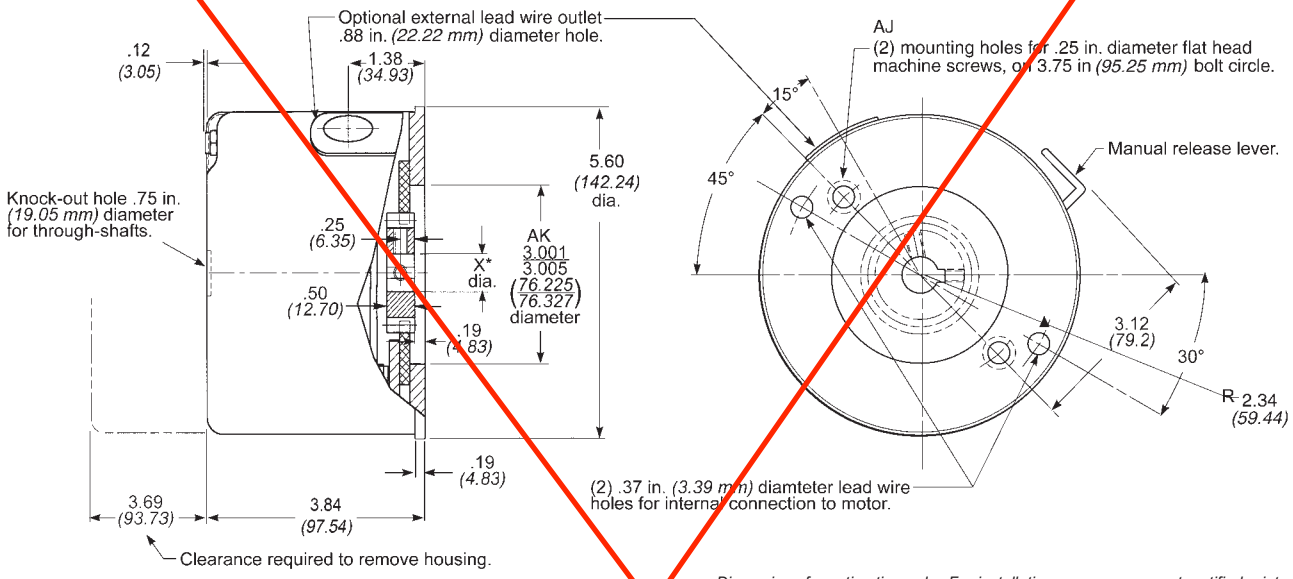
Release Type: Side Lever

Installation and Service Instructions: P/N 8-078-924-06

Parts List: P/N 8-078-914-02



- Adjustable Torque
- Manual Wear Adjustment
- Side Manual Release Lever with Automatic Reset
- Class B Coil Insulation
- Spring-Set Electrically Released
- Lead Wire Length: 24 inches
- Maximum Speed: Horizontal 5000 rpm
- Certified: CSA File LR-6254.



Dimensions for estimating only. For installation purposes request certified prints.

Specifications

Nominal Static Torque	Number of Friction Discs	Coil Size		Maximum Solenoid Cycle Rate①		Thermal Capacity②	Inertia (WK^2)
lb-ft *(Nm)*		AC	DC	cycles/min AC	cycles/min DC	hp-sec/min *(watts)*	lb-ft² *($kgm^2 \times 10^{-4}$)*
1.5 *(2)*	1	4	4	40	20	4 *(50)*	.003 *(1.26)*
3 *(4)*	1	K4	4	36	20	4 *(50)*	.003 *(1.26)*
6 *(8)*	1	M4	K4	36	20	4 *(50)*	.003 *(1.26)*

① Maximum solenoid cycle rate is based on ambient temperature of 72°F *(22°C)* with 50% duty cycle. Does not relate to brake cycle rate (see Thermal Capacity).

② Thermal capacity rating is based on ambient temperature of 72°F *(22°C)*, stop time of one second or less, with no heat absorbed from motor. Derate thermal capacity by 25% for vertical mounting. Refer to *Selection Procedure* Section.

Unit Data/Pricing

Model Number*	Nominal Static Torque (lb-ft) *(Nm)*	List Price **	Weight lbs *(kg)*	Discount Symbol
1-048-151-00-XX	1.5 *(2)*	$420.00	4.6 *(2.1)*	A3
1-048-151-01-XX	1.5 *(2)*	380.00	4.6 *(2.1)*	A3
1-048-161-00-XX	3 *(4)*	435.00	4.6 *(2.1)*	A3
1-048-161-01-XX	3 *(4)*	395.00	4.6 *(2.1)*	A3
1-048-171-00-XX	6 *(8)*	450.00	5 *(2.3)*	A3
1-048-171-01-XX	6 *(8)*	410.00	5 *(2.3)*	A3

*Eighth and Ninth positions designate lead wire position: 00 =internal and external 01 = internal only.

**Subtract $20.00 for brake ordered less hub

Ordering and Identification Information

The following example and tables provide information for selecting the appropriate three-letter suffix when ordering a Stearns Brake.

Example of a complete part number:

1-048-161-XX-BP
- Lead wire position does not apply
- Series
- Torque
- Enclosure
- 115/230 Vac
- 5/8 bore and 3/16 x 3/32 keyway
- 00= Internal and external leadwire position
- 01= Internal only

Current Ratings (amperes)

Coil Size	Current	Voltage: 60 Hz 115 Vac	230 Vac	460 Vac	575 Vac
4	Inrush	3.6	1.8	.9	.7
	Holding	.3	.2	.08	.06
K4	Inrush	4.3	2.2	1.1	.9
	Holding	.3	.2	.08	.07
M4	Inrush	3.0	1.5	.8	.6
	Holding	.6	.3	.1	.1

Modifications are available- see SAB Modification Section

Hub Selection

Char-acter	Bore (in.)	Keyway** (in. x in.)
A*	5/8	1/8 x 1/16
B	5/8	3/16 x 3/32
C*	3/4	3/16 x 3/32
K	1/2	1/8 x 1/16

Maximum allowable bore .750. For through-shaft applications .625 is maximum

*These bores are non-standard. Add $225.00 to list price.

**Keyseats made to ANSI B17.1 Standard.

Standard AC Voltage Ratings

Character	Voltage	Hz
B	115	60
D	110	50
E	200	60
F	230 190	60 50
H	220	50
L	460 380	60 50
M	415	50
N	575	60
O	110/220	50
P	115/208-230	60
Q	208-230/460 190/380	60 50
R	200/400	60

For DC Voltage add $300.00. Includes DC electronic switch (polarized).

56 Series
Mounting Face: NEMA 56C, 143TC and 145TC

The 56,X00 Series have the following design features:

- Spring-Set Electrically Released
- Static Torque 1.5 through 25 lb-ft
- Adjustable Torque, down to 50% of rated nameplate torque
- Manual Wear Adjustment
- Airgap Adjust Gage
- Splined Hub
- IP 21, 23 & 54 (formerly referred to by Stearns as NEMA type 1, 2 & 4 respectively) IP 55, 56, & 57 (formerly referred to by Stearns as NEMA Type 4X (BISSC Certified with epoxy coating and stainless steel hardware on exterior, or with a stainless steel enclosure)
- Universal mounting through 15 lb-ft. The 20 and 25 lb-ft are supplied with springs for vertical modification.

Specifications:

- Lead Wire Length: 24 inches
- Maximum Speed: Horizontal 5000 rpm Vertical 3600 rpm
- Coil Insulation: Standard Class B Optional Class H (56,800 Series Class H standard)
- Certified: CSA File LR-6254
- ABS Type Approval Certified

Product Overview

56000 Series

Designed for industrial applications requiring high performance in a compact lightweight package.

Construction:
Die cast aluminum endplate with stamped steel housing

Available Enclosures:
IP 23, 54 & 55

Release Type:
External knob manual release with or without automatic reset

Through Shaft Capability: Yes (IP 23 only)



56200 Series

Designed for industrial applications requiring the protection of a heavy duty cast iron enclosure.

Construction:
Cast iron endplate and housing.

Available Enclosures: IP 56 & 57

Release Type:
External side lever release with automatic reset

Through Shaft Capability: Yes



56500 Series

Same as 56000 Series with 182TC / 184TC mounting.

Construction:
Cast iron endplate with stamped steel housing
(Direct mount to 182TC / 184TC)

Available Enclosures:
IP 23, 54 & 55

Release Type:
External knob manual release with or without automatic reset

Through Shaft Capability: Yes (IP 23 only)



56900 Series

For use in severe environments found in process industries such as food, pulp and paper mills and chemical plants.

Construction: Stainless steel

Release Type:
Side lever with automatic reset

Available Enclosures: IP 56 & IP 57

Through Shaft Capability: with IP43 rating only



56700 Series

Units designed for industrial applications that fit between a standard C-Face motor and gear reducer. Can also be used to retrofit installed units without braking capability.

Construction: Die cast aluminum endplate and housing

Available Enclosures:
IP 23, 54, 55 & 56

Release Type: External knob release with automatic reset

C-face brake has output shaft



Also Available . . .

56100 Series

Full die cast aluminum endplate and housing with internal release lever

Available Enclosures:
IP 23, 56 & 57



56300 Series

Die cast aluminum endplate with stamped steel housing and external maintained release, IP 21



56400 Series

Cast iron endplate with stamped steel housing and external knob release

Available Enclosures:
IP 23 & 54



56600 Series

Cast iron endplate and housing with internal release lever

Available Enclosures: IP 23, 56 & 57



Series 56,000; 56,100; 56,200; 56,300; 56,400; 56,500; 56,600; 56,700; and 56,900
Mounting Face: NEMA 56C, 143TC and 145TC

Engineering Specifications

Maximum Solenoid Cycle Rate: ①
AC 36 cycles/min
DC 10 cycles/min

Thermal Capacity: ②
Horizontal 9 hp-sec/min *(112 watts)*
Vertical 6.5 hp-sec/min *(80 watts)*

① Maximum solenoid cycle rate is based on ambient temperature of 72°F *(22°C)* with 50% duty cycle.
Does not relate to brake cycle rate (see Thermal Capacity).

② Thermal capacity rating is based on ambient temperature of 72°F *(22°C)*, stop time of one second or less, with no heat absorbed from motor. Refer to *Selection Procedure* Section.

Brake set and release times in milliseconds, when brake and motor are switched separately (for T1/T2 definitions, see page 101):

Static Torque lb-ft	Coil Size	T1	T2
1.5 - 25	4, K4, K4+, M4+	25	14

Series 56,000; 56,100; 56,300; 56,500; and 56,700

Nominal Static Torque lb-ft *(Nm)*	Number of Friction Discs	Coil Size AC	Coil Size DC	Inertia (WK^2) lb-ft² *($kgm^2 \times 10^{-4}$)*
1.5-3 *(2-4)*	1	4	4+	.008 *(3.36)*
6 *(8)*	1	K4	K4+	.008 *(3.36)*
10 *(14)*	2	K4	K4+	.014 *(5.88)*
15 *(20)*	2	K4+	M4+	.014 *(5.88)*
20 *(27)*	3	K4+	M4+	.020 *(8.40)*
25 *(34)*	3	M4+	P4+	.020 *(8.40)*

Series 56,200; 56,400; 56,600; and 56,900

Nominal Static Torque lb-ft *(Nm)*	No. of Friction discs	Coil Size AC	Coil Size DC	Inertia (WK^2) lb-ft² *($kgm^2 \times 10^{-4}$)*
3-6 *(4-8)*	2	4	4+	.014 *(5.88)*
10 *(14)*	2	K4	K4+	.014 *(5.88)*
15 *(20)*	2	K4+	M4+	.014 *(5.88)*
20 *(27)*	3	K4+	M4+	.020 *(8.40)*
25 *(34)*	3	M4+	P4+	.020 *(8.40)*

Current Ratings (amperes)

Solenoid Coil Size*	AC Current	Voltage: 60 Hz 115	200	230	400	460	575	Voltage: 50 Hz 110	220	380	Voltage: DC 24	95	115	230
4	Inrush	3.6	2.1	1.8	1.1	.9	.7	4.1	2.1	.9	13.3	3.6	2.8	1.5
	Holding	.3	.2	.2	.08	.08	.06	.3	.2	.08	.3	*.1*	*.05*	*.03*
4+	Inrush	–	–	–	–	–	–	–	–	–	12.0	4.7	3.7	2.0
	Holding										*.4*	*.1*	*.08*	*.04*
K4	Inrush	4.3	2.5	2.2	1.3	1.1	.9	3.8	1.9	1.1	17.5	4.7	3.7	2.0
	Holding	*.3*	*.2*	*.2*	*.1*	*.08*	*.07*	*.4*	*.2*	*.08*	*.4*	*.1*	*.08*	*.04*
K4+	Inrush	4.6	2.5	2.3	1.2	1.0	.9	4.9	2.0	1.0	20.5	7.5	5.5	2.0
	Holding	*.4*	*.2*	*.2*	*.1*	*.1*	*.08*	*.4*	*.2*	*.1*	*.5*	*.1*	*.08*	*.04*
M4	Inrush	3.0	1.7	1.5	.9	.8	.6	–	–	.8	–	–	–	–
	Holding	*.6*	*.3*	*.3*	*.2*	*.1*	*.21*			*.1*				
M4+	Inrush	4.6	2.5	2.3	1.2	1.0	.9	4.1	2.0	1.3	30.3	7.9	5.5	2.0
	Holding	*.4*	*.2*	*.2*	*.1*	*.1*	*.08*	*.4*	*.2*	*.1*	*.5*	*.1*	*.1*	*.04*
P4+	Inrush	–	–	–	–	–	–	–	–	–	30.3	11.3	8.4	3.0
	Holding										*.5*	*.1*	*.08*	*.04*

Motor Frame Adapters: Series 56,000 through 56,600

WARNING! Before selecting an adapter to mount a brake on a larger motor frame, the torque and thermal capacity required by the application should be determined as shown in the "Selection Procedure" section. A larger motor may indicate a requirement for greater thermal capacity than the brake is designed for. The brake selection must be matched to the motor and application requirements, before use of an adapter is considered.

To Adapt to NEMA Frame Size	AK Dim. in. *(mm)*	Reg. No.	Brake Enclosure ①	Brake Torque	Adapter Stock Number	Additional Shaft Length Required in. *(mm)*
182TC 184TC 213TC 215TC 254TC 256TC	8.50 *(215.90)*	-9	IP 23	1.5-15	5-55-5041-00 List $700.00	.94 *(23.81)*
	8.50 *(215.90)*	-9	IP 54	1.5-6	5-55-5041-00 List $700.00	.94 *(23.81)*
	8.50 *(215.90)*	-9	IP 23	20 & 25	5-55-5043-00 List $700.00	.94 *(23.81)*
	8.50 *(215.90)*	-9	IP 54	10-25	5-55-5043-00 List $700.00	.94 *(23.81)*

① 56,300 Series have NEMA 1 enclosure. For adapter dimensions, see *Technical Data*

1-056-132-00-BQF

Ordering and Identification Information

The following example and tables provide information for selecting the appropriate three-letter suffix when ordering a Stearns Brake.

Example of a complete part number:

1-056-034-00-BFF
- Series
- Torque
- Enclosure
- Lead wire position (internal and external, left and right) standard
- 230 Vac
- 5/8 bore and 3/16 x 3/32 keyway

Hub Selection

Character	Bore (in.)	Keyway** (in. x in.)
A*	5/8	1/8 x 1/16
B	5/8	3/16 x 3/32
C	3/4	3/16 x 3/32
D	7/8	3/16 x 3/32
E	1-1/8	1/4 x 1/8
F*	1-1/4	1/4 x 1/8
K	1/2	1/8 x 1/16
L*	1	1/4 x 1/8
N*	9/16	1/8 x 1/16
O*	11/16	3/16 x 3/32
P*	1-1/16	1/4 x 1/8
R*	13/16	3/16 x 3/32
S*	15/16	1/4 x 1/8
Z	.460	pilot bore

Minimum bore is .500. Maximum allowable bore is 1.25. (maximum shaft length not to exceed end of hub).
For through-shaft applications, .875 is maximum

*These bores are non-standard. Add $225.00 to list price.

**Keyseats made to ANSI B17.1 Standard.

Standard AC Voltage Ratings

Character	Voltage	Hz
B	115	60
D	110	50
E	200	60
F	230 190	60 50
H	220	50
L	460 380	60 50
M	415	50
N	575	60
O	110/220	50
P	115/208-230	60
Q	208-230/460 190/380	60 50
R	200/400	60

Direct Current

Character	Voltage
T	12
U	24
V	36
W	48
X	95
Y	115
Z	230

Consult factory if other DC voltage is needed.

Voltages below 70VDC are polarity sensitive.

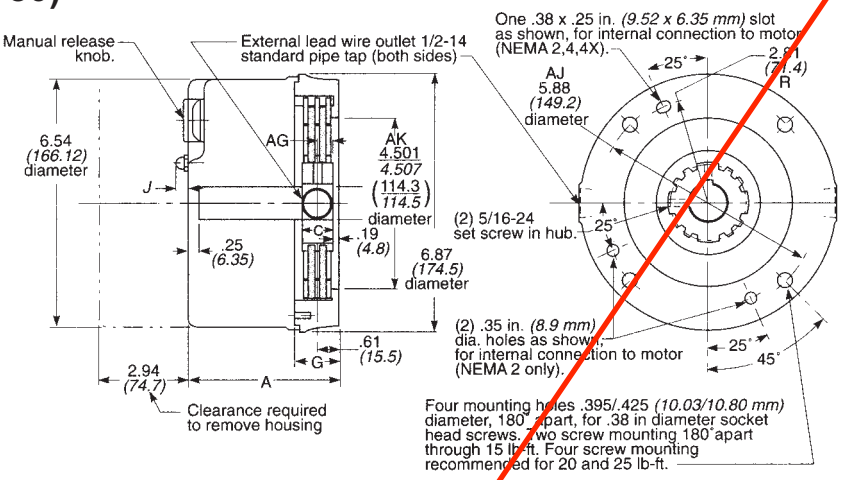
Modifications are available- see SAB Modification Section

Dimensional Drawings are on the pages following.

Series 56,000 (1-056-0XX-00) & Series 56,000-80 (1-056-0XX-80)

Mounting Face: NEMA 56C, 143TC and 145TC
4.5" AK, 5.88" AJ





Dimensions for estimating only.
For installation purposes request certified prints.

Series 56,000 Pricing (Discount Symbol B4)

Nominal Static Torque lb-ft (Nm)	Enclosure	Basic Model Number and List Price**			
		AC	AC List Price**	DC	DC List Price**
1.5 (2)	IP 23	1-056-001-00	$430.00	1-056-005-00	$730.00
	IP 54	1-056-002-00	565.00	1-056-006-00	865.00
	IP 55	1-056-004-00	640.00	1-056-008-00	940.00
3 (4)	IP 23	1-056-011-00	450.00	1-056-015-00	750.00
	IP 54	1-056-012-00	585.00	1-056-016-00	885.00
	IP 55	1-056-014-00	660.00	1-056-018-00	960.00
6 (8)	IP 23	1-056-021-00	515.00	1-056-025-00	815.00
	IP 54	1-056-022-00	650.00	1-056-026-00	950.00
	IP 55	1-056-024-00	725.00	1-056-028-00	1,025.00
10 (14)	IP 23	1-056-031-00	615.00	1-056-035-00	915.00
	IP 54	1-056-032-00	755.00	1-056-036-00	1,055.00
	IP 55	1-056-034-00	830.00	1-056-038-00	1,130.00
15 (20)	IP 23	1-056-041-00	715.00	1-056-045-00	1,015.00
	IP 54	1-056-042-00	855.00	1-056-046-00	1,155.00
	IP 55	1-056-044-00	930.00	1-056-048-00	1,230.00
20 (27)	IP 23	1-056-051-00	805.00	1-056-055-00	1,105.00
	IP 54	1-056-052-00	940.00	1-056-056-00	1,240.00
	IP 55	1-056-054-00	1,015.00	1-056-058-00	1,315.00
25 (34)	IP 23	1-056-061-00	900.00	1-056-065-00	1,200.00
	IP 54	1-056-062-00	1,035.00	1-056-066-00	1,335.00
	IP 55	1-056-064-00	1,110.00	1-056-068-00	1,410.00

Series 56,000- 80* Pricing (Discount Symbol B4)

Nominal Static Torque lb-ft (Nm)	Enclosure	Basic Model Number and List Price**			
		AC	AC List Price**	DC	DC List Price**
1.5 (2)	IP 54	1-056-002-80*	$500.00	1-056-006-80*	$800.00
3 (4)	IP 54	1-056-012-80*	520.00	1-056-016-80*	820.00
6 (8)	IP 54	1-056-022-80*	585.00	1-056-026-80*	885.00
10 (14)	IP 54	1-056-032-80*	690.00	1-056-036-80*	990.00
15 (20)	IP 54	1-056-042-80*	790.00	1-056-046-80*	1,090.00
20 (27)	IP 54	1-056-052-80*	875.00	1-056-056-80*	1,175.00
25 (34)	IP 54	1-056-062-80*	970.00	1-056-066-80*	1,270.00

Enclosure: Lightweight Steel Housing, Aluminum Endplate

Enclosure Protection: IP 23, 54 & 55
(formerly referred to by Stearns as NEMA 2, 4 & 4X* respectively)
(*BISSC certified)

Mounting: Fanguard mounted brakes requiring IP 54 or IP 55 protection may require additional sealing measures beyond seals provided with the brake. Refer to Installation & Service Instruction sheets.

Installation and Service: P/N 8-078-905-60

Parts List: P/N 8-078-906-00

Modifications: Pages 54-63

IP 23 Dimensions

Nominal Static Torque lb-ft (Nm)	Dimensions in Inches *(Dimensions in Millimeters)*					Wt lbs (Kg)
	A	AG	C Hub Width	G	J	
1.5 (2)	4.06 (103.1)	.52 (13.2)	.81 (20.6)	1.23 (31.2)	.31 (7.9)	8 (3.6)
3 (4)						8 (3.6)
6 (8)						8 (3.6)
10 (14)						8 (3.6)
15 (20)						8 (3.6)
20 (27)	4.50 (114.3)	.52 (13.2)	1.18 (30.0)	1.66 (42.2)	.31 (7.9)	9 (4.0)
25 (34)						9 (4.0)

IP 54 / 55 Dimensions

Nominal Static Torque lb-ft (Nm)	Dimensions in Inches *(Dimensions in Millimeters)*					Wt lbs (Kg)
	A	AG	C Hub Width	G	J	
1.5 (2)	4.06 (103.1)	.47 (11.9)	.81 (20.6)	1.21 (30.7)	.37 (9.4)	8 (3.6)
3 (4)						8 (3.6)
6 (8)						8 (3.6)
10 (14)	4.51 (114.6)	.59 (15.0)	1.18 (30.0)	1.66 (42.2)	.37 (9.4)	9 (4.0)
15 (20)						9 (4.0)
20 (27)						9 (4.0)
25 (34)						9 (4.0)

*** 56,000-80 Series includes a C-face gasket only, no hub seal.**

**** Subtract $30.00 for brake ordered less hub.**

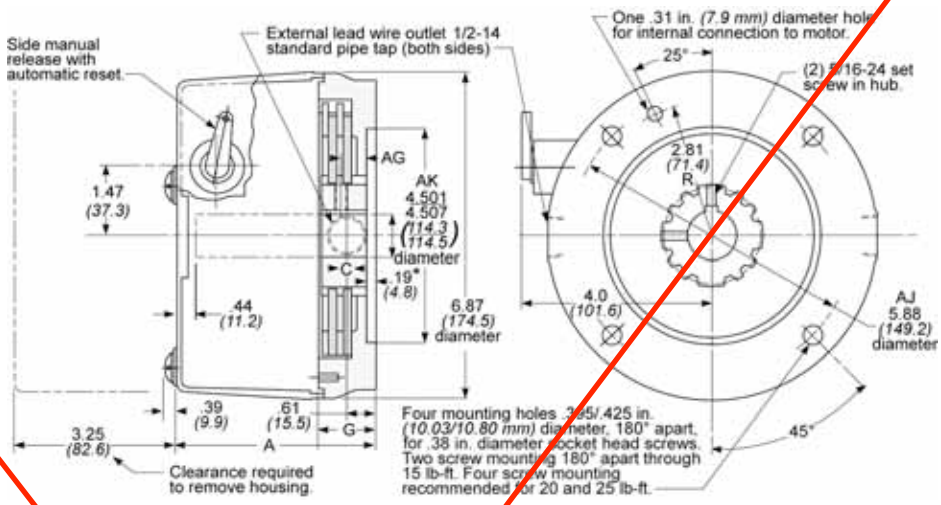
Series 56,200 (1-056-2XX) Cast Iron & Series 56,900 (1-056-9XX) Stainless Steel

Mounting Face: NEMA 56C, 143TC and 145TC
4.5” AK, 5.88” AJ

Installation and Service:
P/N 8-078-905-60

Modifications: Pages 54-63





Dimensions for estimating only. For installation purposes request certified prints.

56,200 Series: Heavy Duty Cast Iron Enclosure

Parts List: P/N 8-078-906-02

Enclosure:
IP 56 & 57 (formerly referred to by Stearns as NEMA Type 4X, BISSC Certified)

Mounting: Fanguard-mounted brakes requiring IP 56 or IP 57 protection may require additional sealing measures beyond seals provided with the brake - Refer to Installation & Service Instruction Sheets.



56,900 Series: Stainless Steel Enclosure

Parts List: P/N 8-078-906-09

Enclosure Protection:
IP 56 & 57 (formerly referred to by Stearns as NEMA Type 4X)

Mounting: Fanguard-mounted brakes requiring IP 56 or IP 57 protection may require additional sealing measures beyond seals provided with the brake - Refer to Installation & Service Instruction Sheets.

IP 56 / IP 57 Dimensions

Nominal Static Torque lb-ft (Nm)	Dimensions in Inches (Dimensions in Millimeters)				Wt lbs (Kg) 56,200	Wt lbs (Kg) 56,900
	A	AG	C Hub Width	G		
3 (4)	4.67 (118.6)	.59 (15.0)	1.18 (30.0)	1.66 (42.2)	17 (7.7)	17 (7.7)
6 (8)					17 (7.7)	17 (7.7)
10 (14)					18 (8.0)	17 (7.7)
15 (20)					18 (8.0)	17 (7.7)
20 (27)					21 (9.5)	21 (9.5)
25 (34)					21 (9.5)	21 (9.5)

Series 56,900 Pricing (Discount Symbol B4)

Nominal Static Torque lb-ft (Nm)	Enclosure	Basic Model Number and List Price*			
		AC	AC List Price*	DC	DC List Price*
3 (4)	IP 57	1-056-914-00	$3,425.00	1-056-918-00	$3,725.00
6 (8)	IP 57	1-056-924-00	3,490.00	1-056-928-00	3,790.00
10 (14)	IP 57	1-056-934-00	3,595.00	1-056-938-00	3,895.00
15 (20)	IP 57	1-056-944-00	3,695.00	1-056-948-00	3,995.00
20 (27)	IP 57	1-056-954-00	3,780.00	1-056-958-00	4,080.00
25 (34)	IP 57	1-056-964-00	3,875.00	1-056-968-00	4,175.00

* Subtract $30.00 for brake ordered less hub.

Series 56,200 Pricing (Discount Symbol B4)

Nominal Static Torque lb-ft (Nm)	Enclosure	Basic Model Number and List Price*			
		AC	AC List Price*	DC	DC List Price*
3 (4)	IP 56	1-056-212-00	$1,350.00	1-056-216-00	$1,650.00
	IP 57	1-056-214-00	1,425.00	1-056-218-00	1,725.00
6 (8)	IP 56	1-056-222-00	1,415.00	1-056-226-00	1,715.00
	IP 57	1-056-224-00	1,490.00	1-056-228-00	1,790.00
10 (14)	IP 56	1-056-232-00	1,520.00	1-056-236-00	1,820.00
	IP 57	1-056-234-00	1,595.00	1-056-238-00	1,895.00
15 (20)	IP 56	1-056-242-00	1,620.00	1-056-246-00	1,920.00
	IP 57	1-056-244-00	1,695.00	1-056-248-00	1,995.00
20 (27)	IP 56	1-056-252-00	1,705.00	1-056-256-00	2,005.00
	IP 57	1-056-254-00	1,780.00	1-056-258-00	2,080.00
25 (34)	IP 56	1-056-262-00	1,800.00	1-056-266-00	2,100.00
	IP 57	1-056-264-00	1,875.00	1-056-268-00	2,175.00

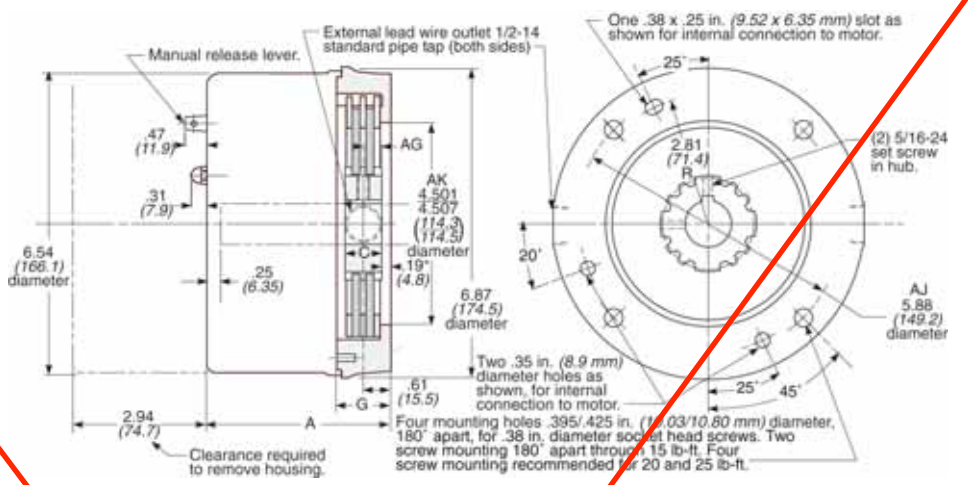
Series 56,300 (1-056-3XX)

Mounting Face: NEMA 56C, 143TC and 145TC , 4.5" AK, 5.88" AJ



56,300 Series Enclosure: IP 21 (formerly referred to by Stearns as NEMA 1), Stamped steel housing, cast aluminum endplate
Release Type: Lever, maintained
Parts List: P/N 8-078-906-03

Installation and Service:
P/N 8-078-905-60



Series 56,300 Pricing (Discount Symbol B4)

Nominal Static Torque lb-ft (Nm)	Basic Model Number and List Price*			
	AC	AC List Price*	DC	DC List Price*
1.5 *(2)*	1-056-301-00	$445.00	1-056-305-00	$745.00
3 *(4)*	1-056-311-00	465.00	1-056-315-00	765.00
6 *(8)*	1-056-321-00	530.00	1-056-325-00	830.00
10 *(14)*	1-056-331-00	630.00	1-056-335-00	930.00
15 *(20)*	1-056-341-00	730.00	1-056-345-00	1,030.00
20 *(27)*	1-056-351-00	820.00	1-056-355-00	1,120.00
25 *(34)*	1-056-361-00	915.00	1-056-365-00	1,215.00

*Subtract $30.00 for brake ordered less hub.

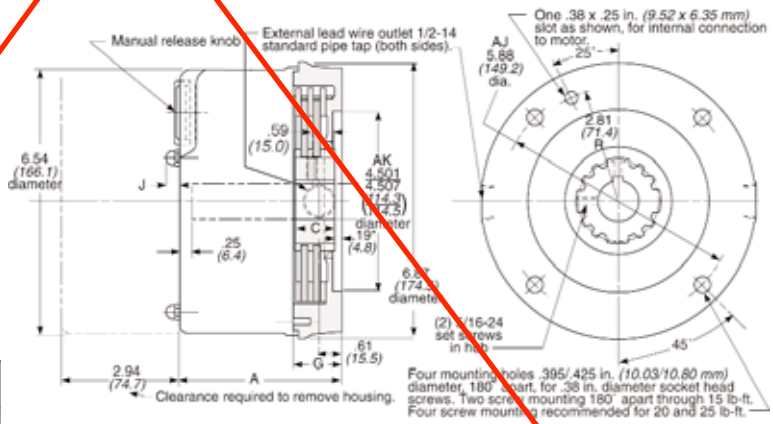
IP 21 Dimensions

Nominal Static Torque lb-ft (Nm)	Dimensions in Inches *(Dimensions in Millimeters)*				Wt lbs (Kg)
	A	AG	C Hub Width	G	
1.5 *(2)*	4.01 *(101.9)*	.59 *(15.0)*	.81 *(20.6)*	1.21 *(30.7)*	8 *(3.6)*
3 *(4)*					8 *(3.6)*
6 *(8)*					8 *(3.6)*
10 *(14)*					8 *(3.6)*
15 *(20)*					8 *(3.6)*
20 *(27)*	4.46 *(113.3)*	.59 *(15.0)*	1.18 *(30.0)*	1.66 *(42.2)*	9 *(4.0)*
25 *(34)*					9 *(4.0)*

Series 56,400 (1-056-4XX)

56,400 Series: Stamped steel housing, cast iron endplate.
Enclosure Protection: IP 23 & 54 (formerly referred to by Stearns as NEMA 2 & 4 respectively)
Release Type: Knob, maintained
Mounting: Fanguard-mounted brakes requiring IP 54 protection may require additional sealing measures beyond seals provided with the brake - Refer to Installation & Service Instruction sheets
Parts List: P/N 8-078-906-04
Installation and Service: P/N 8-078-905-60





Series 56,400 Pricing (Discount Symbol B4)

Nominal Static Torque lb-ft (Nm)	Enclosure	Basic Model Number and List Price*			
		AC	AC List Price*	DC	DC List Price*
3 *(4)*	IP 23	1-056-411-00	640.00	1-056-415-00	940.00
	IP 54	1-056-412-00	775.00	1-056-416-00	1,075.00
6 *(8)*	IP 23	1-056-421-00	705.00	1-056-425-00	1,005.00
	IP 54	1-056-422-00	840.00	1-056-426-00	1,140.00
10 *(14)*	IP 23	1-056-431-00	805.00	1-056-435-00	1,105.00
	IP 54	1-056-432-00	945.00	1-056-436-00	1,245.00
15 *(20)*	IP 23	1-056-441-00	905.00	1-056-445-00	1,205.00
	IP 54	1-056-442-00	1,045.00	1-056-446-00	1,345.00
20 *(27)*	IP 23	1-056-451-00	995.00	1-056-455-00	1,295.00
	IP 54	1-056-452-00	1,130.00	1-056-456-00	1,430.00
25 *(34)*	IP 23	1-056-461-00	1,090.00	1-056-465-00	1,390.00
	IP 54	1-056-462-00	1,225.00	1-056-466-00	1,525.00

*Subtract $30.00 for brake ordered less hub.

IP 23 Dimensions

Nominal Static Torque lb-ft (Nm)	Dimensions in Inches *(mm)*			Wt lbs (Kg)
	A	C Hub Width	G	
3 *(4)*	4.46 *(113.3)*	1.18 *(30.0)*	1.66 *(42.2)*	11 *(5.0)*
6 *(8)*				11 *(5.0)*
10 *(14)*				11 *(5.0)*
15 *(20)*				12 *(5.5)*
20 *(27)*				12 *(5.5)*
25 *(34)*				13 *(6.0)*

IP 54 Dimensions

Nominal Static Torque lb-ft (Nm)	Dimensions in Inches *(mm)*			Wt lbs (Kg)
	A	C Hub Width	G	
3 *(4)*	4.51 *(114.6)*	1.18 *(30.0)*	1.66 *(42.2)*	12 *(5.5)*
6 *(8)*				12 *(5.5)*
10 *(14)*				12 *(5.5)*
15 *(20)*				13 *(6.0)*
20 *(27)*				13 *(6.0)*
25 *(34)*				13 *(6.0)*

Series 56,100 (1-056-1XX) Die Cast Aluminum & Series 56,600 (1-056-6XX) Cast Iron

Mounting Face: NEMA 56C, 143TC and 145TC , 4.5" AK, 5.88" AJ



Release Type: Internal Lever, Non-Maintained

Installation and Service: P/N 8-078-905-60

Modifications: Pages 54-63

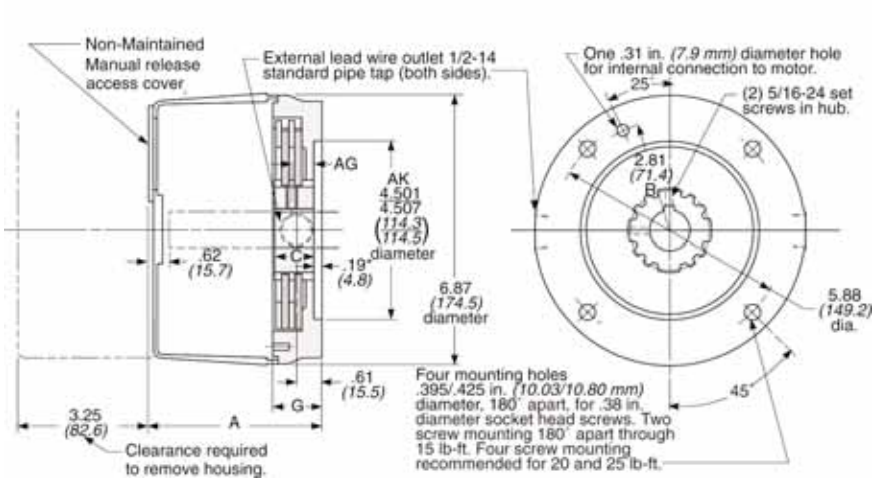
Enclosure Protection: IP 23; 56 & 57 (formerly referred to by Stearns as NEMA 2, 4 & 4X respectively)

Visual Wear Indicator

Mounting: Fanguard-mounted brakes requiring IP 56 or IP 57 protection may require additional sealing measures beyond seals provided with the brake - Refer to Installation & Service Instruction sheets

56,100 Series: Die Cast aluminum enclosure
Parts List: P/N 8-078-906-01

56,600 Series: Cast iron enclosure
Parts List: P/N 8-078-906-06



Series 56,100 Dimensions

Nominal Static Torque lb-ft (Nm)	Enclosure	Dimensions in Inches (mm)				Wt lbs (Kg)
		A	AG	C Hub Width	G	
1.5-15 (2-20)	IP 23	4.41 (112.0)	.59 (15.0)	.81 (20.6)	1.21 (30.7)	8 (3.6)
20-25 (27-34)		4.86 (123.4)		1.18 (30.0)	1.66 (42.2)	10 (4.5)
1.5-6 (2-8)	IP 56/57	4.50 (114.3)	.47 (11.9)	.81 (20.6)	1.21 (30.7)	8 (3.6)
10-25 (14-34)		4.95 (125.7)	.59 (15.0)	1.18 (30.0)	1.66 (42.2)	10 (4.5)

Series 56,600 Dimensions

Nominal Static Torque lb-ft (Nm)	Enclosure	Dimensions in Inches (mm)				Wt lbs (Kg)
		A	AG	C Hub Width	G	
3-25 (4-34)	IP 23	4.95 (125.7)	.59 (15.0)	1.18 (30.0)	1.66 (42.2)	21 (9.5)
3-25 (4-34)	IP 56/57	5.05 (128.3)				

Series 56,100 Pricing (Discount Symbol B4)

Nominal Static Torque lb-ft (Nm)	Enclosure	Basic Model Number and List Price*			
		AC	AC List Price*	DC	DC List Price*
1.5 (2)	IP 23	1-056-101-00	$505.00	1-056-105-00	$805.00
	IP 56	1-056-102-00	640.00	1-056-106-00	940.00
	IP 57	1-056-104-00	715.00	1-056-108-00	1,015.00
3 (4)	IP 23	1-056-111-00	525.00	1-056-115-00	825.00
	IP 56	1-056-112-00	660.00	1-056-116-00	960.00
	IP 57	1-056-114-00	735.00	1-056-118-00	1,035.00
6 (8)	IP 23	1-056-121-00	590.00	1-056-125-00	890.00
	IP 56	1-056-122-00	725.00	1-056-126-00	1,025.00
	IP 57	1-056-124-00	800.00	1-056-128-00	1,100.00
10 (14)	IP 23	1-056-131-00	690.00	1-056-135-00	990.00
	IP 56	1-056-132-00	830.00	1-056-136-00	1,130.00
	IP 57	1-056-134-00	905.00	1-056-138-00	1,205.00
15 (20)	IP 23	1-056-141-00	790.00	1-056-145-00	1,090.00
	IP 56	1-056-142-00	930.00	1-056-146-00	1,230.00
	IP 57	1-056-144-00	1,005.00	1-056-148-00	1,305.00
20 (27)	IP 23	1-056-151-00	880.00	1-056-155-00	1,180.00
	IP 56	1-056-152-00	1,015.00	1-056-156-00	1,315.00
	IP 57	1-056-154-00	1,090.00	1-056-158-00	1,390.00
25 (34)	IP 23	1-056-161-00	975.00	1-056-165-00	1,275.00
	IP 56	1-056-162-00	1,110.00	1-056-166-00	1,410.00
	IP 57	1-056-164-00	1,185.00	1-056-168-00	1,485.00

Series 56,600 Pricing (Discount Symbol B4)

Nominal Static Torque lb-ft (Nm)	Enclosure	Basic Model Number and List Price*			
		AC	AC List Price*	DC	DC List Price*
3 (4)	IP 23	1-056-611-00	1,200.00	1-056-615-00	1,500.00
	IP 56	1-056-612-00	1,335.00	1-056-616-00	1,635.00
	IP 57	1-056-614-00	1,410.00	1-056-618-00	1,710.00
6 (8)	IP 23	1-056-621-00	1,265.00	1-056-625-00	1,565.00
	IP 56	1-056-622-00	1,400.00	1-056-626-00	1,700.00
	IP 57	1-056-624-00	1,475.00	1-056-628-00	1,775.00
10 (14)	IP 23	1-056-631-00	1,365.00	1-056-635-00	1,665.00
	IP 56	1-056-632-00	1,505.00	1-056-636-00	1,805.00
	IP 57	1-056-634-00	1,580.00	1-056-638-00	1,880.00
15 (20)	IP 23	1-056-641-00	1,465.00	1-056-645-00	1,765.00
	IP 56	1-056-642-00	1,605.00	1-056-646-00	1,905.00
	IP 57	1-056-644-00	1,680.00	1-056-648-00	1,980.00
20 (27)	IP 23	1-056-651-00	1,555.00	1-056-655-00	1,855.00
	IP 56	1-056-652-00	1,690.00	1-056-656-00	1,990.00
	IP 57	1-056-654-00	1,765.00	1-056-658-00	2,065.00
25 (34)	IP 23	1-056-661-00	1,650.00	1-056-665-00	1,950.00
	IP 56	1-056-662-00	1,785.00	1-056-666-00	2,085.00
	IP 57	1-056-664-00	1,860.00	1-056-668-00	2,160.00

* Subtract $30.00 for brake ordered less hub.

Series 56,500 (1-056-5XX)

Mounting Face: NEMA 182TC and 184TC
8.5" AK, 7.25" AJ



Enclosure Material: Stamped Steel Housing, Cast Iron Endplate

Enclosure Protection: IP 23, 54 & 55 (formerly referred to by Stearns as NEMA 2, 4 & 4X*) * BISSC Certified

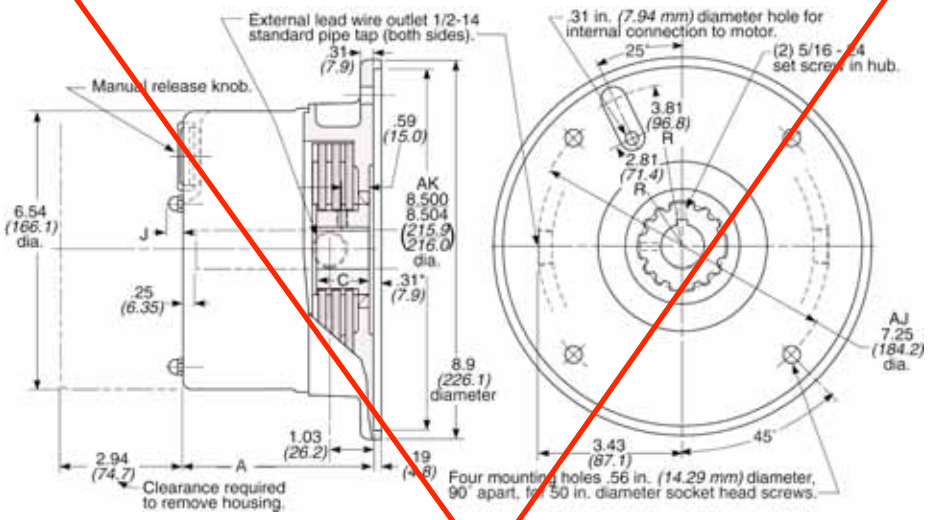
Release Type: Knob, Maintained with Automatic Reset

Mounting: Fanguard-mounted brakes requiring IP 54 or IP 55 protection may require additional sealing measures beyond seals provided with the brake - Refer to Installation & Service Instruction sheets.

Installation and Service:
P/N 8-078-905-60

Parts List: P/N 8-078-906-05

Modifications: Pages 54-63



* Hub location.

Dimensions for estimating only. For installation purposes request certified prints.

IP 23 Dimensions

Nominal Static Torque lb-ft (Nm)	Dimensions in Inches *(Dimensions in Millimeters)*			Wt lbs (Kg)
	A	C Hub Width	J	
10 *(14)*	4.46 *(113.3)*	.81 *(20.6)*	.31 *(7.9)*	14 *(6.4)*
15 *(20)*				14 *(6.4)*
20 *(27)*				14 *(6.4)*
25 *(34)*				15 *(6.8)*

IP 54 / 55 Dimensions

Nominal Static Torque lb-ft (Nm)	Dimensions in Inches *(Dimensions in Millimeters)*			Wt lbs (Kg)
	A	C Hub Width	J	
10 *(14)*	4.51 *(114.6)*	1.18 *(30.0)*	.37 *(9.4)*	14 *(6.4)*
15 *(20)*				14 *(6.4)*
20 *(27)*				15 *(6.8)*
25 *(34)*				15 *(6.8)*

Unit Pricing (Discount Symbol B4)

Nominal Static Torque lb-ft (Nm)	Enclosure	Basic Model Number and List Price*			
		AC	AC List Price*	DC	DC List Price*
10 *(14)*	IP 23	1-056-531-00	$840.00	1-056-535-00	$1,140.00
	IP 54	1-056-532-00	980.00	1-056-536-00	1,280.00
	IP 55	1-056-534-00	1,055.00	1-056-538-00	1,355.00
15 *(20)*	IP 23	1-056-541-00	940.00	1-056-545-00	1,240.00
	IP 54	1-056-542-00	1,080.00	1-056-546-00	1,380.00
	IP 55	1-056-544-00	1,155.00	1-056-548-00	1,455.00
20 *(27)*	IP 23	1-056-551-00	1,030.00	1-056-555-00	1,330.00
	IP 54	1-056-552-00	1,165.00	1-056-556-00	1,465.00
	IP 55	1-056-554-00	1,240.00	1-056-558-00	1,540.00
25 *(34)*	IP 23	1-056-561-00	1,125.00	1-056-565-00	1,425.00
	IP 54	1-056-562-00	1,260.00	1-056-566-00	1,560.00
	IP 55	1-056-564-00	1,335.00	1-056-568-00	1,635.00

* Subtract $30.00 for brake ordered less hub.

Series 87,000 and 87,100
Mounting Face: NEMA 182TC - 256TC/UC

The 87,X00** Series have the following design features:

- Self-Adjusting Design
- Splined Hub
- Lead Wire Length: 24 inches
- Maximum Speed:
  Horizontal 4000 rpm
  Vertical 3600 rpm (modification required for vertical mounting), see SAB Modification Section.
- Coil Insulation: Standard Class B Optional Class H (Class H standard on 87,800)
- Certified: CSA File LR-6254
- ABS Type Approval Certified

** Does not include 87,300 and 87,700 Series brakes.

Engineering Specifications

Nominal Static Torque lb-ft (Nm)	No. of Friction Discs	Coil Size	Maximum Solenoid Cycle Rate① Cycles/min	Thermal Capacity ② hp-sec/min (watts)	Inertia (Wk²) lb-ft² (kgm² x 10⁻⁴) 87,000	87,100	87,700
6 (8)	1	5	30	17.5 (218)	.048 (20.34)	—	—
10 (14)	1	5	30	17.5 (218)	.048 (20.34)	—	.078 (32.76)
15 (20)	1	6	25	17.5 (218)	.048 (20.34)	—	.078 (32.76)
25 (34)	1	6	25	17.5 (218)	.048 (20.34)	—	.078 (32.76)
35 (47)	1	8	20	17.5 (218)	.048 (20.34)	—	.078 (32.76)
50 (68)	2	6	25	17.5 (218)	.089 (37.40)	.089 (37.40)	.108 (45.36)
75 (102)	2	8	20	17.5 (218)	.089 (37.40)	.089 (37.40)	.108 (45.36)
105 (142)	3	8	20	17.5 (218)	.129 (54.45)	.129 (54.45)	.145 (60.90)
125 (169)	3	8	20	20.0 (248)	—	.129 (54.45)	—

① Maximum solenoid cycle rate is based on ambient temperature of 72°F *(22°C)* with 50% duty cycle. Does not relate to brake cycle rate (see *Thermal Capacity*).

② Thermal capacity rating is based on ambient temperature of 72°F *(22°C)*, stop time of one second or less, with no heat absorbed from motor. Derate thermal capacity by 25% for vertical mounting. Refer to *Selection Procedure* Section.
87,800 Thermal capacity is 14 hp-sec/min (174 watts).

Current Ratings (amperes)

Solenoid Coil Size	AC Current	Voltage: 60 Hz 115	200	230	400	460	575	Voltage: 50 Hz 110	220	380	Voltage: DC 24	95	115	230
5	inrush	7.5	4.3	3.7	2.2	1.9	1.5	5.4	4.0	1.9	38.0	8.4	5.6	3.2
	holding	.5	.3	.2	.1	.1	.09	.3	.3	.1	.5	.1	.08	.04
6	inrush	13.0	7.5	6.5	3.7	3.2	2.6	9.4	5.5	3.2	42.8	11.7	8.5	3.7
	holding	.6	.4	.3	.2	.2	.1	.5	.3	.2	.61	.16	.13	.06
8	inrush	17.6	10.3	8.8	5.0	4.2	3.5	15.4	7.7	4.2	43.1	11.4	9.3	4.6
	holding	1.2	.7	.6	.3	.3	.3	1.0	.5	.3	.8	.2	.2	.09

Motor Frame Adapters/Special Endplate

To Adapt to NEMA Frame Size	in. (mm)	Reg. No.	Adapter Stock Number	Additional Shaft Length Required in. (mm)
56C, 143TC, or 145TC 182TFC, 184TFC	4.50 (114.30)	-05	Brake endplate is modified for 4.50 in AK. Adder below*	— (—)
			5-55-7043-00 List $1,300.00	.56 (14.22)
284TC 286TC	10.50 (266.70)	-11	5-55-7055-00 List $450.00	.81 (20.64)
metric	—	-10	Endplate modified for 130mm register (AK) & 165mm bolt circle (AJ). Add: Brake w/aluminum endplate $725.00 includes adder for cast iron endplate. Brake with cast iron endplate: $340.00	—
324TC, 326TC 364TC, 365TC, 404TC or 405TC	12.50 (317.50)	-13	5-55-7046-00 List $875.00	.88 (22.22)
	—	-07	Endplate modified to provide a 6.75" male register (AK) and 7.19" bolt circle (AJ). Adder below*	
182TC/184TC, 213TC, 215TC, 254TC/256TC	8.5 (215.90)	-03	Extended endplate. Adder below*	.625 (15,88)

*Brakes with aluminum endplate: $725.00 (includes adder for cast iron endplate)
*Brakes with cast iron endplate: $340

For motor frame adapters: Series 87,000 through 87,800 see Technical Data

Ordering and Identification Information

The following example and tables provide information for selecting the appropriate three-letter suffix when ordering a Stearns Brake.

Example of a complete part number:

1-087-031-00-BFF
- Series
- Torque
- Enclosure
- Modification
- Lead wire position (internal and external, left and right)
- 230 Vac
- 5/8 bore and 3/16 x 3/32 keyway
- Endplate

Hub Selection

Character	Bore (in.)	Keyway** (in. x in.)
A*	5/8	1/8 x 1/16
B*	5/8	3/16 x 3/32
C*	3/4	3/16 x 3/32
D	7/8	3/16 x 3/32
E	1-1/8	1/4 x 1/8
F	1-1/4	1/4 x 1/8
G	1-3/8	5/16 x 5/32
H	1-5/8	3/8 x 3/16
I*	1-3/4	3/8 x 3/16
J*	1-7/8	1/2 x 1/4
K*	1/2	1/8 x 1/16
L*	1	1/4 x 1/8
M*	1-1/2	3/8 x 3/16
N*	9/16	1/8 x 1/16
O*	11/16	3/16 x 3/32
P*	1-1/16	1/4 x 1/8
Q*	1-7/16	3/8 x 3/16
R*	13/16	3/16 x 3/32
S*	15/16	1/4 x 1/8
T*	1-3/16	1/4 x 1/8
U*	1-5/16	5/16 x 5/32
Z	.600	pilot bore

Maximum allowable bore 1.875 (maximum shaft length not to exceed end of hub).
For thru-shaft applications 1.625 is maximum.
*These bores are non-standard.
Add $250.00 to list price.
**Keyseats made to ANSI B17.1 standard.

Standard AC Voltage Ratings

Character	Voltage	Hz
B	115	60
D	110	50
E	200	60
F	230 190	60 50
H	220	50
L	460 380	60 50
M	415	50
N	575	60
O	110/220	50
P	115/230	60
Q	230/460 190/380	60 50
R	200/400	60

Direct Current

Character	Voltage
T	12
U	24
V	36
W	48
X	95
Y	115
Z	230

Consult factory if other DC voltage is needed.

Modifications are available-see SAB Modification Section

Dimensional drawings are on the pages following.

Series 87,000

Mounting Face: NEMA 182TC 184TC, 213TC, 215TC, 254TC, and 256TC (Note: for 182TFC and 184TFC mounting, add a -05- register) 8.5" AK, 7.25" AJ



Static Torque: 6 through 105 lb-ft

Enclosure Material: IP 23 - Sheet Metal Housing, Aluminum Endplate. IP 54 & 55 - Cast Iron Housing and Endplate. IP 54 & 55 also available in sheet metal housing, aluminum endplate. IP 56 - Cast iron housing and endplate.

Enclosure Protection: IP 23, 54 55 (formerly referred to as NEMA 2, 4 & 4X* respectively) & IP 56. *BISSC Certified

Release Type: Pull Release Knob, maintained with automatic reset. Vertical above IP 54 & 55 supplied with side manual release lever; and all Cast Iron IP 55 brakes supplied with side manual release lever.

Installation, Service and Parts List: P/N 8-078-928-01 *Rev. B brakes*

Mounting: Horizontal, unless modified for vertical. Vertical mounting is defined as 15° or more from horizontal. Vertical above requires modification. Vertical below requires modification on 50-105 lb-ft brakes. Vertical above IP 54/55 includes side manual release. See SAB Modification Section for list price adders.

Fanguard-mounted brakes requiring IP 54 or IP 55 protection may require additional sealing measures beyond seals provided with the brake - Refer to Installation & Service Instruction sheets.

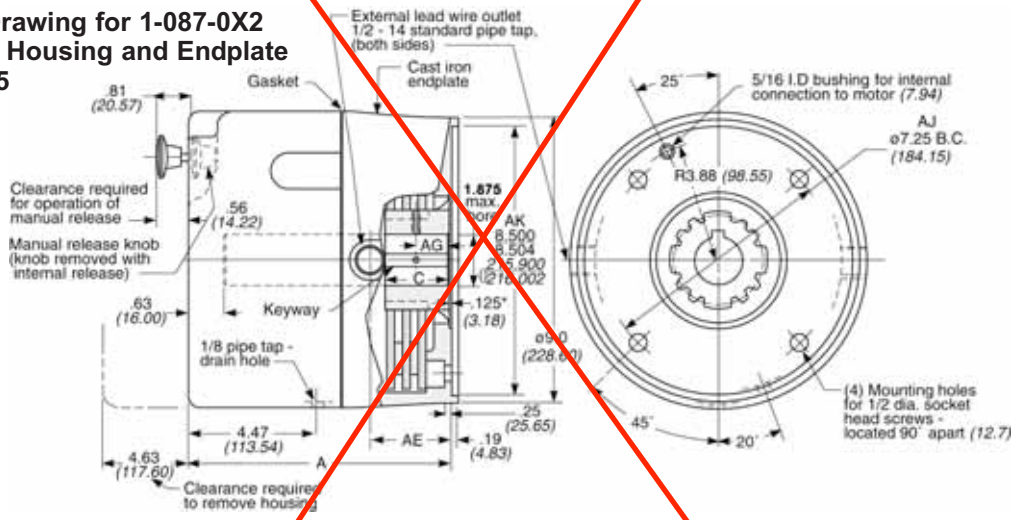
Specifications including bore sizes/voltages: Page 17

Modifications: Pages 54-63 Including New Manual Adjust Option

Brake set and release times in milliseconds, when brake and motor are switched separately (for T1/T2 definitions, see page 101):

Static Torque	Coil Size	T1	T2
10, 15, 25, 50	5 & 6	42	20
35, 75, 105	8	48	20

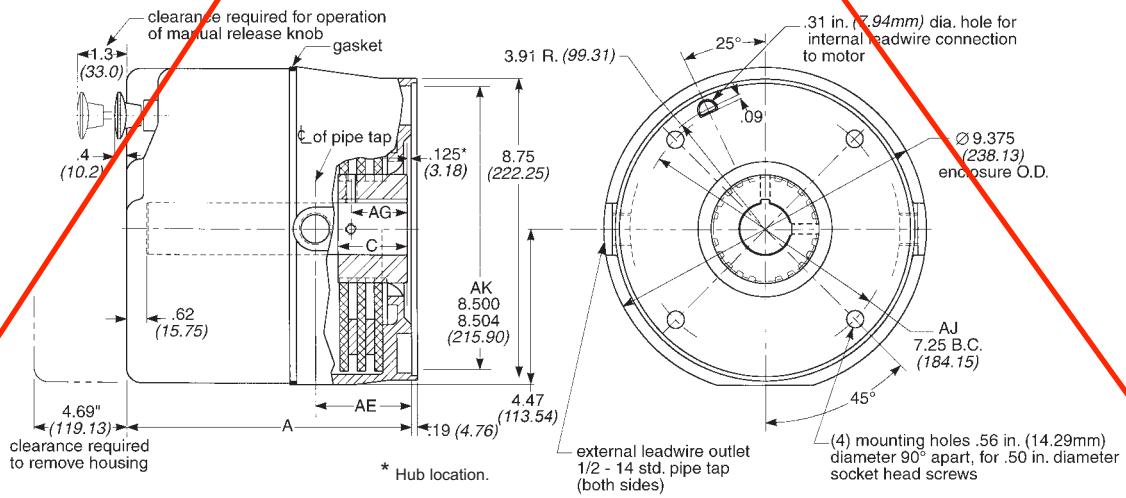
Outline Drawing for 1-087-0X2 Cast Iron Housing and Endplate IP 54 & 55



* Hub location.

Dimensions for estimating only. For installation purposes request certified prints.

Outline Drawing for 1-087-0X1 and 1-087-0X4 Sheet Metal Housing, Aluminum Endplate IP 23, 54 & 55



* Hub location.

Hazardous Location Brakes

BACK TO TABLE OF CONTENTS

Enclosures for standard Stearns disc brakes are designed to prevent accidental contact with the internal mechanism while keeping contaminants from the operating parts. Many installations, however, require additional protection due to the presence of explosive gases or ignitable dusts in the atmosphere. Hazardous locations are defined in the National Electrical Code (NEC) and designated by Class, Division and Group. For a better understanding of hazardous locations, or for definitions of hazardous location terminology, please refer to: http://www.ul.com/global/eng/pages/offerings/services/hazardouslocations/.

- *Class I* – Locations where the atmosphere may contain flammable gases or vapors in explosive or ignitable concentrations. An electric disc brake for Class I locations must be built in such a manner that any ignition of gases or vapors within the brake will not result in rupture of the enclosure or allow a flame or spark to travel from within the brake to the surrounding hazardous atmosphere.
- *Class II* – Locations with combustible dust in suspension in the atmosphere. An electric disc brake for Class II locations must be enclosed in a manner which precludes entry of ignitable dusts or exit of any arcs, sparks, or hot gases which may cause ignition of dusts suspended in the surrounding atmosphere or accumulated on the enclosure. The exterior surface temperature of the brake enclosure must be limited so that it can function at its maximum-rated duty cycle without causing dehydration or carbonization of dust that accumulates on the enclosure.
- *Divisions* – Each hazardous-location Class is also divided into two Divisions, 1 and 2. Division 1 is a *normally* hazardous location. Division 2 is normally *not* hazardous. Division 1 brakes can be used in both types of locations. **Division 2 can be used in Division 2 environments ONLY.**
- *Groups* – Class I gases and vapors are listed in four Groups A, B, C and D, based on specific properties such as maximum explosion pressure and ignition temperature. Class II airborne dusts are listed in three Groups: E, F, and G. The dust properties considered include thermal and electrical conductivity and ignition temperature.

Selection

When specifying a Stearns hazardous-location disc brake, the Class and Group designations of the hazardous atmosphere and its ignition temperature must be known. The selection table gives the hazardous atmospheres that Stearns brakes are suitable for, along with the brake's maximum operating temperature. For more information on hazardous location responsibilities, see: http://www.ul.com/global/eng/pages/offerings/services/hazardouslocations/

Step 1 – Determine the Class and Group designation of the hazardous atmosphere.

Step 2 – For Class I hazardous substances, determine the ignition temperature of the explosive gas or vapor. Select a brake listed for the appropriate group with a maximum external surface temperature that does *not* exceed the ignition temperature of the explosive gas or vapor.

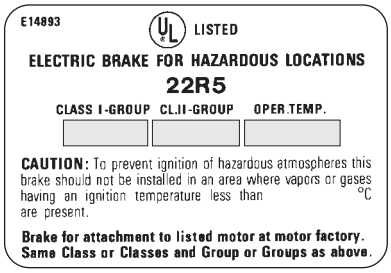
Step 3 – For Class II hazardous substances, select a brake listed for the appropriate group.

Ignition temperatures of Combustible Dusts may be found in NFPA publication NFPA 499 Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas. Ignition temperatures of Flammable Liquids, Gases and Vapors may be found in NFPA publication NFPA 497 Recommended Practice for the Classification of Flammable Liquids, Gases and Vapors and of Hazardous (Classified) locations for Electrical Installations in Chemical Process Areas.

Brake Labels and Listing

Stearns brakes for use in hazardous locations are marked to show the Class, Group, and maximum Class II operating temperature (in a 40°C ambient) of the brake enclosure, as well as the minimum Class I ignition temperature of the gases or vapors to which they can be exposed.

Generally, compliance with the NEC is demonstrated by UL Listing of the product in Underwriters Laboratories Hazardous Location Equipment Directory. A label displaying the UL Listing mark and required rating information will be found on each Stearns brake to confirm the Listing.



In Canada, the Canadian Standards Association (CSA) is an organization with the responsibility to publish and administer national electrical standards as well as to test and certify electrical products. The CUL or CSA monogram will be found on Stearns hazardous-location brakes sold in Canada to confirm certification.

Stearns *motor-mounted*, hazardous-location electric disc brakes are Listed only when mounted directly to a Listed hazardous-location motor of the same Class and Group at the motor manufacturer's facility, and where the combination has been accepted by UL. This procedure completes the explosion-proof assembly of the brake. However, *foot-mounted* Listed hazardous-location disc brakes are also available for coupling to a motor, and may be installed by anyone.

These brakes are listed by UL (Underwriters Laboratories, Inc.,) for use in certain locations classified as hazardous. Installation and servicing must be in compliance with all existing local safety codes. All wiring and electrical connections must comply with the National Electric Code (NEC) and local electrical codes in effect at the time. For additional information see the Underwriters Laboratories (UL) website http://www.ul.com/hazloc/codes/html.

HazLoc inspection authorities are responsible for verifying and authorizing the use of suitably designed, manufactured and installed HazLoc equipment. When questions arise always consult the local Authority Having Jurisdiction (AHJ) for directions and approvals.

Hazardous-Location Brake Enclosures

Division 1, hazardous location brakes are typically provided with machined components, without gaskets. Series 65300 brakes can be provided with gaskets to meet IP 55, 56 or Type 4 enclosure protection. Series 87300 brakes can be provided with gaskets to meet IP 55, 56 or 57 enclosure protection. Series 82300 can be provided with IP 56 enclosure protection. All Division 1 enclosures prevent flame propagation to the outside atmosphere through tortuous flame paths having controlled clearances. If the brake is used in a high humidity or low temperature environment, internal electric heaters should be used.

Division 2 hazardous location brakes are provided with an IP 55 enclosure. Heater and proximity switch options are limited to Division 2, Class II brakes.

Thermal Considerations

A major design requirement of hazardous-location brakes is to limit exterior surface temperature. The surface temperature of the enclosure must not exceed a specified limit as a result of heat energy created in stopping the motor and load. This NEC restriction on the exterior surface temperature limits the hazardous-location brake's ability to dissipate heat, resulting in less thermal capacity than a comparable brake with a standard or dust-tight, waterproof enclosure.

THEREFORE, HAZARDOUS-LOCATION BRAKES ARE INTENDED ESSENTIALLY FOR NON-CYCLIC OR HOLDING PURPOSES, BUT MAY BE USED FOR STOPPING LIGHT INERTIAL LOADS.

Hazardous Location Brake Selection Table

Classification		Minimum Auto-Ignition Temperature of Atmosphere	Minimum Layer or Cloud Ignition Temperature	T Code	Brake Series Division 1	Brake Series Division 2
Class	Group					
I	A	160°C / 320°F		T3C		56800, 87800
	B	160°C / 320°F		T3C		56800, 87800
	C	100°C / 212°F		T5	87300	
		135°C / 275°F		T4	82300	
		160°C / 320°F		T3C		56800, 87800
		180°C / 356°F		T3A	65300	
	D	100°C / 212°F		T5	87300	
		135°C / 275°F		T4	82300	
		160°C / 320°F		T3C		56800, 87800
		180°C / 356°F		T3A	65300	
II	E		100°C / 212°F	T5	87300	
			135°C / 275°F	T4	82300	
			165°C / 329°F	T3B	65300*	
	F		100°C / 212°F	T5	87300	
			135°C / 275°F	T4	82300	
			160°C / 320°F	T3C		56800, 87800
			165°C / 329°F	T3B		87800
			165°C / 329°F	T3B	65300	
	G		100°C / 212°F	T5	87300	
			135°C / 275°F	T4	82300	
			160°C / 320°F	T3C		56800, 87800
			165°C / 329°F	T3B		87800
			165°C / 329°F	T3B	65300	
NOTE: Group E available in select models only. Consult Factory.						

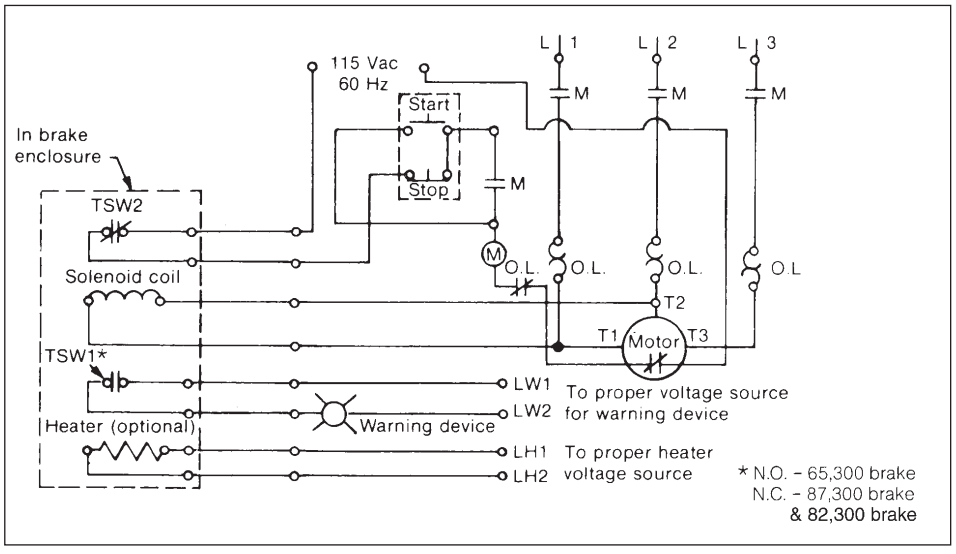
*Series 65,300-07 (New Design Close Coupled) and 65,300-09 (Fan Guard Mount) are Class I Group C and D, Class II Group F and G only
Maximum exterior surface temperature is based on operation in an ambient of 104°F *(40°C)*.

65,300 and 87,300 & 82,300

These brakes rely on a thermostat switch wired to the motor control circuit to limit the brake's enclosure surface temperature. Refer to the circuit diagram. If the brake begins to overheat, the thermostat TSW2 switch will open and interrupt the motor starter and brake solenoid current, causing the brake to set. A second thermostat TSW1 will close on Series 65,X00, or will open on Series 87,300** and 82,300** brakes. The TSW1 switch can be used to actuate alarm or warning light. This switch actuates at a lower temperature than TSW2, and will alert the equipment operator of an impending thermal overload.

**TSW1 is optional on 87,300 and 82,300 series brakes.

Circuit Diagram



Series 65,300 (1-065-3XX-05, -07 & -09)

Division I Hazardous Location
Mounting Face: NEMA 56C, 143TC and 145TC
4.5" AK, 5.88" AJ

Hazardous-location brakes are intended essentially for non-cyclic or holding purposes, but may be used for stopping light inertial loads.



Static Torque: 1.5 through 15 lb-ft

Enclosure Material: Cast Iron

Release Type: Knob, maintained with automatic reset

- Adjustable Torque
- Visual Wear Indicator
- Manual Wear Adjustment
- Epoxy Encapsulated Coil Construction, with Class H Insulation
- NO & NC Thermostat
- Spring-Set Electrically Released
- Lead Wire Length: 36 inches
- Maximum Speed: Horizontal 5000 rpm, Vertical 3600 rpm

No modification required for vertical mounting

Unit Pricing (Discount Symbol B0)

1-065-3XX-05 Series Close Coupled Hazardous location NEMA 7, 9

Model Number	Nominal Static Torque (lb-ft) *(Nm)*	Dimensions in Inches *(mm)*		List Price	Weight lbs *(kg)*
		SL Max.	SL Min.		
1-065-311-05-XXX	1.5 *(2)*	2.95 *(74.93)*	2.25 *(57.15)*	$2,330.00	38 *(17.2)*
1-065-321-05-XXX	3 *(4)*	2.95 *(74.93)*	2.25 *(57.15)*	2,450.00	38 *(17.2)*
1-065-331-05-XXX	6 *(8)*	2.95 *(74.93)*	2.31 *(58.67)*	2,590.00	40 *(18.1)*
1-065-351-05-XXX	10 *(14)*	2.95 *(74.93)*	2.31 *(58.67)*	2,795.00	45 *(20.4)*
1-065-361-05-XXX	15 *(20)*	2.95 *(74.93)*	2.31 *(58.67)*	2,915.00	45 *(20.4)*

1-065-3XX-07 Close Coupled Hazardous location NEMA 7, 9

Model Number	Enclosure	Static Torque (lb-ft)	List Price	Weight lbs *(kg)*
1-065-312-07-XXX	IP 56	1.5	$2,915.00	52 *(23.6)*
1-065-322-07-XXX	IP 56	3	$3,065.00	52 *(23.6)*
1-065-332-07-XXX	IP 56	6	$3,240.00	57 *(25.8)*
1-065-352-07-XXX	IP 56	10	$3,495.00	57 *(25.8)*
1-065-362-07-XXX	IP 56	15	$3,645.00	57 *(25.8)*

Engineering Specifications

Nominal Static Torque (lb-ft) *(Nm)*	No. of Friction Discs	Coil Size	Maximum Solenoid Cycle Rate①	Thermal Capacity ②	Inertia (Wk^2)
			cycles/min	hp-sec/min *(watts)*	lb-ft² *(kgm^2 x 10-4)*
1.5 *(2)*	1	4	40	2 *(25)*	.008 *(3.36)*
3 *(4)*	1	4	40	2 *(25)*	.008 *(3.36)*
6 *(8)*	1	K4	40	2 *(25)*	.008 *(3.36)*
10 *(14)*	2	K4	40	2 *(25)*	.014 *(5.58)*
15 *(20)*	2	K4+	40	2 *(25)*	.014 *(5.58)*

① Maximum solenoid cycle rate is 40 cycles/min., based on ambient temperature of 72°F *(22°C)* with 50% duty cycle. Does not relate to brake cycle rate (see Thermal Capacity).

② Thermal capacity rating is 2 hp-sec/min. (25 watts) based on ambient temperature of 72°F *(22°C)*, stop time of one second or less, with no heat absorbed from motor. Derate thermal capacity by 25% for vertical mounting. Refer to "Selection Procedure" Section.

Ordering and Identification Information

Example of a complete part number:

1-065-351-05-BFB
- BFB — Lead wire position (external left)
- 230 Vac
- 5/8 bore and 3/16 x 3/32 keyway
- Series : (Current Design = 05) (***New*** Fan Guard Mount = 09)

Standard AC Voltage Ratings

Character	Voltage	Hz
B	115	60
D	110	50
E	200	60
F	230 190	60 50
H	220	50
L	460 380	60 50
M	415	50
N	575	60
O	110/220	50
P	115/208-230	60
Q	208-230/460 190/380	60 50
R	200/400	60

Hub Selection

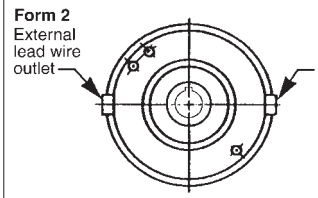
Character	Bore (in.)	Keyway** (in. x in.)
A*	5/8	1/8 x 1/16
B	5/8	3/16 x 3/32
C	3/4	3/16 x 3/32
D	7/8	3/16 x 3/32
K	1/2	1/8 x 1/16
maximum allowable bore	1.0 in. *(22.40 mm)*	

* These bores are non-standard. Add $325.00 to list price.

** Keyseats made to ANSI B17.1 standard

Modifications are available- see SAB Modification Section

Lead Wire Positions



View facing mounting register on brake.

Character	Lead Wire Position
B	Form 2
C	Form 3

Current Ratings (amperes)

Solenoid Coil Size	AC Current	Voltage: 60 Hz						Voltage: 50 Hz		
		115	200	230	400	460	575	110	220	380
4	Inrush Holding	3.6 .3	2.1 .2	1.8 .2	1.1 .08	.9 .08	.7 .06	4.1 .3	2.1 .2	.9 .08
K4	Inrush Holding	4.3 .3	2.5 .2	2.2 .2	1.3 .1	1.1 .08	.9 .07	3.8 .4	1.9 .2	1.1 .08
K4+	Inrush Holding	4.6 .4	2.5 .2	2.3 .2	1.2 .1	1.0 .1	.9 .08	4.9 .4	2.0 .2	1.0 .1

Series 65,300 Continued

1-065-3XX-05 Series

Mounting Requirements: 1-065-3XX-05 Series Hazardous Location Motor Mounted Brake is used for mounting close coupled (directly) to the motor end bell. If the brake is to be mounted to a motor fan guard, or if a motor frame adapter is incorporated, it is recommended that Series 1-065-3XX-09 be used, as it provides additional bearing support for the longer shaft that is required. The acceptability of the brake and motor combination must be determined by Underwriters Laboratories Inc.

Certified: Series 65,300-05 (1-065-3XX-05) USL/CNL, File E-14893, for Class I, Group C and D and Class II, Group E, F and G

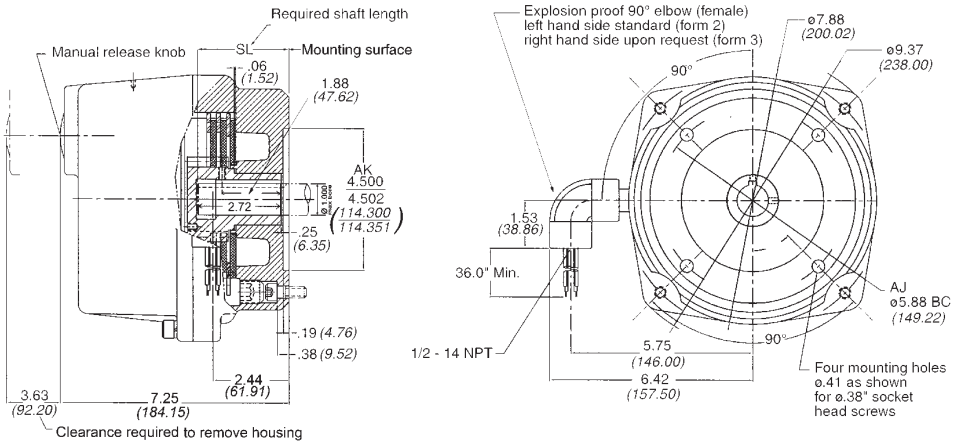
Class I, Zone 1, Group IIA and IIB

Enclosure Protection: Type 1/IP 40 and Hazardous Location NEMA 7, 9

Installation and Service Instructions: P/N 8-078-925-13 *Rev. C & D brakes*

Parts List: P/N 8-078-913-13 *Rev. C & D brakes*

Dimensions for estimating only.
For installation purposes request certified prints.



1-065-3XX-07 Series

Mounting Requirements: 1-065-3XX-07 Series Hazardous Location Motor Mounted Brake is used for mounting close coupled (directly) to the motor end bell. If the brake is to be mounted to a motor fan guard, or if a motor frame adapter is incorporated, it is recommended that Series 1-065-3XX-09 be used, as it provides additional bearing support for the longer shaft that is required. The acceptability of the brake and motor combination must be determined by Underwriters Laboratories Inc.

Certified: Series 65,300-07 (1-065-3XX-07) USL/CNL Listed, File E-14893, for Class I, Group C and D and Class II, Group F and G

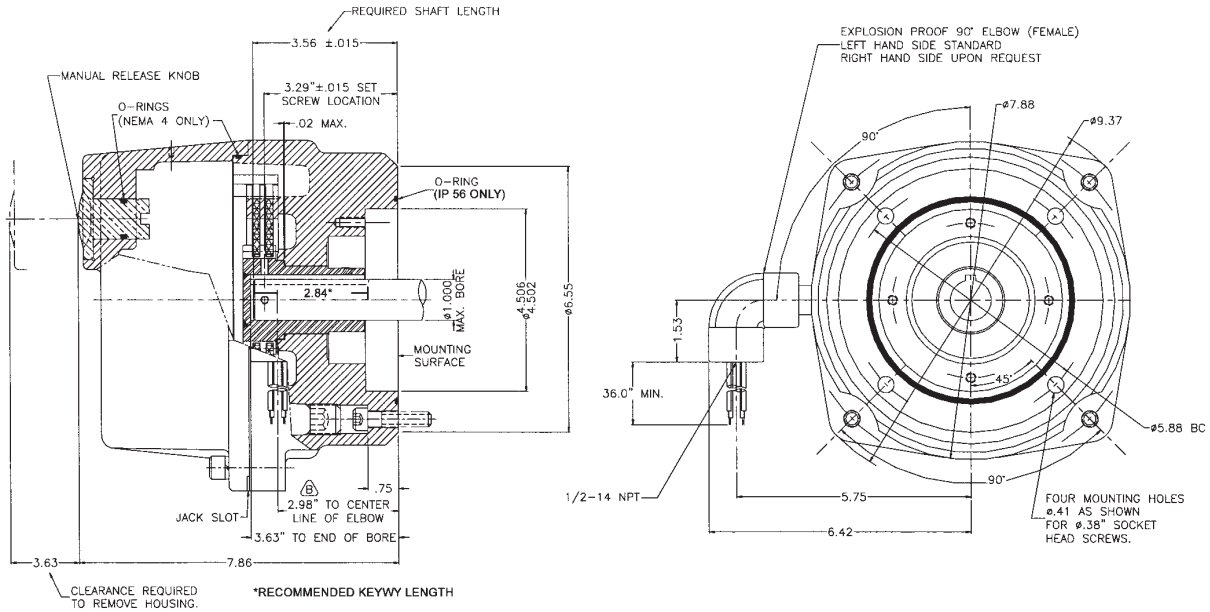
Class I, Zone 1, Group IIA and IIB

Enclosure Protection: Type 4/IP 56, and Hazardous Location NEMA 7, 9, UL Type 4

Installation and Service Instructions: P/N 8-078-925-09

Parts List: P/N 8-078-913-09

Note: 65,300 Series Close-Coupled Brakes (-07) must be mounted directly to motor endbell.



1-065-3XX-09 Fan-Guard Mount IP 23
Hazardous location NEMA 7, 9

Model Number	Static Torque lb-ft *(Nm)*	List Price	Weight lbs *(kg)*
1-065-311-09-XXX	1.5 *(2)*	$2,830.00	52 *(23.6)*
1-065-321-09-XXX	3 *(4)*	2,950.00	52 *(23.6)*
1-065-331-09-XXX	6 *(8)*	3,090.00	57 *(25.8)*
1-065-351-09-XXX	10 *(14)*	3,295.00	57 *(25.8)*
1-065-361-09-XXX	15 *(20)*	3,415.00	57 *(25.8)*

1-065-3XX-09 Series

Mounting Requirements: 1-065-3X1-09 Series Hazardous Location Motor Mounted Brake is recommended for mounting to a motor fan guard or for use with a motor frame adapter. The acceptability of the brake and motor combination must be determined by Underwriters Laboratories Inc.

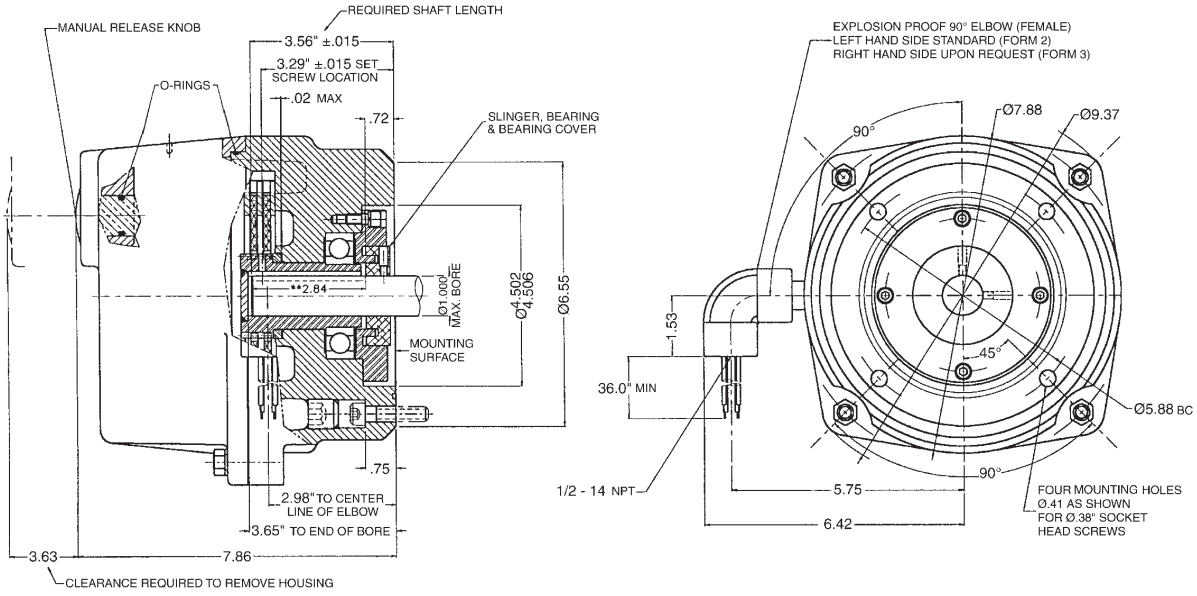
Enclosure Protection: Type 1/IP 40 and Hazardous Location NEMA 7, 9

Certified: 65,300-09 (1-065-3XX-09)
USL/CNL File E-14893, for Class I, Group C and D and Class II, Group F and G
Class I, Zone 1, Group IIA and IIB

Installation and Service Instructions: P/N 8-078-925-09

Parts List: P/N 8-078-913-09

Dimensions for estimating only.
For installation purposes request certified prints.



**Maximum keyway length for Fan Guard Mount (1-065-3XX-09)

Series 87,300-00 and 87,300-02

(1-087-3XX) Motor Mounted Division I Hazardous Location

Mounting Face: NEMA 182TC, 184TC, 213TC, 215TC, 254TC, 256TC 8.5" AK, 7.25" AJ

BACK TO TABLE OF CONTENTS

Static Torque: 10 through 105 lb-ft

Enclosure Material: Cast Iron

Release Type: Knob

Modification required for vertical above mounting. For vertical below, modification required on 50-105 lb-ft. See SAB Modification Section for list price adders.



- Self-Adjusting Design
- Epoxy Encapsulated Coil Construction, with Class H Insulation
- NC Thermostat
- Spring-Set Electrically Released
- Lead Wire Length: 36 inches
- Maximum Speed: Horizontal 4000 rpm, Vertical 3000 rpm
- ABS Type Approval Certified.

Brake set and release times in milliseconds, when brake and motor are switched separately (for T1/T2 definitions, see page 101):

Static Torque	Coil Size	T1	T2
10, 15, 25, 50	5 & 6	42	20
35, 75, 105	8	48	20

Hazardous-location brakes are intended essentially for non-cyclic or holding purposes, but may be used for stopping light inertial loads.

Series 87,300-00

Enclosure Protection: Type 1/IP 40, Type 4/IP 55, or Type 4/IP 57 protection, the brake must be mounted close coupled to the motor end bell (a motor frame adapter may be included). Hazardous Location NEMA 7, 9.

***Mounting Requirements*:** 1-087-3XX-00 Series Hazardous Location Motor Mounted Brake is recommended for mounting close coupled (directly) to the motor end bell. If the brake is to be mounted to a motor fan guard, or if a motor frame adapter is incorporated, it is recommended that Series 1-087-3XX-02 be used, as it provides additional bearing support for the longer shaft that is required. The acceptability of the brake and motor combination must be determined by Underwriters Laboratories Inc.

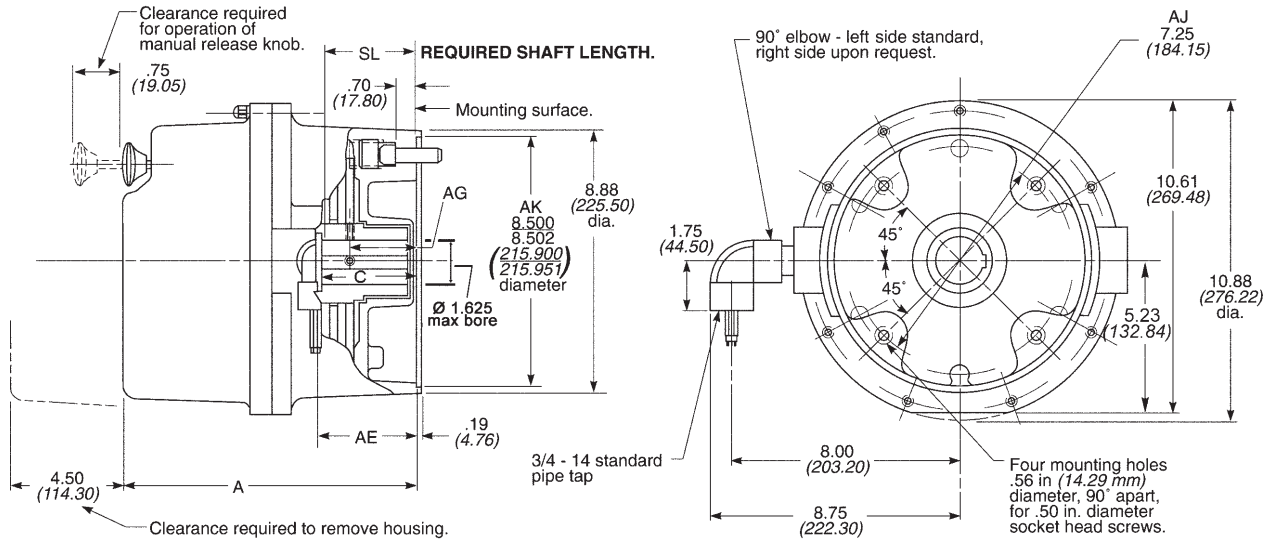
Certified: UL Listed, File E-14893 for Class I, Group C and D and Class II, Group F and G.
CSA Certified, File LR-9584 for Class I, Group C and D, and Class II, Group F and G.

Installation and Service Instructions: P/N 8-078-927-03

Parts List: P/N 8-078-917-03 for *IP 40* 8-078-917-23 *for IP 55*

Dimensions for estimating only. For installation purposes request certified prints.

Outline Drawing for IP 40 & 55



Dimensional Data/Unit Pricing (Discount Symbol D1)

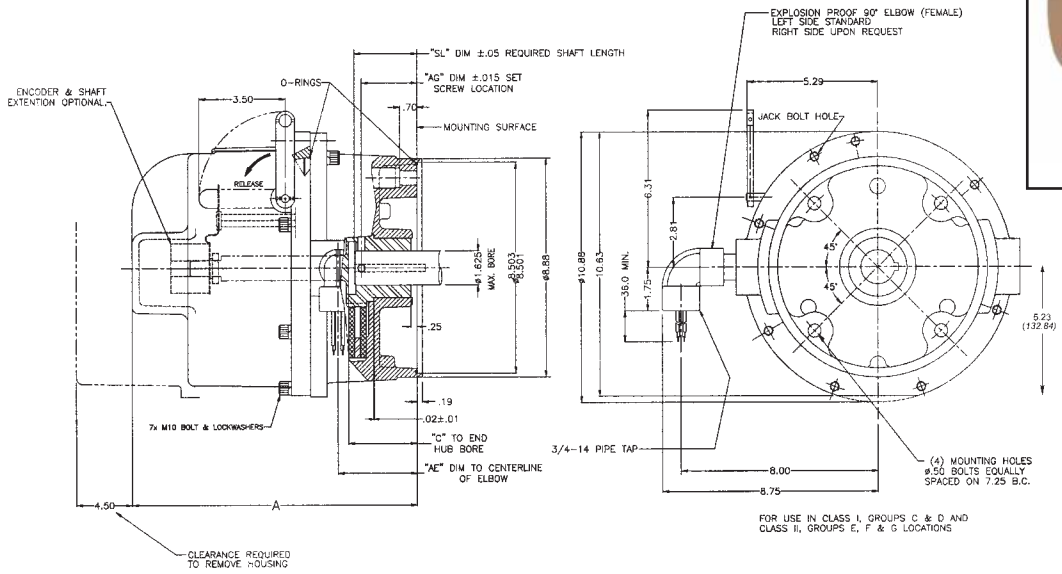
Model Number	Enclosure	Nominal Static Torque (lb-ft) *(Nm)*	List Price	Dimensions in Inches (Dimensions in Millimeters)					Weight lbs *(kg)*
				A	AE	AG	C	SL ± .05"	
1-087-311-00-XXX	IP 40	10 *(14)*	$3,350.00	9.34 *(237.33)*	3.22 *(81.79)*	2.25 *(57.2)*	2.76 *(70.1)*	2.56 *(65.0)*	62 *(28.0)*
1-087-314-00-XXX	IP 55		4,150.00						
1-087-321-00-XXX	IP 40	15 *(20)*	3,500.00	9.34 *(237.33)*	3.22 *(81.79)*	2.25 *(57.2)*	2.76 *(70.1)*	2.56 *(65.0)*	63 *(28.6)*
1-087-324-00-XXX	IP 55		4,300.00						
1-087-331-00-XXX	IP 40	25 *(34)*	3,725.00	9.34 *(237.33)*	3.22 *(81.79)*	2.25 *(57.2)*	2.76 *(70.1)*	2.56 *(65.0)*	63 *(28.6)*
1-087-334-00-XXX	IP 55		4,525.00						
1-087-341-00-XXX	IP 40	35 *(47)*	4,000.00	9.34 *(237.33)*	3.22 *(81.79)*	2.25 *(57.2)*	2.76 *(70.1)*	2.56 *(65.0)*	63 *(28.6)*
1-087-344-00-XXX	IP 55		4,800.00						
1-087-351-00-XXX	IP 40	50 *(68)*	4,700.00	9.34 *(237.33)*	3.22 *(81.79)*	2.25 *(57.2)*	2.76 *(70.1)*	2.56 *(65.0)*	64 *(29.0)*
1-087-354-00-XXX	IP 55		5,500.00						
1-087-361-00-XXX	IP 40	75 *(102)*	5,700.00	9.34 *(237.33)*	3.22 *(81.79)*	2.25 *(57.2)*	2.76 *(70.1)*	2.56 *(65.0)*	65 *(29.5)*
1-087-364-00-XXX	IP 55		6,500.00						
1-087-381-00-XXX	IP 40	105 *(142)*	7,350.00	10.34 *(262.73)*	4.22 *(107.19)*	2.75 *(69.9)*	3.73 *(94.7)*	3.53 *(89.7)*	72 *(32.7)*
1-087-384-00-XXX	IP 55		8,150.00						

Series 87,300-00

Enclosure Protection: IP 57

Certified: UL Listed, File E-14893 for Class I, Group C and D and Class II, Group E, F and G.





Dimensional Data / Unit Pricing (Discount Symbol D1)

Model Number	Enclosure	Nominal Static Torque lb-ft *(Nm)*	List Price	Dimensions in Inches *(Dimensions in Millimeters)*					Wt. Lbs *(kg)***
				A	C	SL	AE	G	
1-087-318-00-XXX	IP 57	10 *(14)*	$6,820	11.57	2.76	2.56	3.22	2.25	63 *(28.6)*
1-087-328-00-XXX	IP 57	15 *(20)*	$6,970	11.57	2.76	2.56	3.22	2.25	64 *(29)*
1-087-338-00-XXX	IP 57	25 *(34)*	$7,195	11.57	2.76	2.56	3.22	2.25	64 *(29)*
1-087-348-00-XXX	IP 57	35 *(47)*	$7,470	11.57	2.76	2.56	3.22	2.25	64 *(29)*
1-087-358-00-XXX	IP 57	50 *(68)*	$8,170	11.57	2.76	2.56	3.22	2.25	65 *(29.5)*
1-087-368-00-XXX	IP 57	75 *(102)*	$9,170	11.57	2.76	2.56	3.22	2.25	66 *(30)*
1-087-388-00-XXX	IP 57	105 *(142)*	$10, 820	12.57	3.73	3.53	4.22	2.75	73 *(33.1)*

Series 87,300-00 and 87,300-02 Continued
(1-087-3XX) Motor Mounted
Division I Hazardous Location

Series 87,300-02

Enclosure Protection: Type 1/IP 40, Type 4/IP 55, or Type 4/IP 56. Hazardous Location NEMA 7, 9.

Installation and Service Instructions: P/N 8-078-927-05

Parts List: P/N 8-078-917-05

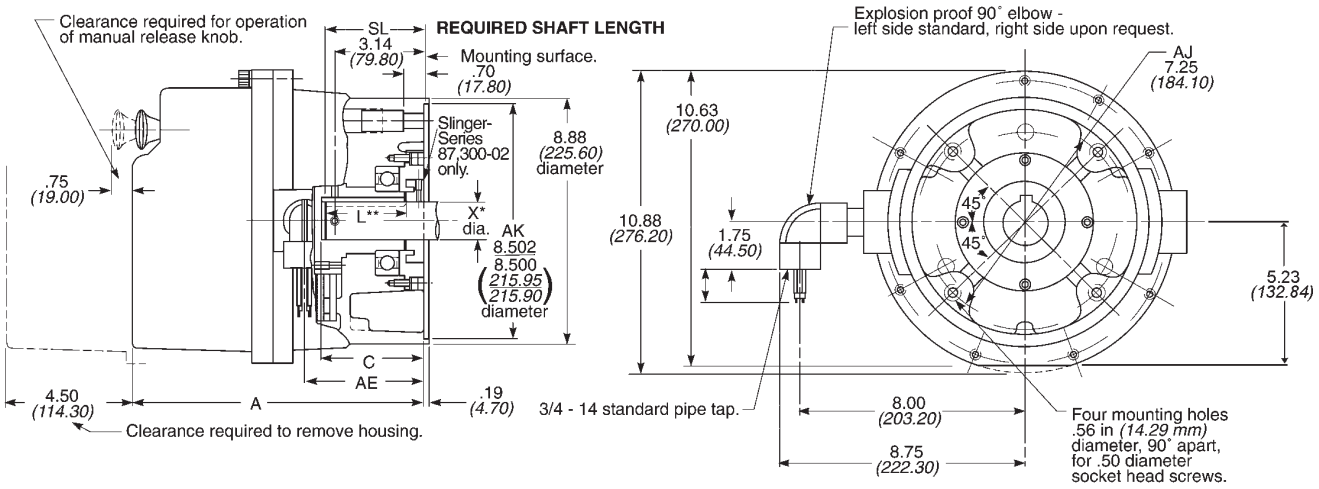
***Mounting Requirements*:** 1-087-3XX-02 Series Hazardous Location Motor Mounted Brake is recommended for mounting to a motor fan guard, or for use with a motor frame adapter. The acceptability of the brake and motor combination must be determined by Underwriters Laboratories Inc.

Certified: UL Listed, File E-14893
Series 87,300-02, Class I Group C and D and Class II, Group E, F and G.
CSA Certified, File LR-9584, Class I, Group C and D, and Class II, Group E, F and G.

Outline Drawing for IP 40 & 55

Hazardous-location brakes are intended essentially for non-cyclic or holding purposes, but may be used for stopping light inertial loads.

Dimensions for estimating only.
For installation purposes request certified prints.



*X max diameter 1.625 in./ min. .875 in. **L is the maximum keyway slot.

Dimensional Data/Unit Pricing (Discount Symbol D1)

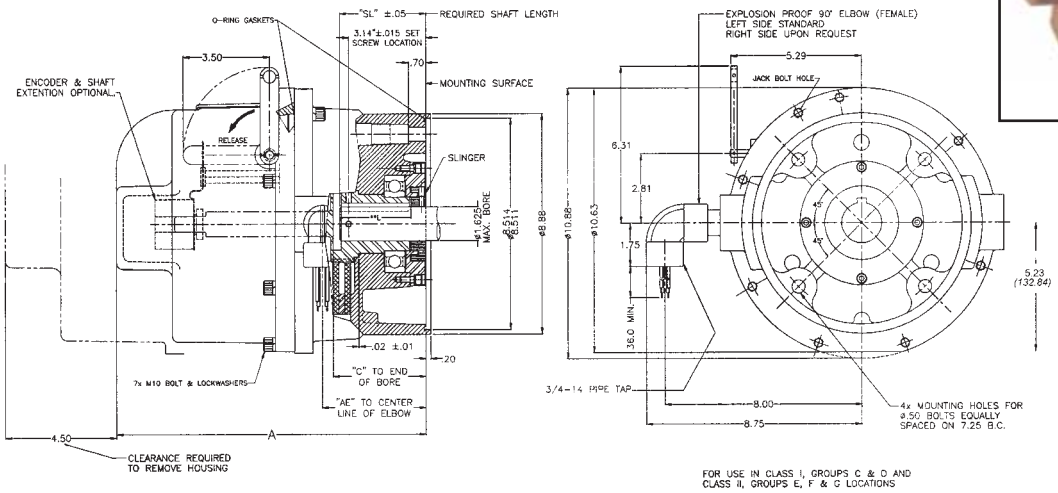
Model Number	Enclosure	Nominal Static Torque (lb-ft) (Nm)	Dimensions in Inches (Dimensions in Millimeters)					List Price	Weight lbs (kg)
			A	AE	C	SL ± .05"	L** Max.		
1-087-311-02-XXX	IP 40	10 (14)	10.34 (262.60)	4.22 (107.19)	3.65 (92.70)	3.50 (88.90)	2.89 (73.40)	$4,200.00	90 (41)
1-087-314-02-XXX	IP 55							$5,000.00	
1-087-321-02-XXX	IP 40	15 (20)	10.34 (262.60)	4.22 (107.19)	3.65 (92.70)	3.50 (88.90)	2.89 (73.40)	4,350.00	90 (41)
1-087-324-02-XXX	IP 55							5,150.00	
1-087-331-02-XXX	IP 40	25 (34)	10.34 (262.60)	4.22 (107.19)	3.65 (92.70)	3.50 (88.90)	2.89 (73.40)	4,575.00	90 (41)
1-087-334-02-XXX	IP 55							5,375.00	
1-087-341-02-XXX	IP 40	35 (47)	10.34 (262.60)	4.22 (107.19)	3.65 (92.70)	3.50 (88.90)	2.89 (73.40)	4,850.00	90 (41)
1-087-344-02-XXX	IP 55							5,650.00	
1-087-351-02-XXX	IP 40	50 (68)	10.34 (262.60)	4.22 (107.19)	3.65 (92.70)	3.50 (88.90)	2.89 (73.40)	5,550.00	90 (41)
1-087-354-02-XXX	IP 55							6,350.00	
1-087-361-02-XXX	IP 40	75 (102)	10.34 (262.60)	4.22 (107.19)	3.65 (92.70)	3.50 (88.90)	2.89 (73.40)	6,550.00	90 (41)
1-087-364-02-XXX	IP 55							7,350.00	
1-087-381-02-XXX	IP 40	105 (142)	10.84 (275.10)	4.72 (119.10)	4.11 (104.40)	3.75 (95.30)	3.14 (79.70)	8,200.00	96 (43.5)
1-087-384-02-XXX	IP 55							9,000.00	

Side release is also available in a fan guard mount design. Consult Stearns and request drawing no. 1-087-305-2D

Series 87,300-02

Enclosure Protection: IP 56





Dimensional Data / Unit Pricing (Discount Symbol D1)

Model Number	Enclosure	Nominal Static Torque lb-ft *(Nm)*	List Price	Dimensions in Inches *(Dimensions in Millimeters)*					Wt. Lbs *(kg)***
				A	C	**L	SL	AE	
1-087-315-02-XXX	IP 56	10 *(14)*	$7,670	12.60	3.65	2.89	3.50	4.22	91 *(41.3)*
1-087-325-02-XXX	IP 56	15 *(20)*	$7,820	12.60	3.65	2.89	3.50	4.22	91 *(41.3)*
1-087-335-02-XXX	IP 56	25 *(34)*	$8,045	12.60	3.65	2.89	3.50	4.22	91 *(41.3)*
1-087-345-02-XXX	IP 56	35 *(47)*	$8,320	12.60	3.65	2.89	3.50	4.22	91 *(41.3)*
1-087-355-02-XXX	IP 56	50 *(68)*	$9,020	12.60	3.65	2.89	3.50	4.22	91 *(41.3)*
1-087-365-02-XXX	IP 56	75 *(102)*	$10,020	12.60	3.65	2.89	3.50	4.22	91 *(41.3)*
1-087-385-02-XXX	IP 56	105 *(142)*	$11,670	13.10	4.11	3.14	3.75	4.72	97 *(44)*

Series 87,300-00 (1-087-3XX)
Division I Hazardous Location
Mounting: Foot Mounted

Static Torque: 10 through 105 lb-ft

Enclosure Material: Cast Iron

Release Type: Knob

Enclosure Protection: Type 1/IP 40, Type 4/IP 55 and Hazardous Location NEMA 7 and NEMA 9

Installation and Service Instructions: P/N 8-078-927-03

Parts List: P/N 8-078-917-03

Mounting Requirements:
1-087-3X2-00 Series Hazardous Location Foot Mounted Brake does not require assembly to the motor to complete the hazardous location enclosure.



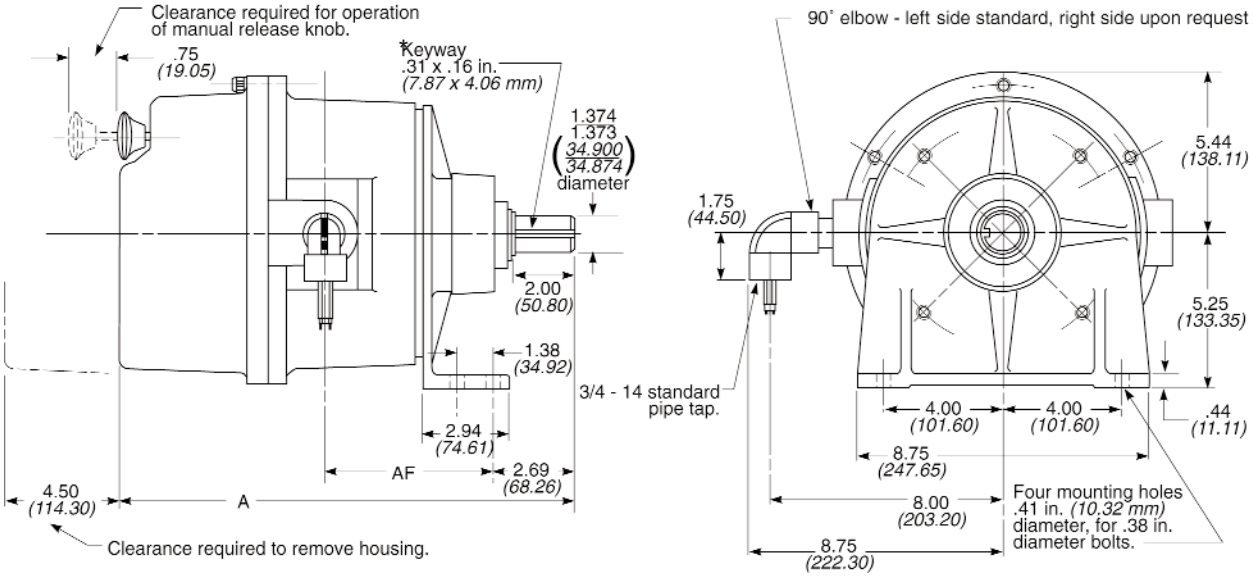
- Self-Adjusting Design
- Epoxy Encapsulated Coil Construction, with Class H Insulation
- NC Thermostat
- Spring-Set Electrically Released
- Lead Wire Length: 36 inches
- Maximum Speed: Horizontal 4000 rpm
- Certified: UL Listed (IP 40 models only), File E-14893 for Class I, Group C and D and Class II, Group F and G. CSA Certified (IP 40 and IP 55 models), File LR-9584 for Class I, Group C and D, and Class II, Group F and G.
- ABS Type Approval Certified

Brake set and release times in milliseconds, when brake and motor are switched separately (for T1/T2 definitions, see page 101):

Static Torque	Coil Size	T1	T2
10, 15, 25, 50	5 & 6	42	20
35, 75, 105	8	48	20

Hazardous-location brakes are intended essentially for non-cyclic or holding purposes, but may be used for stopping light inertial loads.

Dimensions for estimating only. For installation purposes request certified prints.



*Keyseats made to ANSI B17.1 standard

Dimensional Data/Unit Pricing (Discount Symbol D1)

Model Number	Enclosure	Nominal Static Torque (lb-ft) *(Nm)*	List Price	Dimensions in Inches (Dimensions in Millimeters)		Weight (lbs) *(kg)*
				A	AF	
1-087-312-00-XX	IP 40	10 *(14)*	$4,450.00	14.66 *(372.27)*	5.85 *(148.59)*	82 *(37.2)*
1-087-316-00-XX	IP 55		$5,250.00			
1-087-322-00-XX	IP 40	15 *(20)*	$4,600.00	14.66 *(372.27)*	5.85 *(148.59)*	83 *(37.6)*
1-087-326-00-XX	IP 55		$5,400.00			
1-087-332-00-XX	IP 40	25 *(34)*	$4,825.00	14.66 *(372.27)*	5.85 *(148.59)*	83 *(37.6)*
1-087-336-00-XX	IP 55		$5,625.00			
1-087-342-00-XX	IP 40	35 *(47)*	$5,100.00	14.66 *(372.27)*	5.85 *(148.59)*	83 *(37.6)*
1-087-346-00-XX	IP 55		$5,900.00			
1-087-352-00-XX	IP 40	50 *(68)*	$5,800.00	14.66 *(372.27)*	5.85 *(148.59)*	84 *(38.1)*
1-087-356-00-XX	IP 55		$6,600.00			
1-087-362-00-XX	IP 40	75 *(102)*	$6,800.00	14.66 *(372.27)*	5.85 *(148.59)*	85 *(38.5)*
1-087-366-00-XX	IP 55		$7,600.00			
1-087-382-00-XX	IP 40	105 *(142)*	$8,450.00	15.66 *(397.67)*	6.85 *(173.99)*	92 *(41.7)*
1-087-386-00-XX	IP 55		$9,250.00			

Series 87,300 continued

Specifications and Ordering Information for Series 87,300-00 (1-087-3XX-00) and Series 87,300-02 (1-087-3XX-02)

Engineering Specifications

Nominal Static Torque (lb-ft) *(Nm)*	No. of Friction Discs	Coil Size	Maximum Solenoid Cycle Rate① cycles/min	Thermal Capacity② hp-sec./min *(watts)*	Inertia (Wk^2) lb-ft² *($kgm^2 \times 10^{-4}$)*
10 *(14)*	1	5	30	15 *(187)*	.056 *(23.68)*
15 *(20)*	1	6	25	15 *(187)*	.056 *(23.68)*
25 *(34)*	1	6	25	15 *(187)*	.056 *(23.68)*
35 *(47)*	1	8	20	15 *(187)*	.056 *(23.68)*
50 *(68)*	2	6	25	15 *(187)*	.089 *(37.56)*
75 *(102)*	2	8	20	15 *(187)*	.089 *(37.56)*
105 *(142)*	3	8	20	15 *(187)*	.127 *(53.64)*

① Maximum solenoid cycle rate is based on ambient temperature of 72°F *(22°C)* with 50% duty cycle. Does not relate to brake cycle rate (see *Thermal Capacity*).

② Thermal capacity rating is based on ambient temperature of 104°F *(40°C)*, stop time of one second or less, with no heat absorbed from motor. Derate thermal capacity by 25% for vertical mounting. Refer to *Selection Procedure* Section.

Current Ratings (amperes)

Coil Size	Voltage: 60 Hz							Voltage: 50 Hz		
	Current	115 VAC	200 VAC	230 VAC	400 VAC	460 VAC	575 VAC	110 VAC	220 VAC	380 VAC
5	Inrush Holding	7.5 .5	4.3 .3	3.7 .2	2.2 .1	1.9 .1	1.5 .09	5.4 .3	4.0 .25	1.9 .1
6	Inrush Holding	13.0 .6	7.5 .4	6.4 .3	3.7 .2	3.2 .2	2.6 .1	9.4 .5	5.6 .3	3.2 .2
8	Inrush Holding	17.6 1.2	10.3 .7	8.8 .6	5.0 .3	4.2 .3	3.5 .24	15.4 .1	7.7 .5	4.2 .3

Motor Frame Adapters

WARNING! Before selecting an adapter to mount a brake on a larger motor frame, the torque and thermal capacity required by the application should be determined as shown in the "Selection Procedure" section. A larger motor may indicate a requirement for greater thermal capacity than the brake is designed for. The brake selection must be matched to the motor and application requirements, before use of an adapter is considered.

Consult the factory.

Ordering and Identification Information

The following example and tables provide information for selecting the appropriate three-letter suffix when ordering a Stearns Brake.

Example of a complete part number: 1-087-341-02-ELC
- ELC — Lead wire position (external right)
- 341 — 460 Vac
- 02 — 1-1/8 bore and 1/4 x 1/8 keyway (does not apply to foot mounted brake)
- 1-087- — Series -02

Hub Selection

Character	Bore (in.)	Keyway* (in. x in.)
D	7/8	3/16 x 3/32
E	1-1/8	1/4 x 1/8
F	1-1/4	1/4 x 1/8
G	1-3/8	5/16x 5/32
H	1-5/8	3/8 x 3/16
maximum allowable bore	1.625 in.	

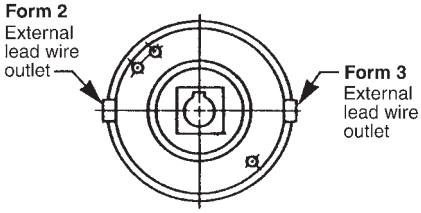
*Keyseats made to ANSI B17.1 standard

Standard AC Voltage Ratings

Character	Voltage	Hz
B	115	60
D	110	50
E	200	60
F	230 190	60 50
H	220	50
L	460 380	60 50
M	415	50
N	575	60
O	110/220	50
P	115/230	60
Q	230/460 190/380	60 50
R	200/400	60

Character	Lead Wire Position
B	Form 2
C	Form 3

Lead Wire Positions



View facing brake mounting register.

Modifications are available-see SAB Modification Section

Series 82,300 (1-082-3XX) Motor Mounted

Division I Hazardous Location
Mounting Face: NEMA 324 and 326 TC, TSC, NEMA 364 and 365 TC,TSC, NEMA 404 and 405 TC, TSC. 12.5" AK, 11.0" AJ

Static Torque: 125 through 330 lb-ft

Enclosure Material: Cast Iron

Release Type: Side lever

Enclosure Protection: Type 1/IP 40, Type 4/IP 56 Hazardous location NEMA 7 and NEMA 9

Modification required for vertical mounting.

Hazardous-location brakes are intended essentially for non-cyclic or holding purposes, but may be used for stopping light inertial loads.

Cast Iron Enclosure, Including new IP 56 & new Fan Guard Mount

- Self-Adjusting Design
- Epoxy Encapsulated Coil Construction, with Class H Insulation
- NC Thermostat
- Spring-Set Electrically Released
- Lead Wire Length: 36 inches
- Maximum Speed:
  3600 RPM Horizontal
  2400 RPM Vertical
- Certified: UL Listed, File E-14893, CSA File LR-9584 for Class I, Group C and D, and Class II, Group E and F, and G.
- ABS Type Approval Certified

Unit Pricing (Discount Symbol D1)

1-082-3XX-00 Series Close Coupled Hazardous location NEMA 7, 9

Model Number	Enclosure	Nominal Static Torque lb-ft *(Nm)*	List Price
1-082-315-00	IP 40	125 *(169)*	$17,000.00
1-082-314-00	IP 56		18,200.00
1-082-325-00	IP 40	175 *(237)*	17,900.00
1-082-324-00	IP 56		19,100.00
1-082-335-00	IP 40	230 *(312)*	18,900.00
1-082-334-00	IP 56		20,100.00
1-082-345-00	IP 40	330 *(447)*	19,800.00
1-082-344-00	IP 56		21,000.00

1-082-3X4-02 Series Fan Guard Mount[1] Hazardous location NEMA 7, 9

Model Number	Enclosure	Nominal Static Torque lb-ft *(Nm)*	List Price
1-082-314-02	IP 56	125 *(169)*	$22,200.00
1-082-324-02	IP 56	175 *(237)*	23,100.00
1-082-334-02	IP 56	230 *(312)*	24,100.00
1-082-344-02	IP 56	330 *(447)*	25,000.00

[1]Also, see page 51 for Mining Brakes - MSHA Certified series 1-082-3X4-06

1-082-3XX-00 Series Foot Mounted Hazardous location NEMA 7, 9

Model Number	Enclosure	Nominal Static Torque lb-ft *(Nm)*	List Price
1-082-316-00	IP 56	125 *(169)*	$24,300.00
1-082-326-00	IP 56	175 *(237)*	25,000.00
1-082-336-00	IP 56	230 *(312)*	26,000.00
1-082-346-00	IP 56	330 *(447)*	27,000.00

Ordering and Identification Information

Example of a complete part number:

1-082-314-00-FNB
- FNB — Lead wire position (external left)
- 575 Vac
- 1-5/8 bore and 3/8 x 3/16 keyway
- Series : (Motor mount = 00) (***New*** Fan Guard Mount = 02)

Standard AC Voltage Ratings

Character	Voltage	Hz
B	115	60
D	110	50
E	200	60
F	230 190	60 50
H	220	50
L	460 380	60 50
M	415	50
N	575	60
O	110/220	50
P	115/230	60
Q	230/460 190/380	60 50
R	200/400	60

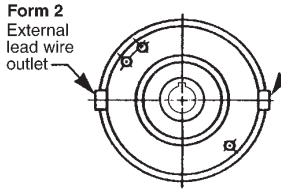
Hub Selection

Character	Bore (in.)	Keyway** (in. x in.)
A	1-1/8	1/4 x 1/8
C	1-3/8	5/16 x 5/32
D	1-1/2	3/8 x 3/16
F	1-5/8	3/8 x 3/16
H	1-3/4	3/8 x 3/16
J	1-7/8	1/2 x 1/4
L *	2	1/2 x 1/4
N	2-1/8	1/2 x 1/4
maximum allowable bore	2.125 in. *(53.975 mm)*	

*These bores are non-standard. Add $600.00 to list price.

**Keyseats made to ANSI B17.1 standard.

Lead Wire Positions



View facing mounting register on brake.

Character	Lead Wire Position
B	Form 2
C	Form 3

Modifications are available- see SAB Modification Section

Motor Frame Adapters

Adapters are available for mounting to 182TC-256TC, 284-286TC, and 444-445TSC motor frames. See Series 82,000 for details.

Engineering Specifications

Nominal Static Torque (lb-ft) *(Nm)*	No. of Friction Discs	Coil Size	Maximum Solenoid Cycle Rate① cycles/min	Thermal Capacity ② hp-sec/min *(watts)*	Inertia (Wk^2) lb-ft2 *($kgm^2 \times 10^{-4}$)*
125 *(169)*	2	9	15	10 *(124)*	.228 *(95.76)*
175 *(237)*	2	9	15	10 *(124)*	.228 *(95.76)*
230 *(312)*	3	9	15	10 *(124)*	.317 *(133.14)*
330 *(447)*	3	K9	13	10 *(124)*	.317 *(133.14)*

① Maximum solenoid cycle rate is based on ambient temperature of 72°F *(22°C)* with 50% duty cycle. Does not relate to brake cycle rate (see Thermal Capacity).

② Thermal capacity rating is based on ambient temperature of 72°F *(22°C)*, stop time of one second or less, with no heat absorbed from motor. Refer to "Selection Procedure" Section.

Current Ratings (amperes) 82,300 Motor Mounted and Foot Mounted

Coil Size	Voltage: 60 Hz						
	Current	115 VAC	200 VAC	230 VAC	400 VAC	460 VAC	575 VAC
9	Inrush Holding	44.0 1.6	25.4 .9	22.0 .8	12.7 .5	11.1 .4	8.8 .3
	Voltage: 50 Hz						
	Current	110 VAC	220 VAC	380 VAC			
	Inrush Holding	32.1 1.2	16.0 .6	11.1 .4			
K9	Voltage: 60 Hz						
	Current	115 VAC	200 VAC	230 VAC	400 VAC	460 VAC	575 VAC
	Inrush Holding	50.0 2.2	28.0 1.3	25.0 1.1	14.0 .6	12.5 .6	10.0 .4
	Voltage: 50 Hz						
	Current	110 VAC	220 VAC	380 VAC			
	Inrush Holding	36.0 1.6	24.0 .9	12.5 .6			

Series 82,300 Continued

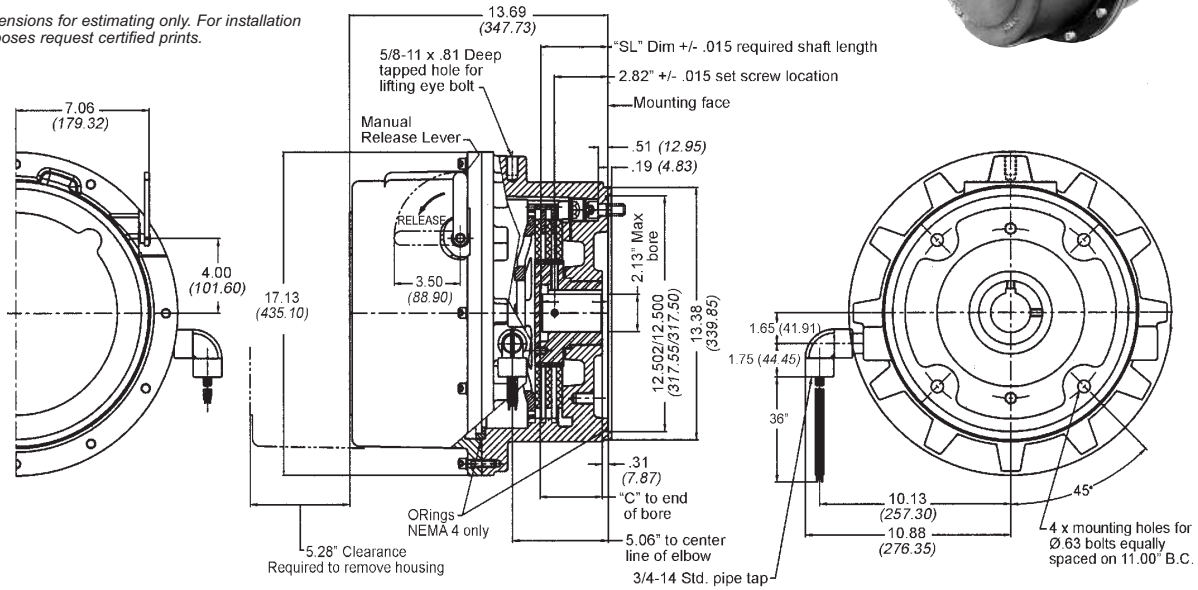
1-082-3XX-00 Series Motor Mounted Brake



Mounting Requirements: 1-082-3XX-00 Series Hazardous Location Motor Mounted Brake is used for mounting close coupled (directly) to the motor end bell. If brake is to be mounted to a motor fan guard, or if a motor frame adapter is incorporated, please contact the factory for information on Series 1-082-3X4-02, as it provides additional bearing support for the longer shaft that is required. The acceptability of the brake and motor combination must be determined by Underwriters Laboratories Inc.

Enclosure Protection: Type 1/IP 40, Type 4/IP 56, and Hazardous Location NEMA 7, 9

Dimensions for estimating only. For installation purposes request certified prints.



Model Number	Torque	C	SL
1-082-31X-00	125 lb-ft	2.79 (70.87)	3.03 (76.96)
1-082-32X-00	175 lb-ft		
1-082-33X-00	230 lb-ft	3.29 (83.57)	3.53 (89.66)
1-082-34X-00	330 lb-ft		

Above drawing is for motor mounted brake only. For fan guard mounted brake (1-082-3X4-02 series), request Stearns drawing no. 1-082-304-2D.

1-082-3X6-00 Series Foot Mounted Brake



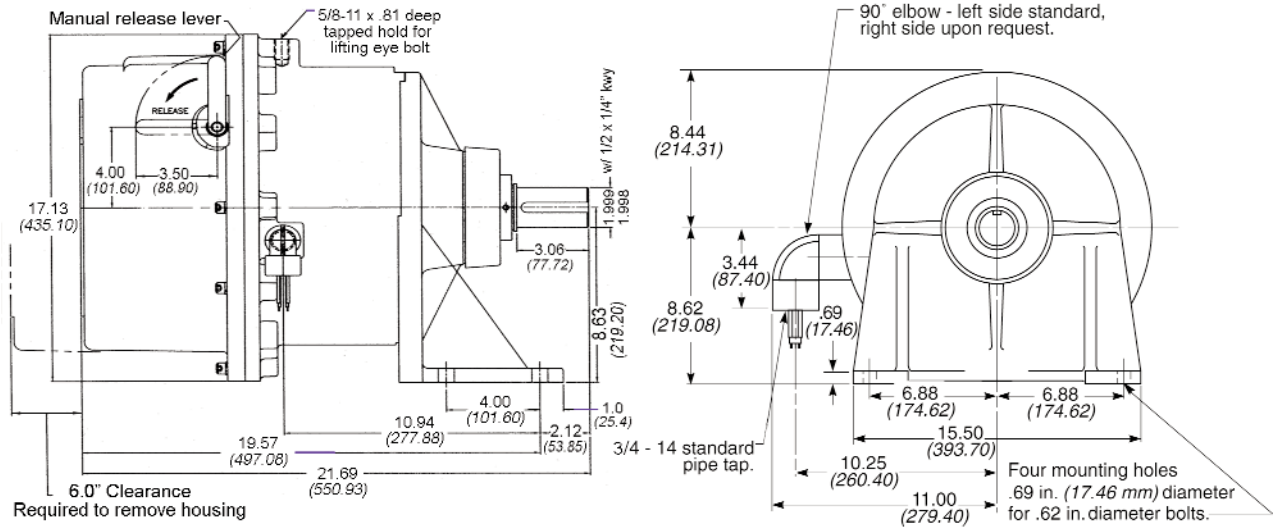
Mounting Requirements: 1-082-3X6-00 Series Hazardous Location Foot Mounted Brake does not require assembly to the motor to complete the hazardous location enclosure.

Enclosure Protection: Type 4/IP 56 and Hazardous Location NEMA 7, 9

Hazardous-location brakes are intended essentially for non-cyclic or holding purposes, but may be used for stopping light inertial loads.

Dimensions for estimating only. For installation purposes, request certified prints.

*Keyseats made to ANSI B17.1 standard



Series 56,800 (1-056-8XX)
Division 2 Hazardous Location
Mounting Face: NEMA 56C, 143TC and 145TC
4.5” AK, 5.88” AJ

BACK TO TABLE OF CONTENTS



Static Torque: 1.5 through 25 lb-ft

Enclosure Material: Cast Iron

Release Type: Side Lever, maintained with auto reset

Enclosure Protection: Type 4/IP 56

Certified: UL Listed, File E 14893 for Class I, Division 2, Groups A, B, C, D, and Class II, Division 2, Groups F and G

Mounting Requirements: 1-056-8X2 Series Hazardous Location Motor Mounted Brake is recommended for mounting close coupled to the motor end bell. The acceptability of the brake and motor combination must be determined by Underwriters Laboratory.

Universal Mounting: Through 15 lb-ft. 20 and 25 lb-ft. supplied with springs for vertical modification.

Epoxy Encapsulated Coil Construction, with Class H Insulation

NC Thermostat

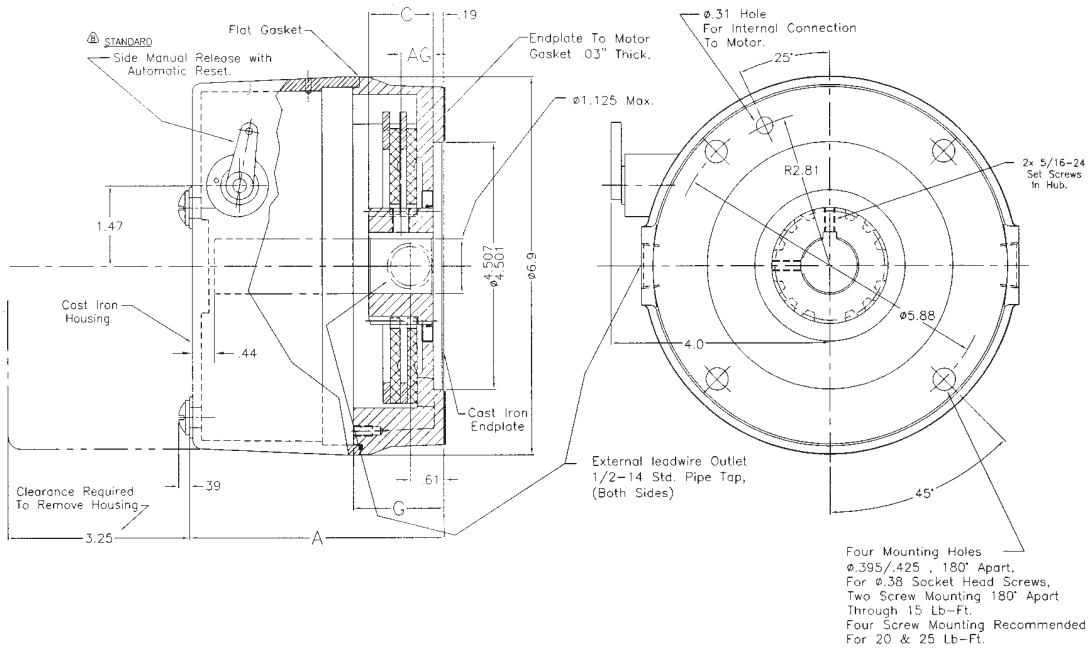
Maximum speed:
Horizontal 5000 rpm
Vertical 3600 rpm

Installation, Service and Parts List:
P/N 8-078-905-18

ABS Type Approval Certified

Brake set and release times in milliseconds, when brake and motor are switched separately (for T1/T2 definitions, see page 101):

Static Torque	Coil Size	T1	T2
1.5 - 25	4, K4, K4+, M4+	25	14



Dimensions for estimating only. For installation purposes request certified prints.

Motor Frame Adapters

WARNING! Before selecting an adapter to mount a brake on a larger motor frame, the torque and thermal capacity required by the application should be determined as shown in the “Selection Procedure” section. A larger motor may indicate a requirement for greater thermal capacity than the brake is designed for. The brake selection must be matched to the motor and application requirements, before use of an adapter is considered.

To Adapt to NEMA Frame Size	AK Dim. in. (mm)	Reg. No.	Brake Torque	Adapter Stock Number	Additional Shaft Length Required in. (mm)
182TC 184TC 213TC 215TC 254TC 256TC	8.50 (215.90)	-9	1.5-6	5-55-5041-00 List $700	.94 (23.81)
	8.50 (215.90)	-9	10-25	5-55-5043-00 List $700	.94 (23.81)

For adapter dimensions, see *Technical Data*.

Unit Pricing (Discount Symbol B4)

Model Number	Nominal Static Torque (lb-ft) (Nm)	Dimensions in Inches (Dimensions in Millimeters) A	AG	C	G	Enclosure	List Price	Wt. lbs (kg)
1-056-812-00	3 (4)	4.7 (119.4)	.59 (15.0)	1.18 (30.0)	1.66 (42.2)	IP 56	1,550.00	15
1-056-822-00	6 (8)	4.7 (119.4)	.59 (15.0)	1.18 (30.0)	1.66 (42.2)	IP 56	1,615.00	15
1-056-832-00	10 (14)	4.7 (119.4)	.59 (15.0)	1.18 (30.0)	1.66 (42.2)	IP 56	1,720.00	17
1-056-842-00	15 (20)	4.7 (119.4)	.59 (15.0)	1.18 (30.0)	1.66 (42.2)	IP 56	1,820.00	17
1-056-852-00	20 (27)	4.7 (119.4)	.59 (15.0)	1.18 (30.0)	1.66 (42.2)	IP 56	1,905.00	21
1-056-862-00	25 (34)	4.7 (119.4)	.59 (15.0)	1.18 (30.0)	1.66 (42.2)	IP 56	2,000.00	21

Engineering Specifications

Nominal Static Torque	No. of Friction Discs	Coil Size	Maximum Solenoid Cycle Rate①	Thermal Capacity②	Inertia (Wk^2)
lb-ft *(Nm)*		AC	cycle/min	hp-sec/min *(watts)*	lb-ft² (kgm² x 10^{-4})
			AC	Horizontal	
1.5 *(2)*	1	4	7.5	3.5 *(43.50)*	.008 *(3.36)*
3 *(4)*	2	4	7.5	3.5 *(43.50)*	.014 *(5.88)*
6 *(8)*	2	4	7.5	3.5 *(43.50)*	.014 *(5.88)*
10 *(14)*	2	K4	7.5	3.5 *(43.50)*	.014 *(5.88)*
15 *(20)*	2	K4+	7.5	3.5 *(43.50)*	.014 *(5.88)*
20 *(27)*	3	K4+	7.5	3.5 *(43.50)*	.020 *(8.40)*
25 *(34)*	3	M4+	7.5	3.5 *(43.50)*	.020 *(8.40)*

① Maximum solenoid cycle rate is based on ambient temperature of 104°F *(40°C)* with 50% duty cycle. Does relate to brake cycle rate (see *Thermal Capacity*).

② Thermal capacity rating is based on ambient temperature of 104°F *(40°C)*, stop time of one second or less, with no heat absorbed from motor. Derate thermal capacity by 25% for vertical mounting. Refer to *Selection Procedure* Section.

Current Ratings (amperes)

Solenoid Coil Size	AC Current	Voltage: 60 Hz						Voltage: 50 Hz		
		115 Vac	200 Vac	230 Vac	400 Vac	460 Vac	575 Vac	110 Vac	220 Vac	380 Vac
4	Inrush Holding	3.6 .3	2.1 .2	1.8 .2	1.1 .08	.9 .08	.7 .06	4.1 .3	2.1 .2	.9 .08
K4	Inrush Holding	4.3 .3	2.5 .2	2.2 .2	1.3 .1	1.1 .08	.9 .07	3.8 .4	1.9 .2	1.1 .08
K4+	Inrush Holding	4.6 .4	2.5 .2	2.3 .2	1.2 .1	1.0 .1	.9 .08	4.9 .4	2.0 .2	1.0 .1
M4+	Inrush Holding	4.6 .4	2.5 .2	2.3 .2	1.2 .1	1.0 .1	.9 .08	4.1 .4	2.0 .2	1.3 .1

Ordering and Identification Information

The following example and tables provide information for selecting the appropriate three-letter suffix when ordering a Stearns Brake.

Example of a complete part number: 1-056-832-00-BFF
- B — Lead wire position (internal and external, left and right)
- F — 230 Vac
- F — 5/8 bore and 3/16 x 3/32 keyway

Hub Selection

Character	Bore (in.)	Keyway** (in. x in.)
A*	5/8	1/8 x 1/16
B	5/8	3/16 x 3/32
C	3/4	3/16 x 3/32
D	7/8	3/16 x 3/32
E	1-1/8	1/4 x 1/8
F*	1-1/4	1/4 x 1/8
K	1/2	1/8 x 1/16
L*	1	1/4 x 1/8
N*	9/16	1/8 x 1/16
O*	11/16	3/16 x 3/32
P*	1-1/6	1/4 x 1/8
R*	13/16	3/16 x 3/32
S*	15/16	1/4 x 1/8

Maximum allowable bore 1.25. For thru-shaft applications, .875 is maximum.

*These bores are non-standard. Add $225.00 to list price.

**Keyseats made to ANSI B17.1 standard.

Standard AC Voltage Ratings

Character	Voltage	Hz
B	115	60
D	110	50
E	200	60
F	230 190	60 50
H	220	50
L	460 380	60 50
M	415	50
N	575	60
O	110/220	50
P	115 230	60
Q	230/460 190/380	60
R	200/400	60

DC voltages not available.

Space heater not available.

Modifications are available- see SAB Modification Section

Series 87,800 (1-087-8XX)
Division 2 Hazardous Location
Mounting Face: NEMA 182TC 184TC, 213TC, 215TC, 254TC, 254UC, 256TC and 256UC
8.5" AK, 7.25" AJ



Static Torque: 6 through 105 lb-ft

Enclosure Material: Cast Iron

Release Type: Knob

Enclosure Protection: Type 4/IP 56 Division 2 Hazardous Duty

Certified: UL Listed, File E-14893. For Hazardous Location Classification, see Dimensional Data below.

Mounting Requirements: 1-87-8XX Series Hazardous Location Motor Mounted Brake is recommended for mounting close coupled to the motor end bell. The acceptability of the brake and motor combination must be determined by Underwriters Laboratory.

Modification required for vertical above mounting. For vertical below, modification required on 50-105 lb-ft.

Epoxy Encapsulated Coil Construction, with Class H Insulation

NC Thermostat

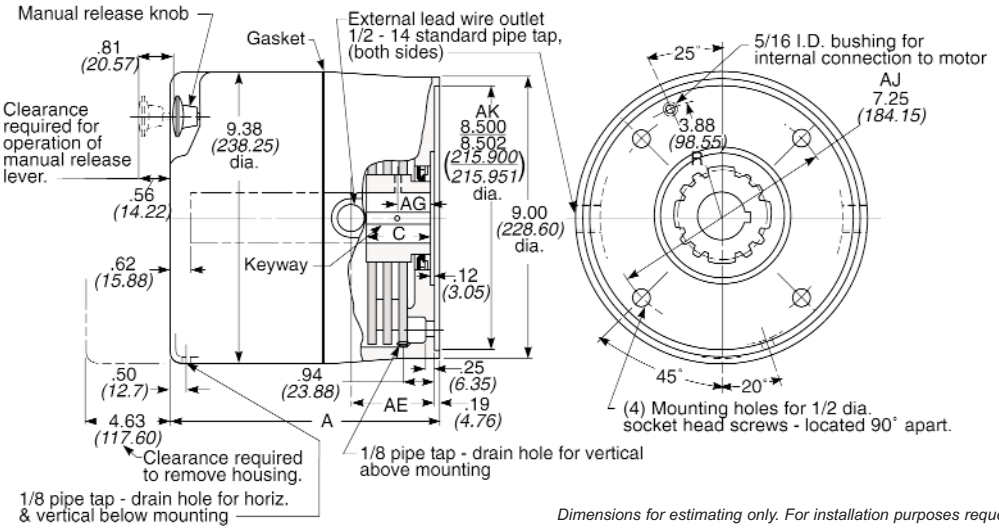
Maximum speed:
Horizontal 4000 rpm
Vertical 3000 rpm

ABS Type Approval Certified

Installation, Service & Parts List:
P/N 8-078-927-08

Brake set and release times, when brake and motor are switched separately (for T1/T2 definitions, see page 101):

Static Torque	Coil Size	T1	T2
10, 15, 25, 50	5 & 6	42	20
35, 75, 105	8	48	20



Dimensions for estimating only. For installation purposes request certified prints.

Dimensional Data/Unit Pricing

Model Numbers	Nominal Static Torque	Hazardous Location Classification Division 2		Dimensions in Inches *(Dimensions in Millimeters)*				Enclosure	List Price	Wt. lbs *(kg)*	Discount Symbol
	lb-ft *(Nm)*	Class I Group -	Class II Group -	A	AE	AG	C				
1-087-802-00	6 *(8)*		F, G	7.56 *(192.02)*	1.81 *(45.97)*	.78 *(19.81)*	1.00 *(25.4)*	IP 56	$2,275.00	42 *(19.1)*	B2
1-087-802-01	6 *(8)*	A, B, C, D	F, G	7.56 *(192.02)*	1.81 *(45.97)*	.78 *(19.81)*	1.00 *(25.4)*	IP 56	$2,275.00	42 *(19.1)*	B2
1-087-812-00	10 *(14)*		F, G	7.56 *(192.02)*	1.81 *(45.97)*	.78 *(19.81)*	1.00 *(25.4)*	IP 56	2,275.00	42 *(19.1)*	B2
1-087-812-01	10 *(14)*	A, B, C, D	F, G	7.56 *(192.02)*	1.81 *(45.97)*	.78 *(19.81)*	1.00 *(25.4)*	IP 56	2,275.00	42 *(19.1)*	B2
1-087-822-00	15 *(20)*		F, G	7.56 *(192.02)*	1.81 *(45.97)*	.78 *(19.81)*	1.00 *(25.4)*	IP 56	2,325.00	43 *(19.5)*	B2
1-087-822-01	15 *(20)*	A, B, C, D	F, G	7.56 *(192.02)*	1.81 *(45.97)*	.78 *(19.81)*	1.00 *(25.4)*	IP 56	2,325.00	43 *(19.5)*	B2
1-087-832-00	25 *(34)*		F, G	7.56 *(192.02)*	1.81 *(45.97)*	.78 *(19.81)*	1.00 *(25.4)*	IP 56	2,400.00	43 *(19.5)*	B3
1-087-832-01	25 *(34)*	A, B, C, D	F, G	7.56 *(192.02)*	1.81 *(45.97)*	.78 *(19.81)*	1.00 *(25.4)*	IP 56	2,400.00	43 *(19.5)*	B3
1-087-842-00	35 *(47)*		F, G	7.56 *(192.02)*	1.81 *(45.97)*	.78 *(19.81)*	1.00 *(25.4)*	IP 56	2,550.00	46 *(20.9)*	B3
1-087-842-01	35 *(47)*	A, B, C, D	F, G	7.56 *(192.02)*	1.81 *(45.97)*	.78 *(19.81)*	1.00 *(25.4)*	IP 56	2,550.00	46 *(20.9)*	B3
1-087-852-00	50 *(68)*		F, G	8.06 *(204.72)*	2.31 *(58.67)*	.97 *(24.64)*	1.50 *(38.10)*	IP 56	2,850.00	42 *(19.1)*	B3
1-087-852-01	50 *(68)*	A, B, C, D	F, G	8.06 *(204.72)*	2.31 *(58.67)*	.97 *(24.64)*	1.50 *(38.10)*	IP 56	2,850.00	42 *(19.1)*	B3
1-087-862-00	75 *(102)*		F, G	8.06 *(204.72)*	2.31 *(58.67)*	.97 *(24.64)*	1.50 *(38.10)*	IP 56	3,350.00	50 *(22.7)*	B3
1-087-862-01	75 *(102)*	A, B, C, D	F, G	8.06 *(204.72)*	2.31 *(58.67)*	.97 *(24.64)*	1.50 *(38.10)*	IP 56	3,350.00	50 *(22.7)*	B3
1-087-882-00	105 *(142)*		F, G	8.56 *(217.42)*	2.81 *(71.37)*	.97 *(24.64)*	2.00 *(50.80)*	IP 56	4,050.00	50 *(22.7)*	B3
1-087-882-01	105 *(142)*	A, B, C, D	F, G	8.56 *(217.42)*	2.81 *(71.37)*	.97 *(24.64)*	2.00 *(50.80)*	IP 56	4,050.00	50 *(22.7)*	B3

Motor Frame Adapters:

WARNING! Before selecting an adapter to mount a brake on a larger motor frame, the torque and thermal capacity required by the application should be determined as shown in the "Selection Procedure" section. A larger motor may indicate a requirement for greater thermal capacity than the brake is designed for. The brake selection must be matched to the motor and application requirements, before use of an adapter is considered.

To Adapt to NEMA Frame Size	AK Dim. in. (mm)	Reg. No.	Adapter Stock Number	Additional Shaft Length Required in. (mm)
56C, 143TC or 145TC	4.50 *(114.30)*	-05	Brake endplate is modified for 4.50 in. AK. An adapter is not furnished. Add: $340.00	— *(—)*
			5-55-7043-00	.56 (14.22)
284 TC or 286TC	10.50 *(266.70)*	-11	5-55-7055-00	.81 (20.64)
324TC, 326TC, 364TC, 365TC, 404TC or 405TC	12.50 *(317.50)*	-13	5-55-7046-00	.88 (22.22)

For adapter dimensions, see *Technical Data.*

Current Ratings (amperes)

Coil Size	AC Current	Voltage: 60 Hz						Voltage: 50 Hz		
		115	200	230	400	460	575	110	220	380
5	inrush	7.5	4.3	3.7	2.2	1.9	1.5	5.4	4.0	1.9
	holding	.5	.3	.2	.1	.1	.09	.3	.25	.1
6	inrush	13.0	7.5	6.5	3.7	3.2	2.6	9.4	5.6	3.2
	holding	.6	.4	.3	.2	.2	.1	.5	.3	.2
8	inrush	17.6	10.3	8.8	5.0	4.2	3.5	15.4	7.7	4.2
	holding	1.2	.7	.6	.3	.3	.3	.1	.5	.3

Engineering Specifications

Nominal Static Torque lb-ft *(Nm)*	No. of Friction Discs	Coil Size	Maximum Solenoid Cycle Rate① cycles/ min	Thermal Capacity② hp-sec/min *(watts)*	Inertia (Wk^2) lb-ft.^{2} ($kgm^2 \times 10^{-4}$)
6 *(8)*	1	5	4	14 *(174)*	.048 *(20.34)*
10 *(14)*	1	5	4	14 *(174)*	.048 *(20.34)*
15 *(20)*	1	6	4	14 *(174)*	.048 *(20.34)*
25 *(34)*	1	6	4	14 *(174)*	.048 *(20.34)*
35 *(47)*	1	8	4	14 *(174)*	.048 *(20.34)*
50 *(68)*	2	6	4	14 *(174)*	.089 *(37.40)*
75 *(102)*	2	8	4	14 *(174)*	.089 *(37.40)*
105 *(142)*	3	8	4	14 *(174)*	.129 *(54.45)*

① Maximum solenoid cycle rate is based on ambient temperature of 104°F (40°C) with 50% duty cycle. Does relate to brake cycle rate (see Thermal Capacity).

② Thermal capacity rating is based on ambient temperature of 104° (40°C), stop time of ne second or less, with no heat absorbed from motor. Derate thermal capacity by 25% for vertical mounting. Refer to *Selection Procedure Section.*

Ordering and Identification Information

The following example and tables provide information for selecting the appropriate three-letter suffix when ordering a Stearns Brake.

Example of a complete part number:

1-087-832-01-ELF
- E — Lead wire position (internal and external, left and right)
- L — 460 Vac
- F — 1-1/8 bore and 1/4 x 1/8 keyway

Hub Selection

Character	Bore (in.)	Keyway** (in. x in.)
A*	5/8	1/8 x 1/16
B*	5/8	3/16 x 3/32
C*	3/4	3/16 x 3/32
D	7/8	3/16 x 3/32
E	1-1/8	1/4 x 1/8
F	1-1/4	1/4 x 1/8
G	1-3/8	5/16 x 5/32
H	1-5/8	3/8 x 3/16
I*	1-3/4	3/8 x 3/16
K*	1/2	1/8 x 1/16
L*	1	1/4 x 1/8
M*	1-1/2	3/8 x 3/16
N*	9/16	1/8 x 1/16
O*	11/16	3/16 x 3/32
P*	1-1/16	1/4 x 1/8
Q*	1-7/16	3/8 x 3/16
R*	13/16	3/16 x 3/32
S*	15/16	1/4 x 1/8
T*	1-3/16	1/4 x 1/8
U*	1-5/16	5/16 x 5/32
Z	.600	pilot bore

Maximum allowable bore 1.625.

*These bores are non-standard. Add $250.00 to list price.

**Keyseats made to ANSI B17.1 standard.

Standard AC Voltage Ratings

Character	Voltage	Hz
B	115	60
D	110	50
E	200	60
F	230 190	60 50
H	220	50
L	460 380	60 50
M	415	50
N	575	60
O	110/220	50
P	115/230	60
Q	230/460 230	60 50
R	200/400	60

Modifications are available- see SAB Modification Section

Optional Space Heater for Class II Brakes only

Series 56,700 (1-056-7XX) Die Cast Aluminum (1-056-7XS) Stainless Steel

Mounting Face: NEMA 56C, 143TC and 145TC

4.5” AK, 5.88” AJ



Static Torque: 1.5 through 25 lb-ft

Enclosure Material: IP 23, 54 & 55 Die Cast Aluminum; IP 56 Stainless Steel

Release Type: Knob, Maintained with automatic reset

Enclosure Protection: IP 23 & 54 (formerly referred to by Stearns as NEMA Type 2 & 4 respectively).

IP 55 & 56 (formerly referred to by Stearns as NEMA Type 4X BISSC Certified & Type 4X stainless steel enclosure, respectively).

- ABS Type Approval Certified
- Spring-Set Electrically Released
- Adjustable Torque
- Manual Release Knob, Maintained with Automatic Reset
- Manual Wear Adjustment

- Maximum Speed: 5000 rpm Horizontal
  3600 rpm Vertical

Note: 56,700 Series mounts between C-Face motor and reducer. Do not apply overhung load to brake output shaft.

Installation and Service: P/N 8-078-905-67

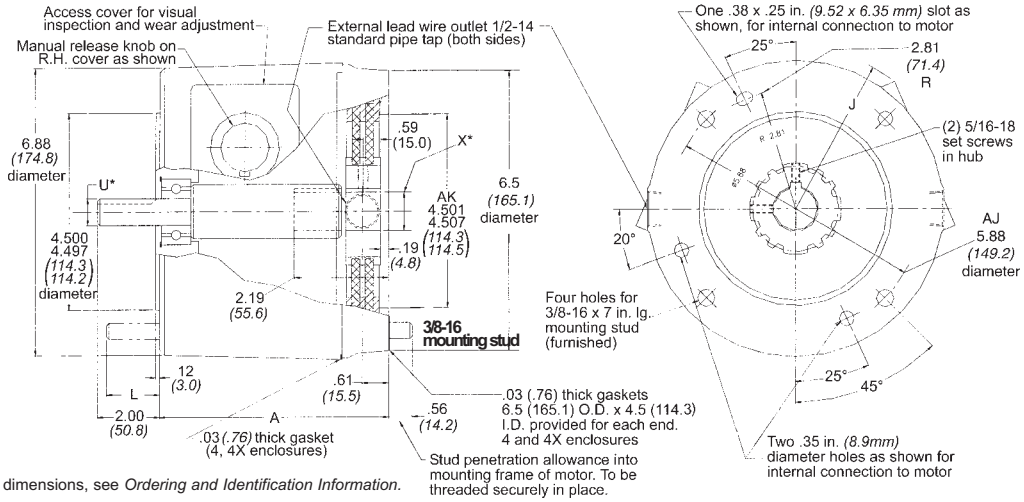
Parts List: P/N 8-078-906-07

Modifications: Pages 54-63

Universal Mounting: Through 15 lb-ft. 20 and 25 lb-ft. supplied with springs for vertical modification.

Brake set and release times in milliseconds, when brake and motor are switched separately (for T1/T2 definitions, see page 101)

Static Torque lb-ft	Coil Size	T1	T2
1½ - 25	4, K4, K4+, M4+	25	14



* For X and U dimensions, see *Ordering and Identification Information.*

Dimensions for estimating only. For installation purposes request certified prints.

Dimensions /Unit Pricing (Discount Symbol E3)

Nominal Static Torque (lb-ft) *(Nm)*	Enclosure	Type	Basic Model Number and List Price		Dimensions in Inches *(mm)* A	J	L	Wt. lbs *(kg)*
1.5 *(2)*	IP 23	AC	1-056-701-0X	$480.00	4.91 *(124.7)*	3.81 *(96.8)*	1.53 *(38.9)*	12 *(5.4)*
		DC	1-056-705-0X	$780.00				
	IP 54	AC	1-056-702-0X	$615.00	4.94 *(125.5)*	3.88 *(98.6)*	1.53 *(38.9)*	13 *(5.9)*
		DC	1-056-706-0X	$915.00				
	IP 55	AC	1-056-704-0X	$690.00	4.94 *(125.5)*	3.88 *(98.6)*	1.53 *(38.9)*	13 *(5.9)*
		DC	1-056-708-0X	$990.00				
3 *(4)*	IP 23	AC	1-056-711-0X	$500.00	4.91 *(124.7)*	3.81 *(96.8)*	1.53 *(38.9)*	12 *(5.4)*
		DC	1-056-715-0X	$800.00				
	IP 54	AC	1-056-712-0X	$635.00	4.94 *(125.5)*	3.88 *(98.6)*	1.53 *(38.9)*	13 *(5.9)*
		DC	1-056-716-0X	$935.00				
	IP 55	AC	1-056-714-0X	$710.00	4.94 *(125.5)*	3.88 *(98.6)*	1.53 *(38.9)*	13 *(5.9)*
		DC	1-056-718-0X	$1,010.00				
	IP 56	AC	1-056-71S-0X	$2,474.00	4.94 *(125.5)*	3.88 *(98.6)*	1.53 *(38.9)*	22 *(10)*
6 *(8)*	IP 23	AC	1-056-721-0X	$565.00	4.91 *(124.7)*	3.81 *(96.8)*	1.53 *(38.9)*	12 *(5.4)*
		DC	1-056-725-0X	$865.00				
	IP 54	AC	1-056-722-0X	$700.00	4.94 *(125.5)*	3.88 *(98.6)*	1.53 *(38.9)*	13 *(5.9)*
		DC	1-056-726-0X	$1,000.00				
	IP 55	AC	1-056-724-0X	$775.00	4.94 *(125.5)*	3.88 *(98.6)*	1.53 *(38.9)*	13 *(5.9)*
		DC	1-056-728-0X	$1,075.00				
	IP 56	AC	1-056-72S-0X	$2,539.00	4.94 *(125.5)*	3.88 *(98.6)*	1.53 *(38.9)*	22 *(10)*
10 *(14)*	IP 23	AC	1-056-731-0X	$665.00	4.91 *(124.7)*	3.81 *(96.8)*	1.53 *(38.9)*	12 *(5.4)*
		DC	1-056-735-0X	$965.00				
	IP 54	AC	1-056-732-0X	$805.00	4.94 *(125.5)*	3.88 *(98.6)*	1.53 *(38.9)*	13 *(5.9)*
		DC	1-056-736-0X	$1,105.00				
	IP 55	AC	1-056-734-0X	$880.00	4.94 *(125.5)*	3.88 *(98.6)*	1.53 *(38.9)*	13 *(5.9)*
		DC	1-056-738-0X	$1,180.00				
	IP 56	AC	1-056-73S-0X	2,639.00	4.94 *(125.5)*	3.88 *(98.6)*	1.53 *(38.9)*	22 *(10)*

Dimensions /Unit Pricing (Discount Symbol E3)

Nominal Static Torque (lb-ft) *(Nm)*	Enclosure	Type	Basic Model Number and List Price		Dimensions in Inches *(mm)* A	J	L	Wt. lbs *(kg)*
15 *(20)*	IP 23	AC	1-056-741-0X	$765.00	4.91 *(124.7)*	3.81 *(96.8)*	1.53 *(38.9)*	12 *(5.4)*
		DC	1-056-745-0X	$1,065.00				
	IP 54	AC	1-056-742-0X	$905.00	4.94 *(125.5)*	3.88 *(98.6)*	1.08 *(27.4)*	13 *(5.9)*
		DC	1-056-746-0X	$1,205.00				
	IP 55	AC	1-056-744-0X	$980.00	4.94 *(125.5)*	3.88 *(98.6)*	1.08 *(27.4)*	13 *(5.9)*
		DC	1-056-748-0X	$1,280.00				
	IP 56	AC	1-056-74S-0X	2,739.00	4.94 *(125.5)*	3.88 *(98.6)*	1.53 *(38.9)*	22 *(10)*
20 *(27)*	IP 23	AC	1-056-751-07	$855.00	5.36 *(136.1)*	3.81 *(96.8)*	1.08 *(27.4)*	12 *(5.4)*
		DC	1-056-755-07	$1,155.00				
	IP 54	AC	1-056-752-07	$990.00	5.39 *(136.9)*	3.88 *(98.6)*	1.08 *(27.4)*	14 *(6.3)*
		DC	1-056-756-07	$1,290.00				
	IP 55	AC	1-056-754-07	$1,065.00	5.39 *(136.9)*	3.88 *(98.6)*	1.08 *(27.4)*	14 *(6.3)*
		DC	1-056-758-07	$1,365.00				
	IP 56	AC	1-056-75S-0X	2,824.00	5.39 *(136.9)*	3.88 *(98.6)*	1.08 *(27.4)*	22 *(10)*
25 *(34)*	IP 23	AC	1-056-761-07	$950.00	5.36 *(136.1)*	3.81 *(96.8)*	1.08 *(27.4)*	13 *(5.9)*
		DC	1-056-765-07	$1,250.00				
	IP 54	AC	1-056-762-07	$1,085.00	5.39 *(136.9)*	3.88 *(98.6)*	1.08 *(27.4)*	14 *(6.3)*
		DC	1-056-766-07	$1,385.00				
	IP 55	AC	1-056-764-07	$1,160.00	5.39 *(136.9)*	3.88 *(98.6)*	1.08 *(27.4)*	14 *(6.3)*
		DC	1-056-768-07	$1,460.00				
	IP 56	AC	1-056-76S-0X	2,919.00	5.39 *(136.9)*	3.88 *(98.6)*	1.08 *(27.4)*	22 *(10)*

* X in 9th digit designates hub bore and shaft size.

Series 56,700 Continued

BACK TO TABLE OF CONTENTS

Engineering Specifications

Nominal Static Torque lb-ft *(Nm)*	No. of Friction Discs	Coil Size		Maximum Solenoid Cycle Rate① cycles/min		Thermal Capacity② hp-sec/min *(watts)*		Inertia (Wk^2) lb - ft^2 ($kgm^2 \times 10^{-4}$)
		AC	DC	AC	DC	Horizontal	Vertical	
1.5 *(2)*	1	4	4+	36	20	9 *(112)*	6.5 *(80)*	.008 *(3.36)*
3 *(4)*	1	4	4+	36	20	9 *(112)*	6.5 *(80)*	.008 *(3.36)*
6 *(8)*	1	K4	K4-	36	20	9 *(112)*	6.5 *(80)*	.008 *(3.36)*
10 *(14)*	2	K4	K4+	36	20	9 *(112)*	6.5 *(80)*	.014 *(5.88)*
15 *(20)*	2	K4+	M4+	36	20	9 *(112)*	6.5 *(80)*	.014 *(5.88)*
20 *(27)*	3	K4+	M4+	36	20	9 *(112)*	6.5 *(80)*	.020 *(8.40)*
25 *(34)*	3	M4+	P4+	36	20	9 *(112)*	6.5 *(80)*	.020 *(8.40)*

① Maximum solenoid cycle rate is based on ambient temperature of 72°F *(22°C)* with 50% duty cycle. Does not relate to brake cycle rate (see Thermal Capacity).

② Thermal capacity rating is based on ambient temperature of 72°F *(22°C)*, stop time of one second or less, with no heat absorbed from motor. Refer to *Selection Procedure* Section.

Current Ratings (amperes)

Solenoid Coil Size	AC Current	Voltage: 60 Hz						Voltage: 50 Hz			Voltage: DC			
		115	200	230	400	460	575	110	220	380	24	95	115	230
4	inrush holding	3.6 .3	2.1 .2	1.8 .2	1.1 .08	.9 .08	.7 .06	4.1 .3	2.1 .2	.9 .08	13.3 .3	3.6 .1	2.8 .05	1.5 .03
4+	inrush holding	–	–	–	–	–	–	–	–	–	12.0 .4	4.7 .1	3.7 .08	2.0 .04
K4	inrush holding	4.3 .3	2.5 .2	2.2 .2	1.3 .1	1.1 .08	.9 .07	3.8 .4	1.9 .2	1.1 .08	17.5 .4	4.7 .1	3.7 .08	2.0 .04
K4+	inrush holding	4.6 .4	2.5 .2	2.3 .2	1.2 .1	1.0 .1	.9 .08	4.9 .4	2.0 .2	1.0 .1	20.5 .5	7.5 .1	5.5 .08	2.0 .04
M4	inrush holding	3.0 .6	1.7 .3	1.5 .3	.9 .2	.8 .1	.6 .1	–	–	.8 .1	–	–	–	–
M4+	inrush holding	4.6 .4	2.5 .2	2.3 .2	1.2 .1	1.0 .1	.9 .08	4.1 .4	2.0 .2	1.3 .1	30.3 .5	7.9 .1	5.5 .08	2.0 .04
P4+	inrush holding	–	–	–	–	–	–	–	–	–	30.3 .5	11.3 .1	8.4 .08	3.0 .04

Ordering and Identification Information

The following example and tables provide information for selecting the appropriate three-letter suffix when ordering a Stearns Brake.

Example of a complete part number:

1-056-731-05-–FF
- Series: 1-056
- Torque: 731
- Enclosure: 05
- Lead wire position (internal and external, left and right)
- 230 Vac
- Does not apply
- 5/8 hub bore and shaft

Hub Bore, Shaft and Keyway Sizes

9th Digit of Model No.	Bore Dia. (X)	Keyway**	Shaft Dia. (U)	Keyway**
5	.625	.19 x .09	.625	.19 x .09
7	.875	.19 x .09	.875	.19 x .09
8*	.875 with sleeve to convert to .625	.19 x .09	.625 with sleeve to convert to .875	.19 x .09

*One sleeve provided in each brake.

**Keyseats made to ANSI B17.1 standard.

Standard AC Voltage Ratings

Character	Voltage	Hz
B	115	60
D	110	50
E	200	60
F	230 190	60 50
H	220	50
L	460 380	60 50
M	415	50
N	575	60
O	110/220	50
P	115/208 230	60
Q	208 230/460 190/380	60 50
R	200/400	60

Direct Current

Character	Voltage
T U V W	12 24 36 48
X Y Z	95 115 230

Consult factory if other DC voltage is needed.

Modifications are available- see SAB Modification Section

Series 87,700 (1-087-7XX)

Mounting Face: NEMA 182TC 184TC, 213TC, 215TC, 254TC, 254UC, 256TC and 256UC Double C-Face Coupler

8.5” AK, 7.25” AJ



Static Torque: 6 through 105 lb-ft

Enclosure Material:
Aluminum Housing, Cast Iron Endplate

Release Type: Side Lever, Maintained with automatic reset

Enclosure Protection: IP 23, 54 & 55 (formerly referred to by Stearns as NEMA 2, 4 & 4X BISSC Certified, respectively).

Installation and Service Instructions:
P/N 8-078-927-27 *Rev. B & C*

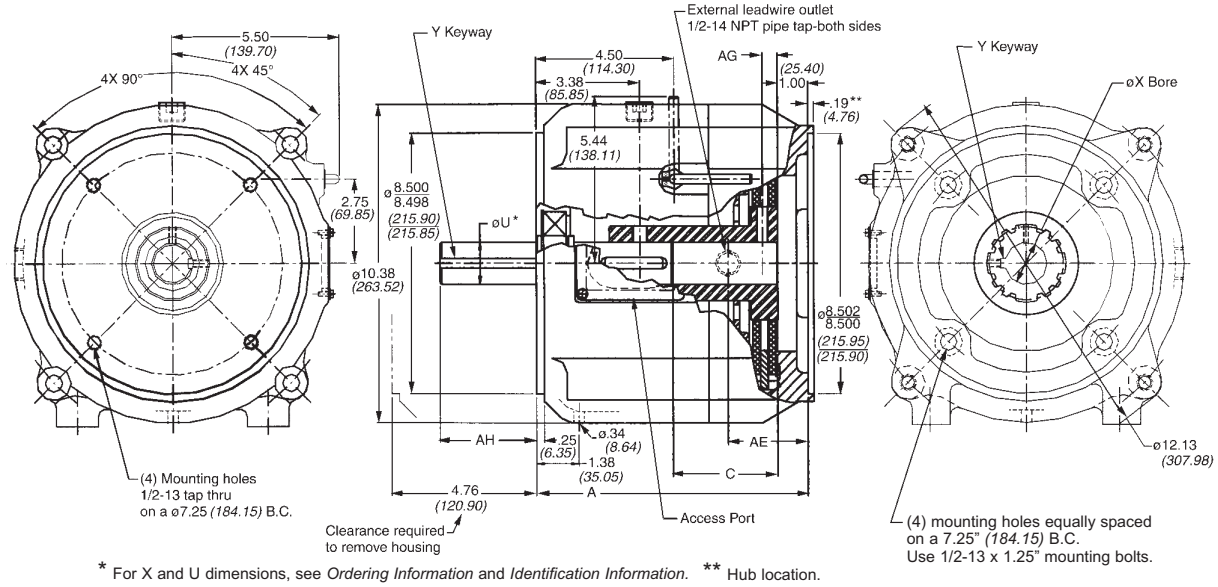
Parts List: P/N 8-078-917-57 *Rev. B*
P/N 8-078-917-67 *Rev. C*

Modifications: Pages 54-63

Note: 87,700 Series mounts between C-Face motor and reducer. Do not apply overhung load to brake output shaft.

Modification required for vertical above mounting. For vertical below, modification required on 50-105 lb-ft. See SAB Modifications for list price adders.

- ABS Type Approval Certified
- Spring-Set Electrically Released
- Self-Adjusting Design
- Maximum Speed: Horizontal 4000 rpm
  Vertical 3600 rpm
- Certified: CSA File LR-6254



* For X and U dimensions, see *Ordering Information* and *Identification Information.* ** Hub location.

Dimensions for estimating only. For installation purposes request certified prints.

Dimensional Data/Unit Pricing (Discount Symbol E2)

Nominal Static Torque lb-ft (Nm)	Enclosure	Basic Model Number and List Price*				Dimensions in Inches *(Dimensions in Millimeters)*				Wt. lbs (kg)**
		AC	AC List Price*	DC	DC List Price*	A	AE	AG	C	
10 *(14)*	IP 23	1-087-711-0X	$2,375.00	1-087-715-0X	$2,945.00	8.38 *(212.72)*	2.12 *(53.93)*	.19 *(4.83)*	2.81 *(71.44)*	66 *(30.0)*
	IP 54	1-087-712-0X	2,925.00	1-087-716-0X	3,495.00					
	IP 55	1-087-712-BX	3,180.00	1-087-716-BX	3,750.00					
15 *(20)*	IP 23	1-087-721-0X	2,375.00	1-087-725-0X	2,945.00	8.38 *(212.72)*	2.12 *(53.93)*	.19 *(4.83)*	2.81 *(71.44)*	66 *(30.0)*
	IP 54	1-087-722-0X	2,975.00	1-087-726-0X	3,545.00					
	IP 55	1-087-722-BX	3,230.00	1-087-726-BX	3,800.00					
25 *(34)*	IP 23	1-087-731-0X	2,450.00	1-087-735-0X	3,020.00	8.38 *(212.72)*	2.12 *(53.93)*	.19 *(4.83)*	2.81 *(71.44)*	66 *(30.0)*
	IP 54	1-087-732-0X	3,050.00	1-087-736-0X	3,620.00					
	IP 55	1-087-732-BX	3,305.00	1-087-736-BX	3,875.00					
35 *(47)*	IP 23	1-087-741-0X	2,600.00	1-087-745-0X	3,170.00	8.38 *(212.72)*	2.12 *(53.93)*	.19 *(4.83)*	2.81 *(71.44)*	66 *(30.0)*
	IP 54	1-087-742-0X	3,200.00	1-087-746-0X	3,970.00					
	IP 55	1-087-742-BX	3,455.00	1-087-746-BX	4,025.00					
50 *(68)*	IP 23	1-087-751-0X	2,750.00	1-087-755-0X	3,320.00	8.88 *(225.42)*	2.62 *(66.68)*	.44 *(11.18)*	3.31 *(84.14)*	73 *(33.0)*
	IP 54	1-087-752-0X	3,350.00	1-087-756-0X	3,920.00					
	IP 55	1-087-752-BX	3,605.00	1-087-756-BX	4,125.00					
75 *(102)*	IP 23	1-087-761-0X	2,795.00	1-087-765-0X	3,365.00	8.88 *(225.42)*	2.62 *(66.68)*	.44 *(11.18)*	3.31 *(84.14)*	73 *(33.0)*
	IP 54	1-087-762-0X	3,395.00	1-087-766-0X	3,965.00					
	IP 55	1-087-762-BX	3,650.00	1-087-766-BX	4,220.00					
105 *(142)*	IP 23	1-087-781-0X	3,100.00	1-087-785-0X	3,670.00	9.38 *(238.12)*	3.12 *(79.38)*	1.00 *(25.40)*	3.81 *(96.84)*	80 *(36.0)*
	IP 54	1-087-782-0X	3,500.00	1-087-786-0X	4,070.00					
	IP 55	1-087-782-BX	3,755.00	1-087-786-BX	4,325.00					

* X in 9th digit designates hub bore and shaft size.

Series 87,700 Specifications continued

Specifications

Nominal Static Torque lb-ft (Nm)	No. of Friction Discs	Solenoid Size	Maximum solenoid Cycle Rate① cycles/min	Thermal Capacity② hp-sec/min (watts)	Inertia (Wk^2) lb-ft² ($kgm^2 \times 10^{-4}$)
10 (14)	1	5	30	17.5 (249)	.078 (32.76)
15 (20)	1	6	25	17.5 (249)	.078 (32.76)
25 (34)	1	6	25	17.5 (249)	.078 (32.76)
35 (47)	1	8	20	17.5 (249)	.078 (32.76)
50 (68)	2	6	25	17.5 (249)	.108 (45.36)
75 (102)	2	8	20	17.5 (249)	.108 (45.36)
105 (142)	3	8	20	17.5 (249)	.145 (60.90)

① Maximum solenoid cycle rate is based on ambient temperature of 72°F *(22°C)* with 50% duty cycle. Does not relate to brake cycle rate (see Thermal Capacity).

② Thermal capacity rating is based on ambient temperature of 72°F *(22°C)*, stop time of one second or less, with no heat absorbed from motor. Derate thermal capacity by 25% for vertical mounting. Refer to *Selection Procedure* Section.

Brake set and release times in milliseconds, when brake and motor are switched separately (for T1/T2 definitions, see page 101):

Static Torque	Coil Size	T1	T2
10, 15, 25, 50	5 & 6	42	20
35, 75, 105	8	48	20

Current Ratings (amperes)

Coil Size	AC Current	Voltage: 60 Hz						Voltage: 50 Hz			Voltage: DC			
		115	200	230	400	460	575	110	220	380	24	95	115	230
5	Inrush Holding	7.5 .5	4.3 .3	3.7 .2	2.2 .1	1.9 .1	1.5 .09	5.4 .3	4.0 .25	1.9 .1	38.0 .5	8.4 .1	5.6 .08	3.2 .04
6	Inrush Holding	13.0 .6	7.5 .4	6.5 .3	3.7 .2	3.2 .2	2.6 .1	9.4 .5	5.6 .28	3.2 .2	42.8 .6	11.7 .2	8.5 .1	3.7 .06
8	Inrush Holding	17.6 1.2	10.3 .7	8.8 .6	5.0 .3	4.2 .3	3.5 .24	15.4 .1	7.7 .5	4.2 .3	43.1 .8	11.4 .2	9.3 .2	4.6 .09

Ordering and Identification Information

The following example and tables provide information for selecting the appropriate three-letter suffix when ordering a Stearns Brake.

Example of a complete part number:

1-087-732-01--FG — Lead wire position (external, left and right)
- FG — 230 Vac
- 01 — Does not apply
- 732 — Hub bore and output shaft size 1.125

Hub Bore, Shaft and Keyway Sizes

9th Digit of Model Number	Dimensions in Inches *(Dimensions in Millimeters)*				
	Bore Dia. (X)	Keyway*	Shaft Dia. (U)	Keyway*	Shaft Length (AH)
1	1.125 1.126 *(28.575 28.600)*	.25 x .12 *(6.35 x 3.18)*	1.125 1.124 *(28.575 28.550)*	.25 x .12 *(6.35 x 3.18)*	2.62 *(66.68)*
3	1.375 1.376 *(34.925 34.950)*	.31 x .16 *(7.94 x 3.97)*	1.375 1.374 *(34.905 34.950)*	.31 x .16 *(7.94 x 3.97)*	3.12 *(79.38)*
5	1.625 1.626 *(41.275 41.300)*	.38 x .19 *(9.52 x 4.76)*	1.625 1.624 *(41.275 41.250)*	.38 x .19 *(9.52 x 4.76)*	3.75 *(95.25)*

For sizes other than those shown, contact factory.
No motor frame adapters or foot mounting kit available.

*Keyseats made to ANSI B17.1 standard.

Standard AC Voltage Ratings

Character	Voltage	Hz
B	115	60
D	110	50
E	200	60
F	230 190	60 50
H	220	50
L	460 380	60 50
M	415	50
N	575	60
O	110/220	50
P	115/230	60
Q	230/460 230	60 50
R	200/400	60

Direct Current

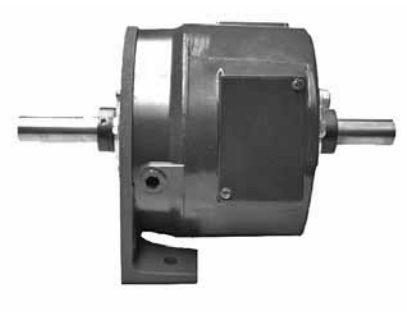
Character	Voltage
T U V W	12 24 36 48
X Y Z	95 115 230

Consult factory if other DC voltage is needed

Modifications are available- see SAB Modification Section

Series 56,703 (1-056-7X3) Foot Mounted, Bearing-Supported Thru-Shaft

BACK TO TABLE OF CONTENTS



Static Torque: 1.5 through 25 lb-ft

Enclosure Material: Die Cast Aluminum

Enclosure Protection: IP 23 (formerly referred to by Stearns as NEMA 2).

Release Type: Side Release Knob

Installation, Service and Parts List: P/N 8-078-905-27

Specifications: Page 11

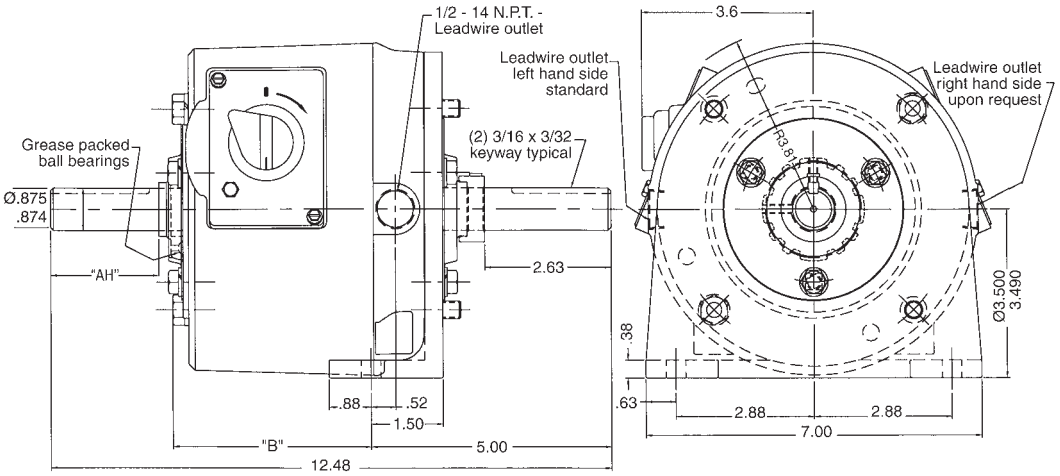
Modifications: Pages 54-63

Maximum overhung or side load measured at one inch from end of shaft: 36 lbs

Universal Mounting: 1.5 through 15 lb-ft. 20 and 25 lb-ft supplied with springs for vertical modification.

Brake set and release times in milliseconds, when brake and motor are switched separately (for T1/T2 definitions, see page 101):

Static Torque lb-ft	Coil Size	T1	T2
1½ - 25	4, K4, K4+, M4+	25	24



Dimensions for estimating only. For installation purposes request certified prints.

Dimensions

Nominal Static Torque		No. of Friction Discs	"B"	"AH"
Lb-Ft	(Nm)			
1.5 3 6	*(2)* *(4)* *(8)*	1	4.13	2.69
10 15	*(14)* *(20)*	2		
20 25	*(27)* *(34)*	3	4.56	2.25

Pricing (Discount Symbol E3)

Nominal Static Torque		Basic Model Number			
Lb-Ft	*(Nm)*	AC	List Price	DC	List Price
1.5	*(2)*	1-056-703-00-XX	$2,480.00	1-056-707-00-XX	$2,780.00
3	*(4)*	1-056-713-00-XX	2,500.00	1-056-717-00-XX	2,800.00
6	*(8)*	1-056-723-00-XX	2,565.00	1-056-727-00-XX	2,865.00
10	*(14)*	1-056-733-00-XX	2,665.00	1-056-737-00-XX	2,965.00
15	*(20)*	1-056-743-00-XX	2,765.00	1-056-747-00-XX	3,065.00
20	*(27)*	1-056-753-00-XX	2,855.00	1-056-757-00-XX	3,155.00
25	*(34)*	1-056-763-00-XX	2,950.00	1-056-767-00-XX	3,250.00

Ordering and Identification Information

The following example and tables provide information for selecting the appropriate two-letter suffix when ordering this Stearns Brake.

Example of a complete part number:

1-056-723-00-QC — Right hand leads
└— 230/460 Vac
Shaft diameter is 7/8"

Example of a complete part number:

1-087-232-00-QC — Right hand leads
└— 230/460 Vac
Shaft diameter is 1-1/4"

Standard AC* Voltage Ratings

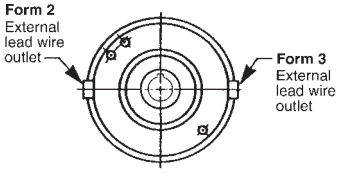
Character	Voltage	Hz
B	115	60
D	110	50
E	200	60
F	230 190	60 50
H	220	50
L	460 380	60 50
M	415	50
N	575	60
O	110/220	50
P	115/208-230	60
Q	208-230/460 190/380	60 50
R	200/400	60

Direct Current

Character	Voltage
T	12
U	24
V	36
W	48
X	95
Y	115
Z	230

Character	Lead Wire Position
B	Form 2
C	Form 3

Lead Wire Positions



View facing mounting register on brake.

*Current ratings see page 11

Modifications are available- see SAB Modification Section

Series 87,200 (1-087-2XX) Foot Mounted, Bearing-Supported Thru-Shaft

BACK TO TABLE OF CONTENTS



Static Torque: 6 through 105 lb-ft.

Enclosure Material: Cast Iron Endplate and Housing

Release Type: Side Lever, maintained with automatic release.

Enclosure Protection: IP 23 & 54 (formerly referred to by Stearns as NEMA 2 & 4, respectively).

Installation and Service Instructions: P/N 8-078-927-00

Parts List: P/N 8-078-917-02

Specifications: Page 17

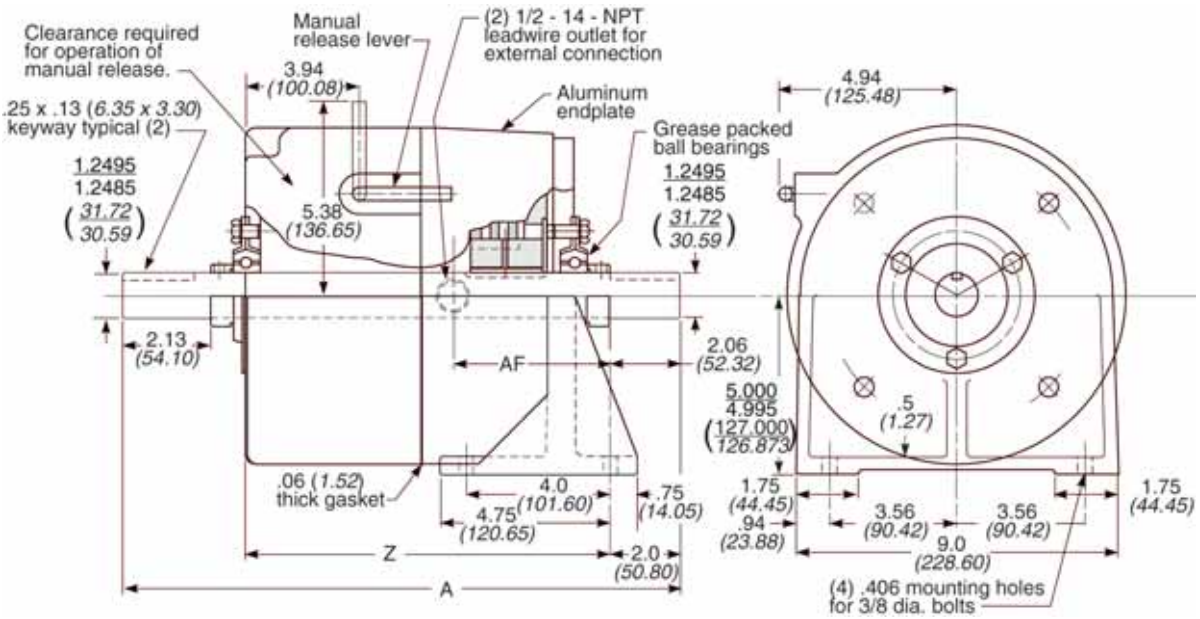
Modifications: Pages 54-63
Self adjust - see SAB Modifications for new manual adjust.

For vertical mounting modification see SAB Modification Section.

Maximum overhung, or side load measured at one inch from end of shaft: 100 lbs on brake housing side, 150 lbs on endplate/foot mount side

Brake set and release times in milliseconds, when brake and motor are switched separately (for T1/T2 definitions, see page 101):

Static Torque	Coil Size	T1	T2
10, 15, 25, 50	5 & 6	42	20
35, 75, 105	8	48	20



*Keyseats made to ANSI B17.1 standard.

Dimensions for estimating only. For installation purposes request certified prints.

Dimensional Data and Engineering Specifications/Unit Pricing (Discount Symbol A2)

Nominal Static Torque lb-ft (Nm)	Enclosure	Basic Model Number and List Price*				Dimensions in Inches (Dimensions in Millimeters)			Thermal Capacity (hp-sec/min)	Inertia Wk² (lb-ft²)	Wt. lbs (kg)**
		AC	AC List Price	DC	DC List Price	A	Z	AF			
10 (14)	IP 23	1-087-211-00	$2,475.00	1-087-215-00	$3,045.00	14.56 (369.82)	9.32 (238.13)	3.56 (90.42)	17.5	.049	72 (33.0)
	IP 54	1-087-212-00	2,675.00	1-087-216-00	3,245.00		9.38 (328.25)				
15 (20)	IP 23	1-087-221-00	2,525.00	1-087-225-00	3,095.00	14.56 (369.82)	9.32 (238.13)	3.56 (90.42)	17.5	.049	72 (33.0)
	IP 54	1-087-222-00	2,725.00	1-087-226-00	3,295.00		9.38 (328.25)				
25 (34)	IP 23	1-087-231-00	2,600.00	1-087-235-00	3,170.00	14.56 (369.82)	9.32 (238.13)	3.56 (90.42)	17.5	.049	73 (33.0)
	IP 54	1-087-232-00	2,800.00	1-087-236-00	3,370.00		9.38 (328.25)				
35 (47)	IP 23	1-087-241-00	2,750.00	1-087-245-00	3,320.00	14.56 (369.82)	9.32 (238.13)	3.56 (90.42)	17.5	.049	73 (33.0)
	IP 54	1-087-242-00	2,950.00	1-087-246-00	3,520.00		9.38 (328.25)				
50 (68)	IP 23	1-087-251-00	3,050.00	1-087-255-00	3,620.00	15.06 (382.50)	9.81 (249.94)	4.06 (103.12)	17.5	.083	78 (35.0)
	IP 54	1-087-252-00	3,250.00	1-087-256-00	3,820.00		9.88 (250.95)				
75 (102)	IP 23	1-087-261-00	3,550.00	1-087-265-00	4,120.00	15.06 (382.50)	9.81 (249.94)	4.06 (103.12)	17.5	.083	78 (35.0)
	IP 54	1-087-262-00	3,750.00	1-087-266-00	4,320.00		9.88 (250.95)				
105 (142)	IP 23	1-087-281-00	4,250.00	1-087-285-00	4,820.00	15.56 (395.20)	10.32 (262.13)	4.56 (115.82)	17.5	.117	81 (37.0)
	IP 54	1-087-282-00	4,450.00	1-087-286-00	5,020.00		10.38 (263.65)				

*See "Ordering Information", previous page.

Marine, Maritime & Navy Brakes

Solenoid-Actuated Brakes

	Marine		Marine		Maritime		Navy
Description	Suitable for many shipboard and severe duty applications		Suitable for many shipboard and severe duty applications		Suitable for many Coast Guard, shipboard and severe duty applications when "ductile iron" is specified		Designed to Military Specification
Compliance (Note A)	IEEE 45 ABS		IEEE 45 ABS		IEEE 45 Federal Standard 46 ABS		MIL-B-16392C (Ships)
Spring Set Operation (Note E)	Armature Actuated Brake (AAB)		Solenoid Actuated Brake (SAB)				
Stearns Series (Note B)	350	360	1-056-200-K0	1-087-0xx-K0 1-082-0xx-K0 1-086-0xx-K0	1-087-Mxx	1-082-4xx 1-086-4xx	1-087-6xx 1-082-6xx 1-086-6xx
Enclosure	IP 56	IP 56	IP 56	(Note C) IP 54, IP 56	IP 54		IP 56
Enclosure Finish	DI - Water Based Primer Alum - anodize MIL-A-8525 F		Water Based Primer		Alkyd Primer MIL TT-P-645C		Enamel MIL-E-15090
Coil	Encapsulated Construction Class H Insulation		Injection Molded Construction Class B Insulation		Injection Molded Construction Class B Insulation		Encapsulated Class H
Endplate or Mount Plate Material	Steel		Cast Iron		Ductile Iron		Ductile Iron
Housing Material	Cast Aluminum or Ductile Iron		Cast Iron		Ductile Iron		Ductile Iron
Support Plate Material	N/A		Steel	(Note H)	Ductile Iron		Ductile Iron
Pressure Plate & Stationary Disc Material	N/A		Brass		Brass		Brass
Self Adjusting (Note G)	No. Gap By Gage		No, Gap By Scale	Yes	Yes		Yes
Manual Release (Note D)	Optional		Maintained		Maintained		Non-Maintained

A. IEEE 45 compliance nameplate is optional. ABS Certificate SB374021
B. Additional options and modifications are included in the full 12 digit part number
C. IP 56 with side release option available in 1-087-000-K0 & 1-082-000-K0
D. The maintained release holds the brake in a release condition until the brake is electrically, or manually, re-engaged
The non-maintained ("deadman") release is manually held in the the released condition, re-setting when the force is removed
E. Spring-set, Solenoid with coil & linkage actuated brake (SAB), AC or DC voltage coil
Spring-set, Armature actuated direct-acting brake (AAB), DC voltage coil
F. Carrier ring friction disc is standard with the 350 & 360 series and is an option in the SAB brakes
G. Stainless Steel Self-Adjust is standard with the 1-08x-600 and 1-087-M00
H. 1-087: cast aluminum; 1-082: cast iron; 1-086: ductile iron

Armature-Actuated Brakes

MIL-B-16392C is inactive for new design and is no longer required, except for replacement purposes, per statement issued by Naval Sea Systems Command in June of 2001. The armature-actuated brake (AAB) was designed in consultation with Naval specification authorities as a suitable Commercial off the shelf (COTS) motor brake.

Series 350

Pressure Plate Mount
Internal Maintained Manual Release

Torque (lb-ft)	Model Number	NEMA Frame Size	List Price
75	3-51-734H0	182TC-256TSC	$4,266.00
110	3-51-744H0	182TC-256TSC	$4,466.00
110	3-51-744J0	284TC-286TSC	$4,665.00
110	3-51-744K0	324TC-405TSC	$4,866.00
180	3-51-844J0	284TC-286TSC	$4,909.00
180	3-51-844K0	324TC-405TSC	$5,209.00
300	3-51-944k0	324TC-405TSC	$6,605.00

Series 360

Magnet Body Mount
Internal Maintained/ Optional External
Non-Maintained Manual Release

Torque (lb-ft)	Model Number	NEMA Frame Size	List Price
60	3-61-644H0	182TC-256TSC	$3,395.00
60	3-61-644J0	284TC-286TSC	$3,595.00
75	3-61-734H0	182TC-256TSC	$4,266.00
110	3-61-744H0	182TC-256TSC	$4,466.00
110	3-61-744J0	284TC-286TSC	$4,665.00
180	3-61-844J0	284TC-286TSC	$4,909.00
180	3-61-844K0	324TC-405TSC	$5,209.00
300	3-61-944K0	324TC-405TSC	$6,605.00
300	3-61-944L0	444TC	$6,915.00

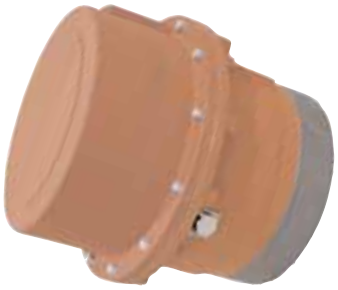
Mining Brakes - MSHA Certified

BACK TO TABLE OF CONTENTS

Stearns 1-082-3X4-06 series of electric fail-safe motor brakes are now certified for use in underground mines by the federal Mine Safety and Health Administration (MSHA).

Stearns is the only supplier of MSHA certified motor brakes.

MSHA approves and certifies products for use in underground coal and gassy mines to ensure that they do not cause a fire or explosion.



Features:

Fan Guard Mounted

Mounting face: 12.5" AK, 11.0" AJ (NEMA 324 and 326 TC, NEMA 364 and 365 TC, NEMA 404 and 405 TC)

Static Torque: 125 through 330 lb-ft

Spring-Set Electrically-Released

Enclosure Material: Cast Iron

Manual Release Type: Side lever, latching with automatic reset when electric power is applied to the brake coil

Enclosure Protection: IP 56

Self-Adjust Design: Automatic adjustment for friction disc wear - to reduce maintenance

Class H Coil Insulation

Thermal Cut-Out Switch

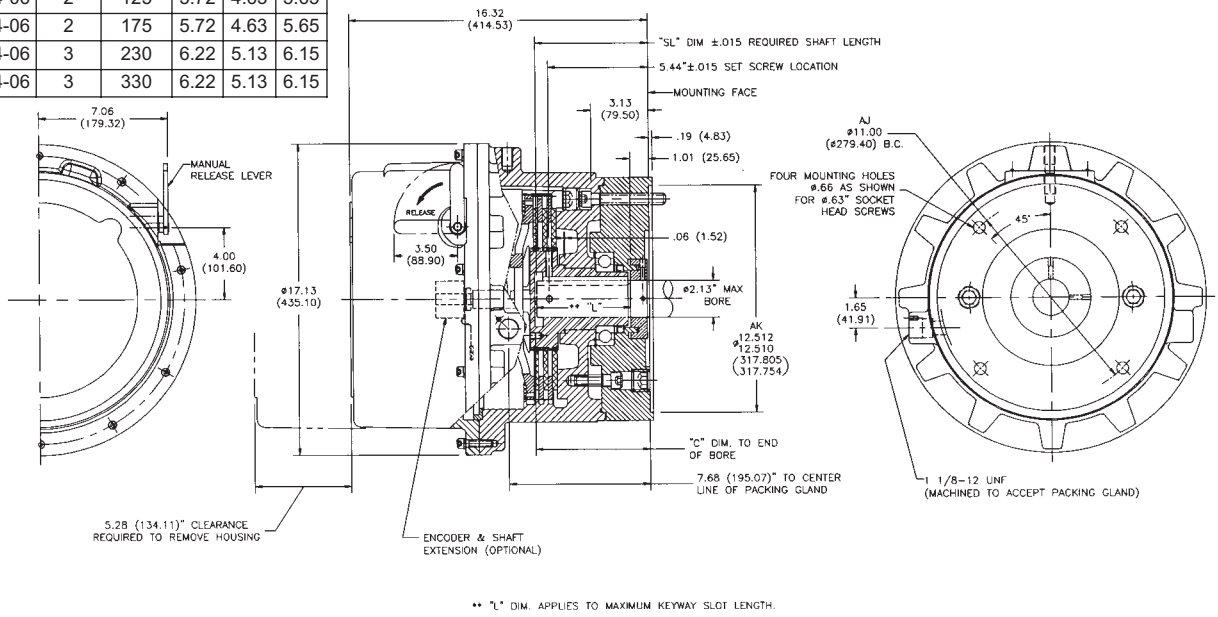
Electrical Connections terminate at terminal block

MSHA Certification Number: 18-XPA070006-0

Options:

- Internal Encoder
- Internal Electric Heater
- Electrical Release Indicator Switch
- Carrier Ring Friction Discs

Model No. IP56	No. of Discs	Torque Lb-Ft	C	**L	SL
1-082-314-06	2	125	5.72	4.63	5.65
1-082-324-06	2	175	5.72	4.63	5.65
1-082-334-06	3	230	6.22	5.13	6.15
1-082-344-06	3	330	6.22	5.13	6.15



** "L" DIM. APPLIES TO MAXIMUM KEYWAY SLOT LENGTH.

Unit Pricing (Discount Symbol D1)

Model No.	Enclosure	Nominal Static Torque lb-ft *(Nm)*	List Price
1-082-314-06	IP56	125 *(169)*	$26,700
1-082-324-06	IP56	175 *(237)*	$27,800
1-082-334-06	IP56	230 *(312)*	$29,000
1-082-344-06	IP56	330 *(447)*	$30,000

Ordering Information - specify[1]:

- Model Number
- Bore & keyway[2]
- Voltage[2]
- Options
- Leadwire packing gland - left or right (looking towards brake mounting face). Note: encoder option requires that the encoder wiring enters the brake from the opposite side of all of the other brake wiring.

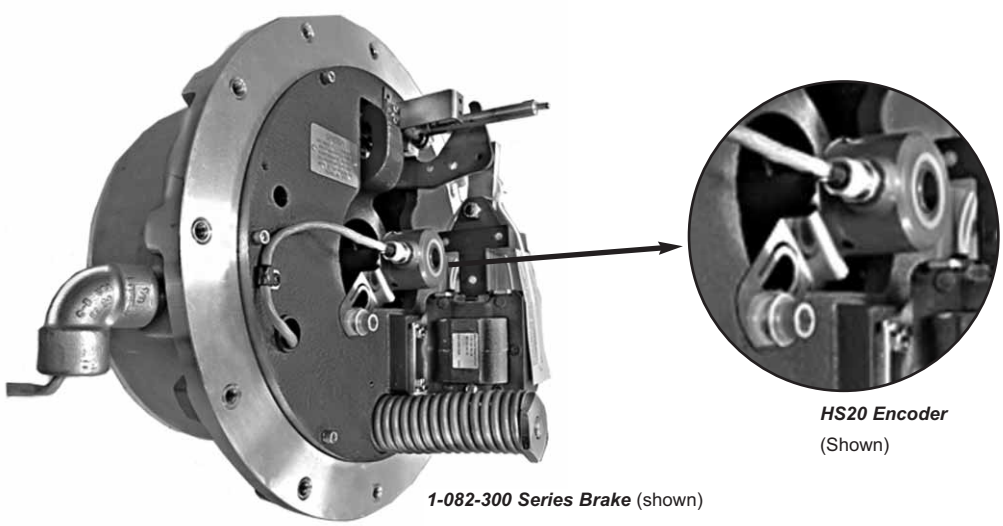
1 These brakes need to be purchased from the motor manufacturer, as the required shaft length (dimension "SL" above) is not standard.

2 Refer to Stearns Catalog page 37

Encoder Brakes

BACK TO TABLE OF CONTENTS

Stearns Solenoid Actuated Brakes with Internally Mounted Encoder



HS20 Encoder (Shown)

1-082-300 Series Brake (shown)

Features

- Available in frame sizes 182TC - 505TC
- All enclosure ratings available, including hazardous location
- Separate conduit exits are provided for the brake and encoder leads, to minimize potential electrical interference
- Choice of popular encoder manufacturers

Benefits

- Encoder located in protected environment - enclosed inside the brake housing
- Simplified encoder mounting - using a hub or shaft-mount encoder - and it's already done!
- Reduced package length - an internal encoder does not add any length to the brake
- Lower installed cost

Ordering Information

Stearns brakes with internal encoders are purchased through the motor manufacturer, as the required shaft length and diameter are non-standard. An internal encoder is not a retrofit option, like a brake coil, heater or switch. To order the brake motor package, specify the brake model and encoder option from table on following page.

Encoder Brakes (Con't)

Stearns Solenoid Actuated Brakes with Internally Mounted Encoder

Ordering Information

For Stearns Solenoid Actuated Brakes (SABs), with internal encoders -
Specify the complete brake model number and encoder option from the following table.
Contact factory for pricing.

Industrial Locations[1]

Frame Size	Brake Series	Torque Range (lb-ft)	Encoder Options[2]	Connector / Cable[3]	Stearns Drawing No.[4]
182TC - 256TC	1-087-E00	25 - 105	HS20	M12, 8 Pin / 15' or 5m	1087E00ED
324TC - 405TC	1-081-000	125 - 230	HS20 HS25	M12, 8 Pin / 15' M12, 8 Pin / 5m	10810022ED
324TC - 405TC	1-082-000	125 - 440	HS20 HS25	M12, 8 Pin / 15' M12, 8 Pin / 5m	10820022ED
444TC - 505TC	1-086-000	500 - 1000	HS20 HS25 HS35M	M12, 8 Pin / 15' M12, 8 Pin / 5m 10 Pin MS / 15'	10860022ED 10860022ED 10860022E35D

Division 1 Hazardous Location[5]

182TC - 256TC	1-087-300	10 - 105	HS20	M12, 8 Pin / 15' M12, 8 Pin / 5m	1087308D[6]
324TC - 405TC	1-082-300	125 - 330	HS20 HS25	M12, 8 Pin / 15' M12, 8 Pin / 5m	1082304D[7]

[1] Brake must be supplied by the motor manufacturer (a longer "stepped-down" motor shaft is required).

[2] Encoders are Optical, 1024 PPR.

[3] Cables are shielded. Lengths are from encoder connector, inside the brake (not from outside of brake housing)

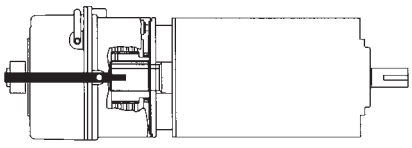
[4] Request this drawing for shaft design requirements

[5] No motor shaft modifications required, beyond the brake requirements for a standard hazardous location brake.

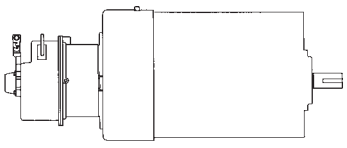
[6] Drawing 1087308D brake model mounts close-coupled to the motor end bell.
For the brake model that mounts to the motor fan guard - with a slinger - refer to drawing 10873052D.

[7] Based on 182 C-frame on accessory end of motor (7-1/4" bold circle).

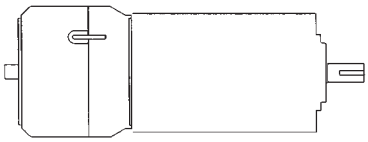
In addition to the fully enclosed brake with internal encoder options, encoders can be adapted externally to Stearns brakes:



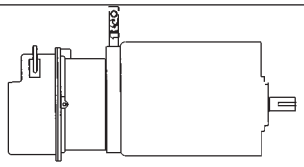
Motor shaft mounted encoder tethered to the brake housing.



Motor shaft mounted encoder bolted to the brake housing.



Encoder mounts to the stepped shaft of a double C-face brake (145TC-256TC frame.)



In-line coupling style encoder (182TC-256TC frame).

Information Needed for Modifications

Stearns is dedicated to providing you with the most comprehensive selection of modified spring-set disc brakes on the market today. We have included a list of our more popular modifications complete with descriptions, pictures and graphics when applicable and list price adders along with their representative series. Note that modification list prices are subject to the same discounts as apply to the complete brake assembly.

Below please find examples of how the modifications are called out with a letter in the 8th position of the 12 digit model number. Note that these listings are not complete, but represent our more popular selections. For any special applications and modification requirements not found here, please contact your Stearns representative.

IMPORTANT – The modification letter will appear in the *8th position* to call out the modification.

Examples:

1-056-XXX-__X
8th position

1-087-XXX-__X
8th position

1-08X-XXX-__X
8th position

See specific tables for some of the available options of the series required.

If two or more letter modifications are required, the 8th position of the part number will remain zero and position 10, 11 and 12 will be assigned by Stearns as a special part number.

All Series

Modification	Letter
Vertical Mounting - Above Motor	A
Class H Insulation	H
Space Heater (115 Volt Circuit)	I
Space Heater (115 Volt Circuit), Brass Pressure Plate and Stationary Disc	J
Brass Pressure Plate and Stationary Disc	K
Vertical Mounting - Below Motor	L
Thru-Shaft Housing (Standard)	Q
Vertical Mounting - Above Motor and Class H Insulation	T
Electrical Release Indicator Switch, N.O. contacts	W
Side Manual Release with Shaft Through Housing Stamped Steel	Z
Series 87,X00 Only	
Vertical Mounting - Above Motor, Brass Pressure Plate and Stationary Disc	N
Series 81,X00, 82,X00 87,000 and 87,100	
Side Manual Release	Y

Solenoid Actuated Brakes Modification Index

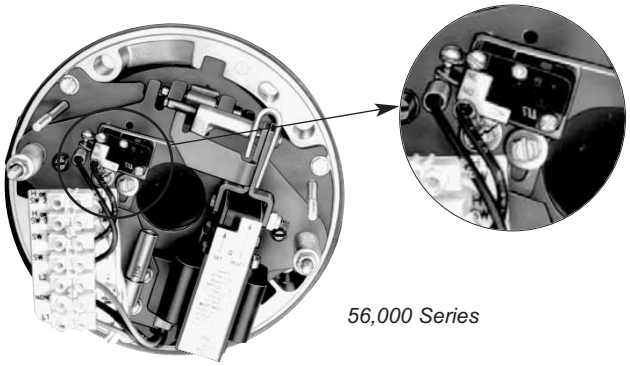
BACK TO TABLE OF CONTENTS

Category	Description	Modification Number (M___)	Page
Coils	Class H Insulation	M6	56
	DC Coil Option	M9	57
	Non-Standard Voltage AC	M25	60
	Non-Standard Voltage DC	M9	57
	Special Leadwire Length	M31	61
Corrosion Resistance	Brass Pressure Plate	M3	55
	Brass Stationary Disc	M4	55
	Breather Drain	M5	56
	Space Heater (115 or 230 volt)	M13	57
	Special Paint	M14	58
	Stainless Steel Self-Adjust	M15	58
	Stainless Steel Hardware	M16	58
	Corrosion-Resistant Endplate	M39	62
	Stainless Steel Hub	M42	62
Endplates	Special Internal Leadwire Hole	M35	61
	Corrosion-Resistant Endplate	M39	62
	Special Milling: Flat Bottom on Housing & Endplate	M40	62
Friction Discs	Special Material Friction Disc	M44	63
	Carrier Ring Disc (Steel or Zinc Aluminum)	M46	63
	Carrier Ring Disc (Bronze)	M47	63
Gaskets	Motor Gasket	M38	62
	Viton® Gasket	M43	63
Hubs/ Brake Shaft	Non-Standard Bore or Keyway	M11	57
	Special Shaft - Coupler Brakes	M29	60
	Taper-Lock Hubs	M30	61
	Stainless Steel Hub	M42	62
	Splined Hub and Friction Disc	M45	63
Machining Options	Encoder/Tach Machining	M7	56
	Metric Machining	M33	61
	Special Milling: Flat Bottom on Housing & Endplate	M40	62
Manual Adjust	Manual Adjust for 87,000 Series	M48	63
Manual Release	Side Manual Release	M12	57
	Non-Maintained (Deadman)	M32	61
	Internal Release	M37	62
Mounting	Vertical	M21, M23, M24	59-60
	Metric Machining	M33	61
	Motor Frame Adapters		97
	Foot Mounting Kits		98
Nameplates	Mylar or Metal	M10	57
	Brass Nameplate	M41	62
Paint/ Special Finish or Material	Brass Pressure Plate	M3	55
	Brass Stationary Disc	M4	55
	Special Paint	M14	58
	Stainless Self-Adjust	M15	58
	Stainless Steel Hardware	M16	58
	Corrosion-Resistant Endplate	M39	62
	Stainless Steel Hub	M42	62
Special Housing	Thru-Shaft NEMA 2	M19	59
	Thru-Shaft NEMA 4 and 4X	M20	59
	Split Housing	M36	62
Switches	Electrical Release Indicator	M1	55
	Electrical Release Indicator Proximity Switch	M2	55
	Thermal Switch	M18	58
	Wear Indicator	M27	60
Tach Mounting	Tach Machining	M7	56
	Thru-Shaft NEMA 2	M19	59
	Thru-Shaft NEMA 4 and 4X	M20	59
Torque Derating	Brass Pressure Plate	M3	55
	Brass Stationary Disc	M4	55
	Special Derating of Torque	M34	61
Wiring Options	Conduit Box with Terminal Strip	M8	56
	Terminal Strip	M17	58
	Special Length Leadwires	M31	61
	Internal Leadwire Hole	M35	61

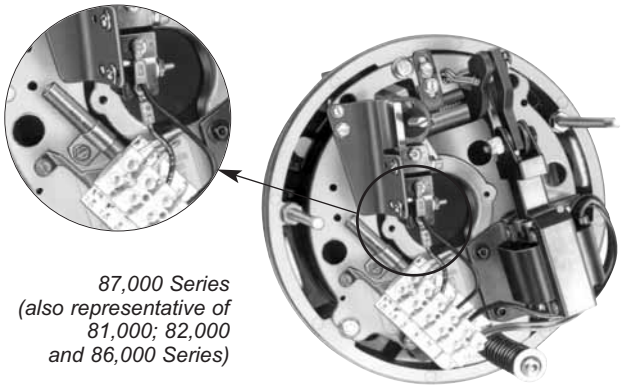
M1 Electrical Release Indicator Switch

Series	List Price Adder
56,X00 & 65,300	$450.00
81,000; 82,000; 87,X00	450.00
86,X00	900.00

This switch is used to indicate when the brake is in a released, non-holding position. This mechanism utilizes a mechanical limit switch.



56,000 Series



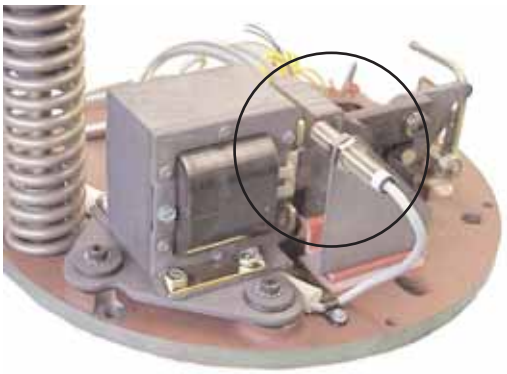
87,000 Series (also representative of 81,000; 82,000 and 86,000 Series)

Not available on 56,800 or 87,800 Series Brakes.

M2 Electrical Release Indicator Proximity Switch

Same function as the switch in M1 above; except, M2 uses an electronic proximity sensor.

Series	List Price Adder
81,000 82,000 87,X00	$1375.00
86,X00	2750.00

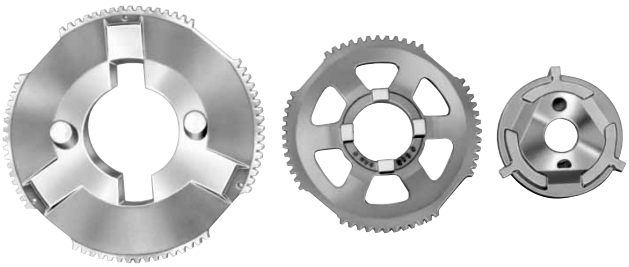


Not available on 56,800 or 87,800 Series Brakes.

M3 Brass Pressure Plate

Typically used in marine applications or in applications where the potential for sparks need to be eliminated. Brass can also be used to reduce torque.

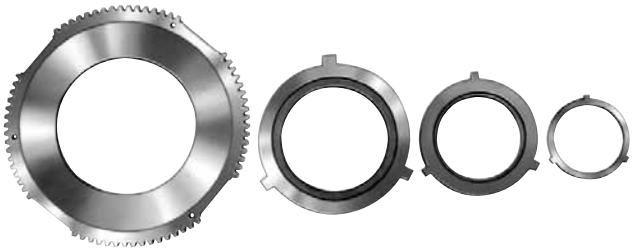
Series	List Price Adder
56,X00	See M4
65,X00	$250.00
81,000; 82,000	800.00
86,X00	1050.00
87,X00	600.00



M4 Brass Stationary Discs

Used with brass pressure plate (List per disc).

Series	List Price Adder
56,X00	$250.00
65,X00	250.00
87,X00	450.00
81,000; 82,000	600.00
86,X00	750.00



M5 Breather Drain

A drain plug is tapped into the bottom of the housing to let moisture escape. This option is only available on brakes with cast aluminum or cast iron housings.

Series	List Price Adder
56,X00	$380.00
65,X00	500.00
81,000 82,000 86,X00 87,X00	380.00



M6 Class H Insulation

Brake is provided with an epoxy encapsulated coil, rated for NEMA Class H designation.

These Class H coils are standard on hazardous location brakes.

Series	List Price Adder
56,X00	$145.00
87,X00	175.00
81,000 82,000	285.00
86,X00	570.00



M7 Housing Machining for Encoder/Tach Mounting

Series	Standard Machining[1]				Close Tolerance[2]			Tether Mount [3]	
	Bolt Circle & Register		Bolt Circle - but no Register		Bolt Circle & Register			A Single Bolt Hole	
	Open[4] Enclosure List Price Adder	Enclosed[5] List Price Adder	Open[4] Enclosure List Price Adder	Enclosed[5] List Price Adder	Open[4] Enclosure List Price Adder	Enclosed[5] List Price Adder	Maximum Thru-Shaft Dia. (inch)	Open[4] Enclosure List Price Adder	Enclosed[5] List Price Adder
56,X00 (except N/A for 56,800)	N/A	N/A	N/A	N/A	N/A	N/A		$350	$460
87,000 - 87,100	$700	$1,200	$80	$350	$2,450	$2,750	1.63	$240	$350
87,M00 - 87,500 - 87,600	N/A	$1,200	N/A	$350	N/A	$2,750		N/A	$350
81,000 - 82,000[6]	$1,100	$1,375	$305	$580	$2,550	$2,825	2.5	$465	$740
86,000	$1,100	$1,375	$380	$780	$2,550	$2,950		$540	$940

[1]**Standard Machining:** The housing is machined for a thru shaft, and to allow for an encoder or tach to be mounted. This option is only available on brakes with cast aluminum or cast iron housings. Consult factory for availability.

[2]**Close tolerance:** The housing and endplate are assembled and dowel pinned together - then machined as a matched set for a through shaft and encoder mounting. This option is only available on brakes with cast aluminum or cast iron housings. This option is recommended for Series 81,000; 82,000; and 86,X00 due to the long distance between the motor and encoder.

[3]**Tether Mount:** The housing is machined for a through shaft, and a single tapped hole for a bolt to secure a tether arm. (56,X has a through hole and tach-welded nut on inside of housing, instead of a tapped hole).

[4]Referred to on the product pages in the catalog as IP23

[5]Referred to on the product pages as IP54/55 (these enclosure ratings no longer apply when the housing is machined for this modification - the customer is responsible for meeting any specific enclosure rating when assembling the encoder.

[6]M7 Modification for Series 81,000 and 82,000 will also require the M12 Modification; the side manual release.



M8 Conduit Box with Terminal Strip

A terminal strip is located inside the conduit box. It allows for easy connection and identification of lead wires.

Series	List Price Adder
All series except hazardous location *(not available for the 48,100 series)*	$300.00 (IP 23) $600.00 (IP 54)
All hazardous location brakes	$600.00



M9 DC Coil Option

For DC voltage applications. Operates with an electronic DC switch module.

Series	List Price Adder	Additional Adder for Non-Standard Voltage
56,X00	$ 300.00	$ 250.00
87,X00	570.00	250.00
81,000	1050.00	250.00
82,000	1565.00	250.00
86,X00	2625.00	500.00

For standard voltage listing, see the ordering information section for the specific brake.

Not available on Hazardous Location Brakes.

M10 Nameplates

To order new brake nameplates, the serial number of the brake is required. A loose nameplate shipped from Stearns Division without being attached to a brake must have all agency markings removed (UL, CSA, etc.). In order to have a brake renameplated with the appropriate agency markings, it must be returned to Stearns Division for product verification.

List Price:	First Nameplate	$150.00
Net Price:	Additional Mylar Nameplates	1.50
	Additional Metal Nameplates	4.00

M11 Nonstandard Hub or Keyway

For standard bore diameter and keyway specifications, see specific brake selection page. For taper bores, consult factory for pricing.

Description	List Price Adder					
	48,100	56,X00	65,X00	81,000 82,000 86,000	87,000 87,100 87,800	87,700
All Quantities and Enclosures	$225.00	225.00	325.00	600.00	250.00	250.00

M12 Side Manual Release

Side release not available on the 1-065-300 or the 1-086-000

Sheet Metal Housing (IP 23 Only)	List Price Adder
56,000; 56,400; 56,500	$50.00
87,000; 87,100	$50.00

Cast Iron Housing	List Price Adder
87,000 IP 23	$385.00 includes casti iron housing adder of $110
87,000 IP 54	$275.00
81,000 82,000	$350.00



M13 Space Heater (115 or 230 Volt Only)

A space heater cartridge is used to prevent moisture build-up inside the brake housing.

Series	Wattage	List Price Adder
56,X00*	15	$210.00
81,000; 82,000; 86,X00	50 and 75	275.00
87,X00**	25 to 30	225.00
Hazardous Duty Brakes	25 to 50	750.00

*Not available on 56,800 or 87,800 Series Brakes
**Not available in 87,800 Class I



56,000 Series



87,000 Series (also representative of 81,000; 82,000 & 86,000 Series)

M14 Special Paint



The standard paint for all brake series (except BISSC Certified & Maritime/Navy) is a red, water-base primer, painted inside and out.

For additional corrosion protection, a special (green) zinc chromate primer can be provided (painted inside and out) in place of the standard red primer. List price adders as shown.

Series	List Price Adder
56,X00	$210.00
65,X00	300.00
81,000; 82,000; 86,X00	550.00
87,000	525.00

Other Special Paint options are available - either primers, a white epoxy finish coat, or clean finish (exterior primer removed). Consult factory for pricing.

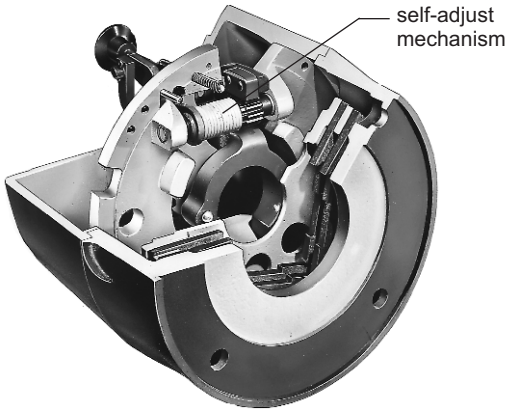
BISSC Certified paint (white epoxy exterior paint) is standard for brake series with IP55 and IP57 enclosure ratings - and the prices are included in the standard list prices.

Maritime and Navy brakes have their own specified paints, with pricing included in the standard list prices.

M15 Stainless Steel Self-Adjust Mechanism

For severe duty applications. This option includes a stainless steel pinion and plated wrap spring in the auto-adjust mechanism. It is only available on the 81,000; 82,000; 86,000 and 87,000 Series Brakes

Series	List Price Adder
81,000; 82,000; 87,000	$350.00
86,X00	$700.00



M16 Stainless Steel Hardware

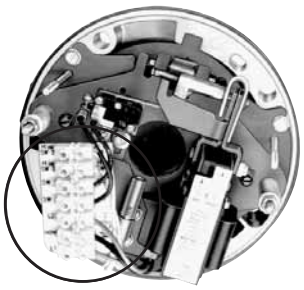
All external hardware is provided in stainless steel.

Series	List Price Adder
48,100	$125.00
56,X00, 87,X00	$150.00
81,000, 82,000 86,000	$275.00

M17 Terminal Strip

A terminal strip is located in the inside of the brake, on the support plate. It allows for easy connection and identification of lead wires.

Series	List Price Adder
ALL	$150.00



56,000 Series



87,000 Series (also representative of 81,000; 82,000 & 86,000 Series)

M18 Thermostat (thermal switch)

This switch is used to indicate when a brake is overheating. Thermostats are standard in 8X,300 and 65,X00 Series. This option is for NON-UL brakes only.

Series	Switch Operation Specificatons	List Price Adder
87,X00	Normally Closed: Opens at 295°F, Closes at 255°F	$400.00
81,000, 82,000 86,X00	Normally Closed: Opens at 210°F, Closes at 180°F	400.00
56,X00	Normally Closed: Opens at 195°F, Closes at 175°F	400.00



M19 Through-Shaft Enclosure

This configuration allows for the motor shaft to extend beyond the housing of the brake.

This modification lowers the brake enclosure rating to IP10.

Series	List Price Adder
56,000, 56,400	N/C
56,100, 56,200	$110.00
56,600	110.00
81,000, 82,000	225.00
86,000	300.00
87,000, 87,100 sheet metal	N/C*
87,000, 87,100 with cast iron housing	225.00 (adder for cast iron housing is $210.00 additional)

*Up to 1-5/16".
Above 1-5/16", add $80.00.



M20 Through-Shaft Cast Iron Enclosure with Lip Seal

This configuration allows the motor shaft to extend beyond the housing of the brake with a bushing to use with a housing lip seal.

This modification lowers the brake enclosure rating to IP10.

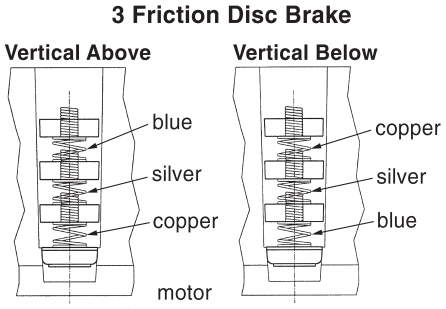
Series	List Price Adder
56,100, 56,200 56,600	$220.00
81,000, 82,000	500.00
86,000	700.00
87,000, 87,100	300.00



M21 Vertical Mounting for 56,000 Series & 65,300 Series

The 56,000 20 and 25 lb-ft Series Brakes are shipped with spring kits. Vertical modification at 15° from horizontal. Read installation and service instructions for details on its use.

Description	List Price Adder
Factory assembly for three disc configuration.	$20.00



Example of 56,000 Series spring requirements for vertical above and below mounting.

M23 Vertical Mounting for 87,X00 Series

For factory modification to vertical above or below application. Vertical modification at 15° from horizontal.

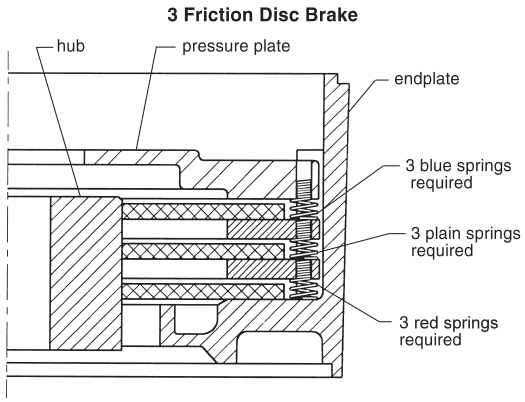
Series 87,000 & 87,100

Torque Value (lb-ft)	IP 23 & IP 54 steel hsg Above	IP 23 & IP 54 steel hsg Below	IP 54/55 cast iron Above	IP 54/55 cast iron Below
6, 10, 15, 25 & 35	$95.00	no mod req'd	$370.00*	no mod req'd
50 & 75	$105.00	$105.00	$380.00*	$105.00
105	$135.00	$135.00	$410.00*	$135.00

*Includes adder for side manual release

Series 87,300; 87,800; 87,700

Torque Value (lb-ft)	Vertical Above	Vertical Below
6, 10, 15, 25 & 35	$95.00	no mod req'd
50 & 75	$105.00	$105.00
105	$135.00	$135.00



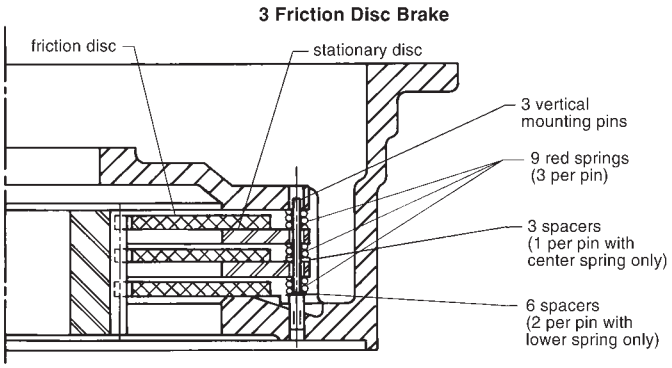
Example of 87,000 Series spring requirements for vertical above mounting.

M24 Vertical Mounting for 81,000; 82,000 and 86,000 Series

These brakes require factory modifications for vertical applications. Vertical modification at 15° from horizontal.

Series	Torque Value (lb-ft)	IP 23 Above & Below	IP 54 Above	IP 54 Below
81,000 & 82,X00	125 & 175	$250.00	$575.00*	$250.00
81,000 & 82,X00	230	300.00	650.00*	300.00
82,X00	330	300.00	650.00*	300.00
82,X00	440	500.00	850.00*	500.00
86,000	500 & 750	750.00	750.00*	750.00

*Includes adder for side manual release

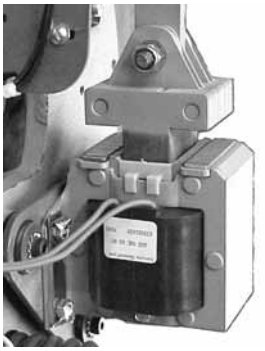


Example of 81,000 Series pin, spring and spacer requirements for vertical above mounting.

M25 Voltage Non-Standard (AC)

For standard voltage listing, see the ordering information section for the specific brake.

Series	List Price Adder
48,100	$165.00
65,X00	165.00
56,000	165.00
81,000; 82,X00	200.00
86,X00	400.00
87,X00	175.00

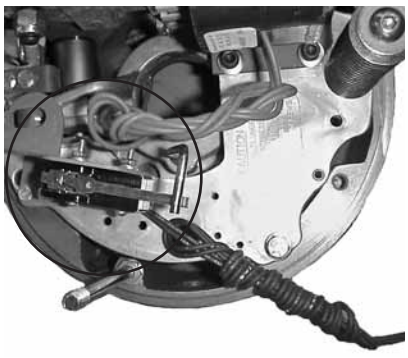


M27 Wear Indicator (Friction Disc) Switch

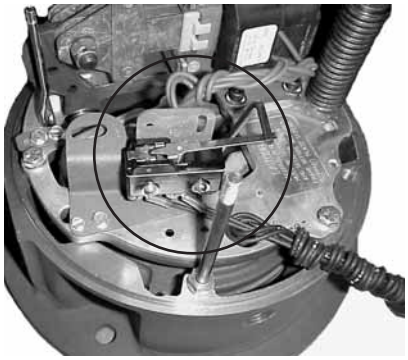
A mechanical switch is installed to indicate when the friction disc requires replacement.

Series	List Price Adder
81,000; 82,X00	$225.00
86,000	225.00
87,X00*	225.00

**Switch supplied with leads (Switches N/A on Series 87,800)*



87,000 Assembly



87,000 Assembly

M29 Special Shaft-Coupler Brake and Foot Mount Brake

Any non-standard input or output shaft on a 56,700, 87,200 or 87,700 Series Brake.

Series	List Price Adder
56,700	$325.00
87,200; 87,700	325.00



M30 Taper-Lock Hubs

For use in severe duty applications and reversing application to secure the brake hub to the motor shaft.

Series	Series	List Price Adder
87,000; 87,100 IP 23 only	10 to 35 lb-ft	$200.00
	50 to 75 lb-ft	225.00
	105 lb-ft	250.00
81,000	125 & 175 lb-ft	225.00
	230 lb-ft	325.00
82,000	125 & 175 lb-ft	375.00
	230 & 330 lb-ft	550.00
	440 lb-ft	675.00





M31 Special Length Lead Wires

Up to 5’	Series	List Price Adder
	All	$65.00

Over 5’	Series	List Price Adder
	All	$130.00

M32 Non-Maintained (Deadman) Manual Release

The brake is mechanically released while the release is pulled into a release position. Once released, the brake sets.

Series*	List Price Adder
56,200, 56,700, 56,800 & 56,900	$110.00
56,000, 56,400 & 56,500	185.00
81,000; 82,000 & 87,000	125.00
86,000	250.00

**N/A on 56,300.*
Standard on 56,100 and 56,600.



M33 Metric Machining Including Cast Iron Endplate

Stearns SAB’s can be used with metric motor frames. The following table indicates standard frame capabilities for an IEC B14 Face mount.

Series	IEC Frame Sizes	List Price Adder
56,200; 56,400; 56,600 & 56,900	B14 flange in sizes 80; 90 & 100 B5 flange in sizes D63 & D71	$340.00
56,500	B14 flange in sizes 112; 132 & 160 B5 flange in sizes D71; D80; D90; D100 & D112	$340.00
87,000	B14 flange in sizes 112; 132 & 160 B5 flange in sizes D71; D80; D90; D100 & D112	$340.00

M34 Derating of Torque

Stearns industrial SAB’s can be custom built to meet your specific torque requirements.

Series	List Price Adder	Derate To
56,500	$315.00	6 lb-ft
87,100	315.00	20 or 30 lb-ft
81,000 & 82,000	460.00	To be approved with application engineering

M35 Special Internal Lead Wire Hole with Bushing

Any non-standard, internal lead wire hole in the endplate.

Series	List Price Adder
All brakes except hazardous location brakes	$175.00



M36 Housing Split

SAB's can be provided with a split housing.

Series	List Price Adder
81,000; 82,000 & 86,000	$725.00
81,000; 82,000 & 86,000 gasketed	$1,000.00
87,000; 87,100 sheet metal	$200.00
87,000; 87,100 cast iron gasketed	$250.00



M37 Internal Release

An internal manual release requires that the housing be removed before the brake can be released by hand.

**N/A for hazardous location brakes*

Series	List Price Adder
87,0XX; 81,0XX; 82,0XX; 86,0XX	N/C

M38 Motor Gasket

The brake is provided with an additional C-Face gasket to be placed between the brake and motor.

Series*	List Price Adder
81,000; 82,000; 86,000	$100.00
56,X00 & 87,000	75.00

**N/A for hazardous location brakes*

M39 Corrosion-Resistant Endplate

Rust preventative treatment applied to brake endplate.

Series	List Price Adder
56,200, 56,400, 56,500, 56,800 & 65,300	$425.00
81,000; 82,X00 & 86,000	575.00
87,X00	475.00



M40 Special Milling: Flat Bottom on Housing & Endplate

This modification is provided in the event the flange between the endplate and housing interfere with the mounting configuration.

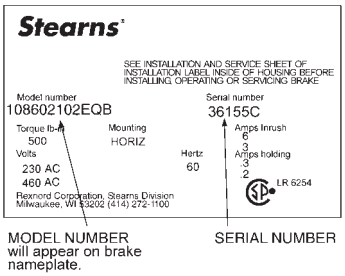
Series	List Price Adder
81,000; 82,000 & 86,000	$650.00



M41 Brass Nameplate with Special Engraving

Brass nameplates offer greater durability in outdoor applications.

Series	List Price Adder
81,000; 82,000 & 86,000	$75.00



M42 Stainless Splined Hub

Stainless steel splined hubs are available for extreme outdoor applications, to prevent corrosion on the disc and hub interface.

Series	List Price Adder
81,000; 82,000 & 86,000	$1060.00
87,000	800.00



M43 Viton® Gasket

Gaskets and o-rings in brakes can be provided in Viton® (flourocarbon) material, in place of the standard neoprene. However, the V-wiper steel-backed seals that are used on pull rod manual releases are not available in Viton® and remain as neoprene.

Viton® is a registered trademark name of DuPont.

Series	List Price Adder
81,000; 82,000; 86,000	$1,300.00
87,000*	$1,125.00
56,000	$950.00

*Viton® gaskets and o-rings are standard for 87,X00 series, except for hazardous location brakes where Viton® seals are N/A.

***Except series 56,200; 56,700; & 56,900 - where Viton gaskets are standard.*

M44 Special Friction Disc (per Disc)

Any non-standard friction disc in a brake. Cost is per disc.

Non-standard discs include: hi-inertia friction discs and heavy duty friction discs. Does not include carrier ring friction discs (see M46 and M47).

Series	List Price Adder
87,000	$50.00
56,000	45.00



M45 Splined Hub and Friction Disc

Standard on most models. Used for severe duty and reversing applications.

Series	List Price Adder
87,300	No Charge

Series	Torque (lb-ft)	List Price Adder
87,X00*	6-35 lb-ft	190.00
	50 & 75 lb-ft	290.00
	105 lb-ft	390.00

** Spline is standard on this series. Adder is for pre-revision 24-tooth spline.*

M46 Carrier Ring Friction Disc

The friction material is bonded to a steel or zinc/aluminum alloy ring.
This is used for severe duty applications and applications where people are being moved.

Series	Carrier ring material	List Price Adder (per disc)
Horizontal Use Only		
81,000	Steel	700.00
82,000	Steel	700.00
Horizontal or Vertical Use		
87,X00** (not available on 87,300 or 87,800 series	Zinc aluminum alloy	550.00



M47 Carrier Ring Friction Disc (Bronze)

The friction material is bonded to a bronze ring.
This is used for severe duty applications and applications where people are being moved.

Horizontal applications only

*** Only available with pre-revision design, 24-tooth splined hub, which is included in this price*

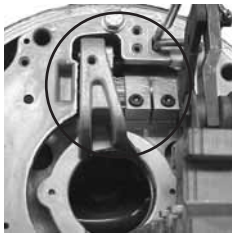
Series	List Price Adder (per disc)
81,000	N/A
82,000	$1050.00
86,000	1250.00
87,X00**	
6-35 lb-ft	925.00
50 & 75 lb-ft	1850.00
105 lb-ft	2775.00



M48 1,08X,000 Series Manual Adjust Mechanism

Excellent for holding applications when disc wear is not a concern. (Not available on hazardous location brakes.)

Series	List Price Adder
87,000	Subtract $50 List
81,000 82,000 86,000	No Charge



M60 Encoders

Internally mounted encoders are available in some series brakes, including some hazardous location brakes. See pages 52-53 for series availability and additional information.

Maximum Encoder Diameter (in.)	
1-056	N/A
1-087-E00	2.0”
1-081 & 1-082	2.5”
1-086	3.5”

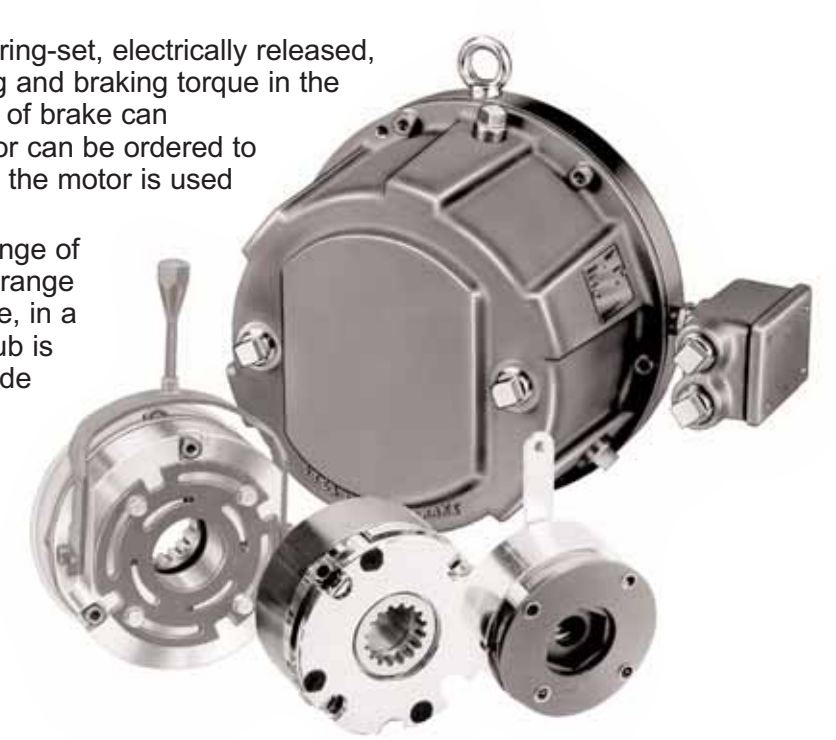


Introduction to Armature Actuated Brakes (AAB)

BACK TO TABLE OF CONTENTS

The Armature Actuated Brakes are spring-set, electrically released, friction devices, which develop holding and braking torque in the absence of electrical power. This type of brake can decelerate and hold a rotational load or can be ordered to provide a holding function only, where the motor is used as the dynamic brake.

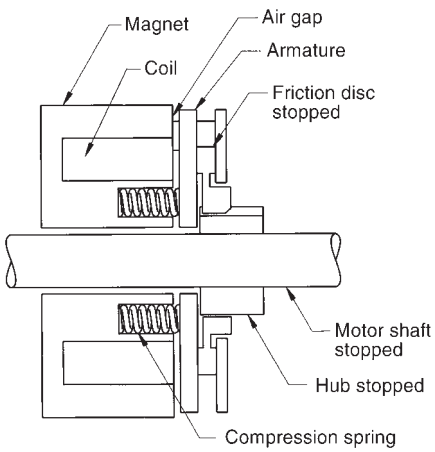
AAB's are available to meet a wide range of braking requirements. Available sizes range from 3 lb-in up to 300 lb-ft static torque, in a variety of mounting options. A short hub is available for face mounting or to provide for maximum space efficiency. Features include Class H magnet wire coils, corrosion resistance, and optional manual release lever. Custom designs and modifications are possible; consult the factory for more information.



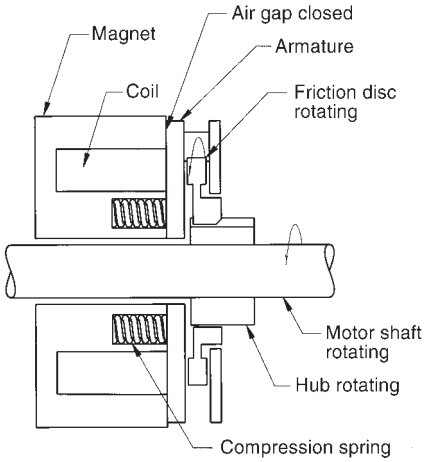
Operating Principle

A hub which is attached to the shaft supports the rotatable friction disc. Brake torque is developed when springs apply a clamping force between the brake armature, friction disc and pressure plate. When electrical power is applied, the armature is pulled by the electromagnetic force in the magnet body assembly which overcomes spring action allowing the friction disc to rotate freely. When electrical power is interrupted, the electromagnetic force is removed and the pressure spring will mechanically force the armature plate to clamp the friction disc between itself and the pressure plate, thereby torque is developed.

Engaged Condition (power off)



Disengaged Condition (power on)



Continued on next page

Product Overview

BACK TO TABLE OF CONTENTS

Series 310 & 311

Pages 67-70



Delivers high torque in a compact package for servo and stepper motor applications

Sizes ranging from 8 to 400 lb-in, (.9 to 45.2 Nm) of torque

Series 320

Pages 71-72



Commercial duty, for small gear motors

Sizes ranging from 3 to 50 lb-in (.34 to 5.6 Nm) of torque

Series 321 Totally - Enclosed Non-ventilated (TENV) & Series 322 IP54 Enclosure

Pages 73-76

Sizes from 3 to 72 lb-in (.34 to 8.1 Nm) of torque



Series 321 NEMA C TENV

Pages 77-78

Direct mounting to 48C and 56C motors

Sizes from 1.5 to 25 lb-ft (2 to 34 Nm) of torque



Series 331 & 333

Pages 79-80, 84



High performance brake for metric/IEC applications.

Direct drop-in for Kebco, Lenze, and Binder.

Sizes ranging from 3 to 300 lb-ft, (4 to 400 Nm) of torque

Series 331 & 333 NEMA C-Face

Pages 82-84

- Adaptors for NEMA frame sizes 48C through 405TC/UC
- Enclosed version available in NEMA 48C through 215TC



Series 350

Pages 85-86



Pressure plate mounted, IP56 enclosure, ideal for Portal Crane applications.

Torque sizes ranging from 75-300 lb-ft (102-400 Nm).

Series 360

Pages 87-88

Magnet-body mounted brake in an IP-56 enclosure. Ideal for Portal Crane applications.

Torque sizes ranging from 60-300 lb-ft (80-400 Nm).



Proving Switches and AC Rectifiers

Pages 89-93

For use with AAB Series 333, 350, and 360



Pages 94-96

AAB Modifications

Description, Availability, and Pricing

Armature Actuated Brakes (AAB) Torque Selection

BACK TO TABLE OF CONTENTS

Select the proper torque rating based on horsepower and rpm (speed at the clutch or brake) using the *Torque Selection Chart* below. Based on 1.4 service factor.

For other service factors and speeds, use the formulas shown below.

Formula for TABLE 1

$$T = \frac{63{,}025 \times P}{N} \times SF$$

T = Static torque, lb-in.

P = Horsepower, hp

N = Shaft speed at brake, rpm

SF = Service Factor

63,025 = Constant

Formula for TABLE 2

$$T = \frac{5{,}252 \times P}{N} \times SF$$

T = Static torque, lb-ft.

P = Horsepower, hp

N = Shaft speed at brake, rpm

SF = Service Factor

5,252 = Constant

Caution: Do not use Table 1 to select brakes for overhauling or high inertial loads, or where a stop in specified time or distance is required. For these applications the total inertia of the load and power transmission system must be determined to make a brake selection. Refer to sections on torque and thermal ratings and determination.

NOTE: Series 310 and 311 for holding applications only.

TABLE 1

Series 320, 321, 322 Static Torque in lb-in. *(Nm)*

Motor hp	rpm									
	600	800	1000	1200	1500	1800	2000	2400	3000	3600
	Static Torque lb-in *(Nm)*									
1/20	18 *(2.03)*	7 *(.79)*	7 *(.79)*	7 *(.79)*	3 *(.34)*	3 *(.34)*	3 *(.34)*	3 *(.34)*	3 *(.34)*	3 *(.34)*
1/12	18 *(2.03)*	18 *(2.03)*	7 *(.79)*	7 *(.79)*	7 *(.79)*	7 *(.79)*	7 *(.79)*	3 *(.34)*	3 *(.34)*	3 *(.34)*
1/8	35 *(3.95)*	18 *(2.03)*	18 *(2.03)*	18 *(2.03)*	18 *(2.03)*	7 *(.79)*	7 *(.79)*	7 *(.79)*	7 *(.79)*	3 *(.34)*
1/6	35 *(3.95)*	35 *(3.95)*	18 *(2.03)*	18 *(2.03)*	18 *(2.03)*	18 *(2.03)*	18 *(2.03)*	7 *(.79)*	7 *(.79)*	7 *(.79)*
1/4	—	35 *(3.95)*	35 *(3.95)*	35 *(3.95)*	18 *(2.03)*	18 *(2.03)*	18 *(2.03)*	18 *(2.03)*	18 *(2.03)*	7 *(.79)*
1/3	—	—	35 *(3.95)*	35 *(3.95)*	35 *(3.95)*	18 *(2.03)*	18 *(2.03)*	18 *(2.03)*	18 *(2.03)*	18 *(2.03)*
1/2	—	—	—	—	35 *(3.95)*	35 *(3.95)*	35 *(3.95)*	35 *(3.95)*	18 *(2.03)*	18 *(2.03)*
3/4	—	—	—	—	—	—	35 *(3.95)*	35 *(3.95)*	35 *(3.95)*	35 *(3.95)*
1	—	—	—	—	—	—	—	—	—	35 *(3.95)*

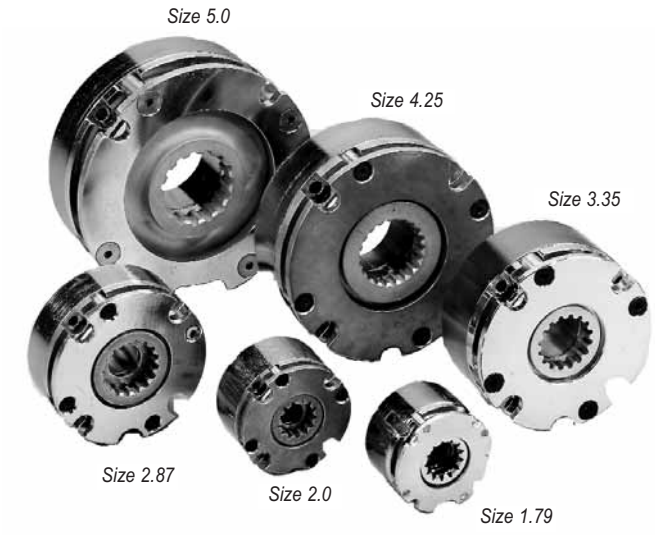
TABLE 2

Series 333/350/360 Static Torque in lb-ft. *(Nm)*

Motor hp *(kw)*	rpm									
	600	800	1000	1200	1500	1800	2000	2400	3000	3600
	Static Torque lb-ft *(Nm)*									
1/3 *(.25)*	6 *(8)*	6 *(8)*	3 *(4)*	3 *(4)*	3 *(4)*	3 *(4)*	3 *(4)*	3 *(4)*	3 *(4)*	3 *(4)*
1/2 *(.37)*	12 *(16)*	6 *(8)*	6 *(8)*	6 *(8)*	3 *(4)*	3 *(4)*	3 *(4)*	3 *(4)*	3 *(4)*	3 *(4)*
3/4 *(.55)*	12 *(16)*	12 *(16)*	6 *(8)*	6 *(8)*	6 *(8)*	6 *(8)*	3 *(4)*	3 *(4)*	3 *(4)*	3 *(4)*
1 *(.75)*	25 *(34)*	12 *(16)*	12 *(16)*	12 *(16)*	6 *(8)*	6 *(8)*	6 *(8)*	6 *(8)*	6 *(8)*	3 *(4)*
1-1/2 *(1.1)*	25 *(34)*	25 *(34)*	12 *(16)*	12 *(16)*	12 *(16)*	12 *(16)*	6 *(8)*	6 *(8)*	6 *(8)*	6 *(8)*
2 *(1.5)*	25 *(34)*	25 *(34)*	25 *(34)*	25 *(34)*	12 *(16)*	12 *(16)*	12 *(16)*	6 *(8)*	6 *(8)*	6 *(8)*
3 *(2.2)*	45 *(60)*	45 *(60)*	25 *(34)*	25 *(34)*	25 *(34)*	25 *(34)*	12 *(16)*	12 *(16)*	12 *(16)*	12 *(16)*
5 *(3.7)*	60 *(80)*	60 *(80)*	45 *(60)*	45 *(60)*	25 *(34)*	25 *(34)*	25 *(34)*	25 *(34)*	25 *(34)*	12 *(16)*
7-1/2 *(5.6)*	110 *(150)*	110 *(150)*	60 *(80)*	60 *(60)*	45 *(60)*	45 *(60)*	45 *(60)*	25 *(34)*	25 *(34)*	25 *(34)*
10 *(7.5)*	180 *(240)*	110 *(150)*	110 *(150)*	110 *(150)*	60 *(80)*	45 *(60)*	45 *(60)*	45 *(60)*	25 *(34)*	25 *(34)*
15 *(11.2)*	300 *(400)*	180 *(240)*	110 *(150)*	110 *(150)*	110 *(150)*	60 *(80)*	60 *(80)*	60 *(80)*	45 *(60)*	45 *(60)*
20 *(14.9)*	300 *(400)*	180 *(240)*	180 *(240)*	180 *(240)*	110 *(150)*	110 *(150)*	110 *(150)*	60 *(80)*	60 *(80)*	60 *(80)*
25 *(18.6)*	—	300 *(400)*	180 *(240)*	180 *(240)*	180 *(240)*	110 *(150)*	*	*	*	*
30 *(22.4)*	—	300 *(400)*	300 *(400)*	300 *(400)*	180 *(240)*	180 *(240)*	*	*	*	*
40 *(29.8)*	—	—	300 *(400)*	300 *(400)*	300 *(400)*	180 *(240)*	*	*	*	*
50 *(37.3)*	—	—	—	—	300 *(400)*	300 *(400)*	*	*	*	*
60 *(44.7)*	—	—	—	—	300 *(400)*	300 *(400)*	*	*	*	*

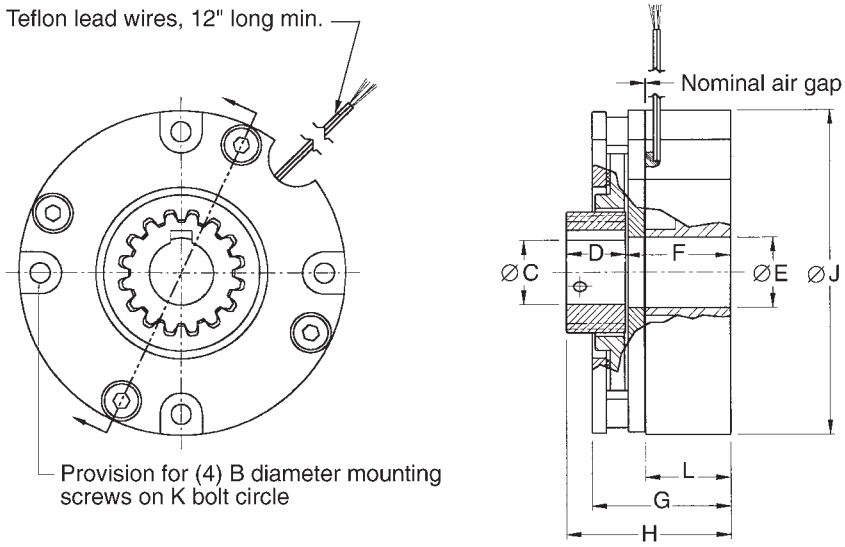
* Exceeds maximum speed rating.

Series 310



- *Torque: 10 to 350 lb-in (1.1 to 39.5 Nm)*
- *UL Recognized Class H coil insulation system to US Standards (UR) and Canadian National Standards (CUR) - File E125303*
- *Spring activated and DC voltage released*
- *High torque, Compact size*
- *Corrosion resistant finishes*
- *Standard voltages 24 and 90 Vdc 115 and 230 Vac*
- *Available voltages 12, 36, 48 and 180 Vdc*
- *Low inertia rotating parts*
- *Splined hub for quiet dependable operation*
- *Holding applications only*
- *Installation and Service Instructions: P/N 8-078-888-00*

Option A, Long Hub



Dimensional Data

Size	Model Number	Mounting Screw		ØC Maximum	D Hub Lengths	E	Hub Location	G	H Overall	J	L Mounting Screw thru Mag. Body
		B	K				F				
1.79	310-24010	#2 *(M2)*	Ø1.640 *(41.656)*	5/16 *(8mm)*	.406 *(10.31)*	.560 *(14.22)*	.914 *(23.22)*	1.185 *(30.10)*	1.320 *(33.53)*	1.79 *(45.47)*	.354 (9)
	310-25010							1.325 *(33.66)*	1.470 *(37.34)*		
2.0	310-34010	#6 *(M3)*	Ø1.770 *(44.958)*	5/16 *(8mm)*	.406 *(10.31)*	.425 *(10.80)*	.969 *(24.62)*	1.190 *(30.23)*	1.375 *(34.93)*	2.00 *(50.80)*	.845 (21.5)
2.87	310-44010	#8 *(M4)*	Ø2.500 *(63.500)*	5/8 *(15mm)*	.520 *(13.21)*	.625 *(15.88)*	.927 *(20.55)*	1.220 *(30.99)*	1.447 *(36.75)*	2.87 *(72.89)*	.750 (19)
3.35	310-54010	#10 *(M5)*	Ø2.913 *(73.990)*	5/8 *(15mm)*	.700 *(17.78)*	1.125 *(28.58)*	1.213 *(30.81)*	1.630 *(41.40)*	1.913 *(48.59)*	3.35 *(85.09)*	1.086 (27.6)
4.25	310-64010	1/4 *(M6)*	Ø3.750 *(95.250)*	7/8 *(22mm)*	.700 *(17.78)*	1.500 *(38.10)*	1.336 *(33.93)*	1.752 *(44.50)*	2.036 *(51.7)*	4.25 *(107.95)*	1.085 (27.6)
5.0	310-74010	1/4 *(M6)*	Ø4.500 *(114.300)*	15/16 *(24mm)*	.800 *(20.32)*	1.750 *(44.45)*	1.387 *(35.23)*	1.905 *(48.39)*	2.187 *(55.55)*	5.00 *(127.00)*	1.062 (27)

Series 310 Continued

Engineering Specifications/Pricing (Discount Symbol R1)

Size	Part Number	Nominal Static Torque		Friction Material Type	Approximate Weight		Electric Power (watts)	Hub and Disc Inertia		List Price
		lb-in	*Nm*		lbs	*kg*		lb-in-sec²	*kg-cm-sec²*	
1.79	310-24010-XX-XX	10	*1.13*	Holding	.5	*0.23*	13	1.7275E-05	*1.9876E-05*	$492.00
	310-25010-XX-XX	13	*1.47*							$532.00
2.0	310-34010-XX-XX	18	*2.03*	Holding	.7	*.32*	17	1.6150E-05	*1.8582E-05*	$588.00
2.87	310-44010-XX-XX	40	*4.52*	Holding	1.5	*.68*	17	1.1150E-04	*1.2829E-04*	$656.00
3.35	310-54010-XX-XX	140	*15.8*	Holding	3	*1.36*	22	1.6047E-04	*1.8464E-04*	$794.00
4.25	310-64010-XX-XX	200	*22.5*	Holding	4.5	*2.04*	26	6.4099E-04	*7.3751E-04*	$948.00
5.0	310-74010-XX-XX	350	*39.5*	Holding	6.6	*2.99*	19	1.9996E-03	*2.3007E-03*	$1,240.00

Ordering Information

310-2401 0-0H-JA

- Group "3" Armature Acting Brake
- 3-10: For AAB-S Models
- 4=Standard Torque, 3= Reduced Torque
- Options – **TABLE 3**
- Voltages – **TABLE 2**
- Hub bore and Keyseat – **TABLE 1**

AAB-S Unit Sizes	Part Number
1.79	2
2.0	3
2.87	4
3.35	5
4.25	6
5.0	7

Character	Options	Available by size
0	standard brake	ALL
H	Quiet operation, plastic carrier disc	1.79, 2.0, 2.87, 3.35*, 4.25*

*With carrier disc option, size 3.35 torque is 50 lb-in holding, and size 4.25 torque is 100 lb-in holding

Numeral or Letter	Options
1	Standard Unit

Numeral	Enclosure type
0	None

Table 1: hub bores 310-24010 - ☐☐ -JA

Character to insert	Bore +001/.001	Keyway Size		Bores Available (Size)					
		Width inches	Depth inches	1.79	2.0	2.87	3.35	4.25	5.0
0D	1/4	1/16	1/32	X	X				
0F	5/16	1/16	1/32	X	X				
0H	3/8	3/32	3/64	X	X	X			
0J	1/2	1/8	1/16			X	X		
0L	5/8	3/16	3/32			X	X	X	X
0N	3/4	3/16	3/32					X	X
0O	7/8	3/16	3/32					X	X
0P	15/16	1/4	1/8						X
	Metric	*mm*	*mm*						
06	6	2	1	X	X				
07	7	2	1	X	X				
08	8	2	1	X	X				
09	9	3	1.4			X			
10	10	3	1.4			X			
11	11	4	1.8			X			
12	12	4	1.8			X			
14	14	5	2.3			X	X	X	
15	15	5	2.3			X	X	X	
17	17	5	2.3					X	X
18	18	6	2.8					X	X
19	19	6	2.8					X	X
20	20	6	2.8					X	X
22	22	6	2.8					X	X
23	23	8	3.3						X
24	24	8	3.3						X

NOTE: Non-standard bore sizes available, contact factory. Add $60.00 for non-standard bore size.

Table 2:
Coil Voltage 310-2401-0H-☐A

Character to insert	Voltage	List Adder	Current Rating in amps					
			1.79	2.0	2.87	3.35	4.25	5.0
C	*12 Vdc	$40.00	1.01	1.10	1.29	1.82	1.76	1.26
E	24 Vdc	—	.51	.55	.66	.93	.89	.64
G	*48 Vdc	40.00	.27	.29	.35	.46	.54	.40
J	90 Vdc	—	.13	.14	.16	.23	.22	.16
L	*180 Vdc	40.00	.08	.09	.09	.13	.14	.11
N	115 Vac	30.00	.11	.16	.16	.17	.25	.17
P	230 Vac	30.00	.06	.08	.08	.09	.13	.09

*These voltages are non-standard. Add $40.00 for non-standard coil voltage.

Table 3:
Options 310-24010-0H-J☐

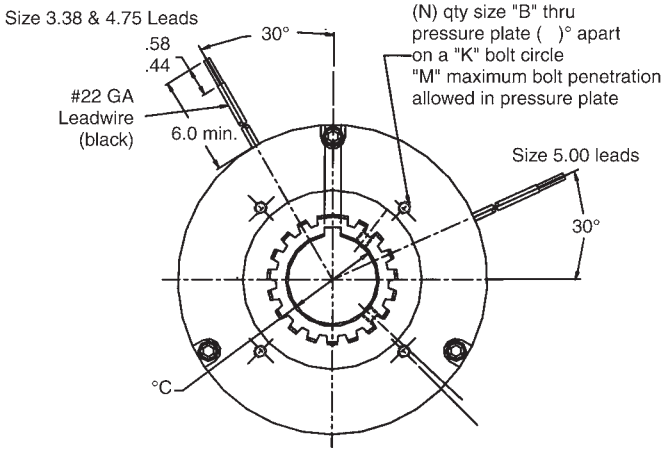
Character	Options	Available by size
A	Basic Brake, Magnet Body Mounted, Long Hub	1.79, 2.0, 2.87, 3.35* 4.25*, 5.0*

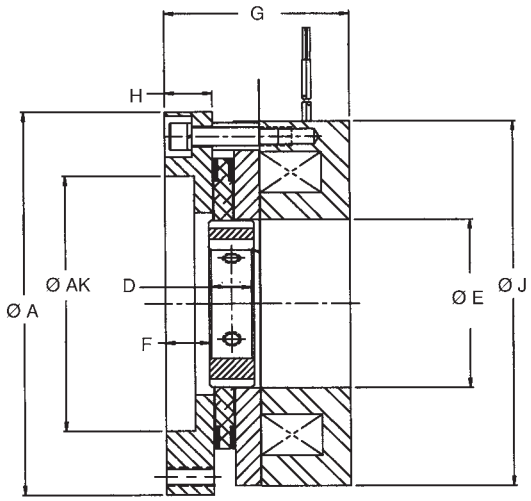
*Sizes 3.35, 4.25 and 5.0 have a pass-through hub.

Series 311



- *Torque: 75 to 400 lb-in (8.5 to 45.2 Nm)*
- *UL Recognized Class H coil insulation system to US Standards (UR) and Canadian National Standards (CUR) - File E125303*
- *Spring activated and DC voltage released*
- *Corrosion resistant finishes*
- *Standard voltages 24 and 90 Vdc*
- *Available voltages 12, 36, 48 and 180 Vdc*
- *Low inertia rotating parts*
- *Splined hub for quiet dependable operation*
- *Holding applications only*
- *Installation and Service Instructions: P/N 8-078-888-00*





Dimensions in Inches (*mm*)

Size	Model Number	K	N	B	A	AK	ØC Maximum	D Hub Lengths	E	Hub Location F	G	H	J	M
3.38	311-54010	2.500 *(63.500)*	Qty. 2 (180°) apart	#10-24 UNC	3.375 *(85.725)*	-	1.125	1.00 *(25.4)*	1.713 *(43.51)*	.30 *(7.620)*	1.999 *(50.775)*	.383 *(9.728)*	3.380 *(85.852)*	.360 *(9.144)*
4.75	311-64010	3.125 *(79.375)*	Qty. 4 (90°) apart	#10-32 UNF	4.750 *(120.650)*	2.750 *(69.850)*	1.375	.562 *(14.27)*	2.350 *(59.690)*	.16 *(4.064)*	2.310 *(58.670)*	.493 *(12.522)*	4.750 *(120.65)*	.465 *(11.811)*
5.00	311-74010	4.750 *(120.650)*	Qty. 6 (60°) apart	1/4-20 UNC	5.250 *(133.35)*	3.500 *(88.900)*	1.500	.620 *(15.75)*	2.312 *(58.725)*	.60 *(15.240)*	2.540 *(64.516)*	.656 *(16.662)*	5.00 *(127.00)*	.625 *(15.875)*

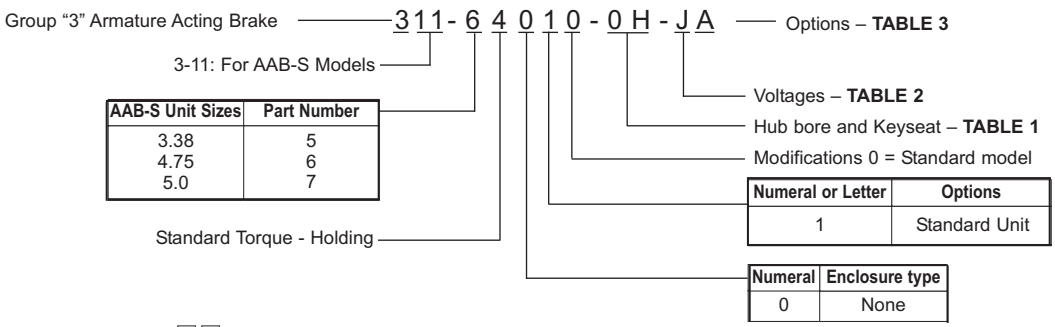
NOTE: Mounting bolt circles, mounting hole thread sizes, and quantity of mounting holes can be changed to meet your requirements. Please contact factory to request mounting dimensions other than those shown here

Series 311 Continued

Engineering Specifications/Pricing (Discount Symbol R1)

Size	Part Number	Nominal Static Torque		Friction Material Type	Approximate Weight		Electric Power (watts)	Hub and Disc Inertia		List Price
		lb-in	*Nm*		lbs	*kg*		lb-in-sec²	kg-cm-sec²	
3.38	311-54010-XX-XX	75	*8.5*	holding	2.75	*1.25*	25	5.2 E-04	*5.99E-04*	$872.00
4.75	311-64010-XX-XX	120	*13.6*	holding	7.00	*3.18*	30	1.48E-03	*1.71E-03*	1,040.00
5.0	311-74010-XX-XX	400	*45.2*	holding	8.75	*3.97*	30	1.87E-03	*2.16E-03*	1,364.00

Ordering Information



AAB-S Unit Sizes	Part Number
3.38	5
4.75	6
5.0	7

Numeral or Letter	Options
1	Standard Unit

Numeral	Enclosure type
0	None

Table 1: hub bores 311-64010 - ☐☐ -JA

Character to insert	Bore +001/.001	Keyway Size*		Bores Available (Size)		
		Width inches	Depth inches	3.38	4.75	5.0
0B	5/8	3/16	3/32	X	X	
0D	7/8	3/16	3/32	X	X	X
0E	1-1/8	1/4	1/8	X	X	X
0G	1-3/8	1/4	1/8		X	X
0M	1-1/2	1/4	1/8			X
	Metric	*mm*	*mm*			
12	12	4	1.8	X		
14	14	5	2.3	X	X	
15	15	5	2.3	X	X	
17	17	5	2.3	X	X	
18	18	6	2.8	X	X	
19	19	6	2.8	X	X	
20	20	6	2.8	X	X	
22	22	6	2.8	X	X	X
23	23	8	3.3	X	X	X
24	24	8	3.3	X	X	X
25	25	8	3.3	X	X	X
26	26	8	3.3	X	X	X
28	28	8	3.3	X	X	X
30	30	8	3.3		X	X
32	32	10	3.3		X	X
34	34	10	3.3		X	X
35	35	10	3.3			X
36	36	10	3.3			X
38	38	10	3.3			X

NOTE: Non-standard bore sizes available, contact factory.
Add $60.00 for non-standard bore size.
*Keyseats made to ANSI B17.1 standard.

Table 2:
Coil Voltage 311-6401-0H-☐A

Character to insert	Voltage	List Adder
C	*12 Vdc	$40.00
E	24 Vdc	—
G	*48 Vdc	40.00
J	90 Vdc	—
L	*180 Vdc	40.00

*These voltages are non-standard. Add $40.00 for non-standard coil voltage.

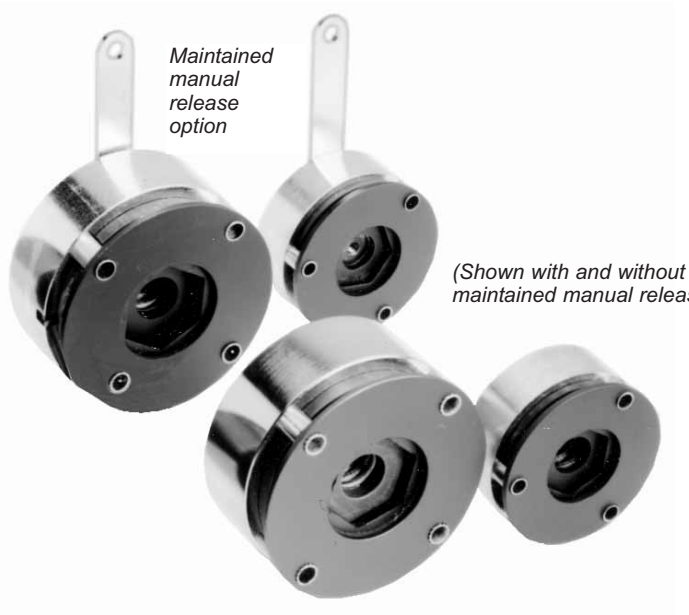
Table 3:
Options 311-64010-0H-J☐

Character	Options
A	Basic Brake, Endplate Mounted, Long Hub*

* Pass-through hub

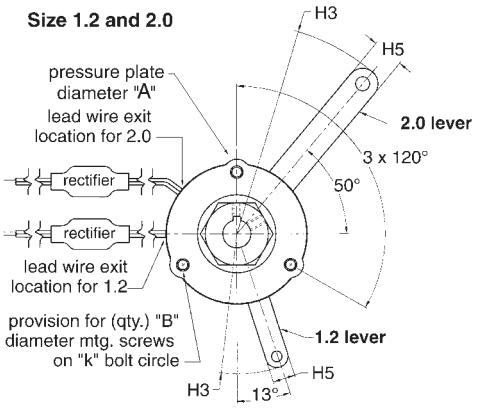
Series 320 Armature Actuated Brakes

BACK TO TABLE OF CONTENTS

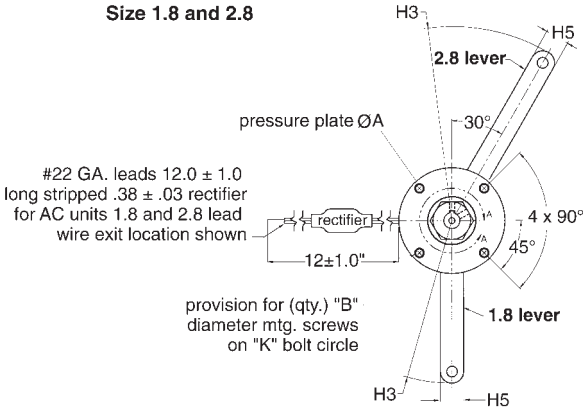


- *Torque rating 3 to 50 lb-in / (.34 to 5.6 NM)*
- *UR and CUR Recognized insulation system, E-125303 and sizes 1.8, 2.8 brakes with internal power supply File E-71115*
  Class B temperature rise with Class H mag wire
- *Available with two types of friction disc for holding (H) or dynamic (D) stopping applications*
- *Corrosion resistance*
- *Optional "double D" friction discs are available in 3-7 lb-in dynamic and 3-15 lb-in holding brakes. DD shafts fit the brake directly without a brake hub, no shaft keyway cost and simplify assembly*
- *Optional maintained manual release*
- *Optional mounting plates to make conversion over to the superior Stearns product easy*
- *Optional AC Rectifiers - internal or external in-line*
- *Optional band seal (not available for 1.2 size)*
- *Installation and Service Instructions: P/N 8-078-889-00*

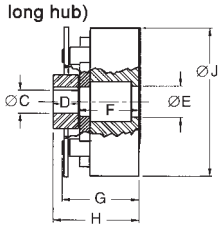
Size 1.2 and 2.0

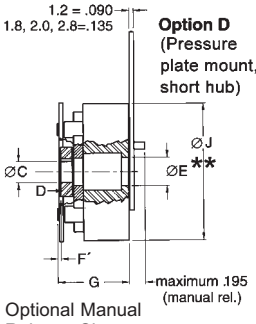


Size 1.8 and 2.8

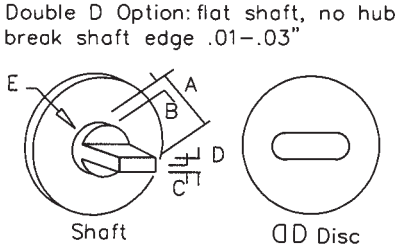


Option A
(magnet body mount, long hub)





Optional Manual Release Shown



Brake Size	A	B
1.2	.25 + .05/-.00	.075 max.
1.8	.30 + .13/-.00	.075 max.

Shaft Size	C	D	E
5/16	.052	.105 /.103	.3135 /.3115
3/8	.063	.126 /.124	.376 /.374

Dimensional Data

Size	Model Number	Mounting Screw Qty.	Mounting Screw B	Mounting Screw K	Maximum Shaft Length (Manual Release Units)		Hub Location F	Hub Location F`	E**	G	H Long Hub	H3	H5	J	D Hub Lengths Long	D Hub Lengths Short	A
1.2D *1.2H*	3-20-2401G *3-20-2501G*	3	Ø.140 *#4, #6 (M3)*	Ø1.545 *(39.243)*	.300	*(7.62)*	.685 *(17.40)* .860 *(21.84)*	.015 *(.381)*	.410 *(10.41)*	.890 *(22.60)* 1.065 *(27.05)*	1.065 *(27.05)* 1.240 *(31.50)*	2.5 *(63.5)*	.40 *(10.16)*	1.77 *(44.96)*	.38 *(9.65)*	.19 *(4.83)*	1.925 *(48.90)*
1.8D *1.8H*	3-20-4401G *3-20-4501G*	4	Ø.177 *#6 (M3.5)*	Ø2.125 *(53.975)*	.430	*(10.92)*	.995 *(25.27)*	.015 *(.381)*	.450 *(11.43)*	1.260 *(32.00)*	1.405 *(35.69)*	3.775 *(95.885)*	.55 *(10.16)*	2.43 *(61.72)*	.410 *(10.41)*	.25 *(6.35)*	2.55 *(64.77)*
2.0D *2.0H*	3-20-5401G *3-20-5501G*	3	Ø.145 *#6 (M3)*	Ø2.220 *(56.388)*	.430	*(10.92)*	.933 *(23.70)*	.015 *(.381)*	.530 *(13.46)*	1.190 *(30.23)*	1.623 *(41.22)*	3.775 *(95.885)*	.55 *(10.16)*	2.50 *(63.5)*	.69 *(17.53)*	.31 *(7.87)*	2.50 *(63.50)*
2.8D *2.8H*	3-20-7401G *3-20-7501G*	4	Ø.188 *#8 (M4)*	Ø2.844 *(72.738)*	.490	*(12.45)*	.954 *(24.23)*	.050* *(1.27)*	1.10 *(27.94)*	1.415 *(35.94)*	1.364 *(34.64)*	4.5 *(95.885)*	.55 *(10.16)*	3.25 *(82.55)*	.410 *(10.41)*	*	3.32 *(84.33)*

*Size 2.8 can be pressure plate mounted using the long hub. The F` dimension shown for size 2.8 is for pressure plate mount using the long hub.
** No thru bore with manual release option.

Series 320 Continued

Engineering Specifications/Pricing (Discount Symbol R2)

Size	Part Number	Nominal Static Torque		Friction Material	Approx Weight		Electric Power	Hub and Disc Inertia	Thermal Capacity	Maximum Bore		List Price Vdc		Options List Price Adders			
												Std Brake	With manual Release	Double "D" friction disc	Carrier ring friction disc	Brake release indicator	Band seal
		lb-in	*Nm*	Type	lbs	*kg*	(watts)	oz-in-sec^2	HP-sec/min	in	*mm*						
1.2D	3-20-2401G-XX-XX	3	*.34*	Dynamic	.4	*.181*	7	7.02 x 10^{-5}	Consult Factory	3/8	*9*	$180	$230	No charge	$20	$80	N/A
1.2H①	3-20-2501G-XX-XX	5①	*.56*	Holding①	.4	*.181*	9	7.02 x 10^{-5}		3/8	*9*	190	240	No charge	Not available	80	N/A
1.8D	3-20-4401G-XX-XX	7	*.79*	Dynamic	1.1	*.499*	10	4.8 x 10^{-4}	.26	1/2②	*12*	200	260	No charge	20	80	$16
1.8H①	3-20-4501G-XX-XX	15①	*1.69*	Holding①	1.1	*.499*	10	4.8 x 10^{-4}		1/2②	*12*	230	290	No charge	20	80	16
1.8D	3-20-4601G-XX-XX	15	*1.69*	Dynamic	1.1	*.499*	10	4.8 x 10^{-4}		1/2②	*12*	250	310	Not available	Not available	80	16
2.0D	3-20-5401G-XX-XX	18	*2.03*	Dynamic	1.2	*.544*	12.5	2.23 x 10^{-3}	.32	1/2	*12*	230	290	Not available	20	80	16
2.0H①	3-20-5501G-XX-XX	30①	*3.39*	Holding①	1.2	*.544*	12.5	2.23 x 10^{-3}		1/2	*12*	270	330	Not available	20	80	16
2.8D	3-20-7401G-XX-XX	35	*3.95*	Dynamic	2.0	*.91*	17	2.3 x 10^{-3}	.17	1/2②	*12*	310	370	Not available	20	80	22
2.8H①	3-20-7501G-XX-XX	50①	*5.65*	Holding①	2.0	*.91*	17	2.3 x 10^{-3}		1/2②	*12*	350	410	Not available	Not available	80	22

①For holding applications only. ②Set Screws located 120° from keyway.

Ordering Information

Group "3" Armature Acting Brake. — 320- 4 4 0 1 G - 0 H - J D — Options – **Table 3**

320 = For AAB-R Models

Voltages – **Table 2**

Hub bore and Keyway – **Table 1**
For Double "D" Bores See **Table 1A**

AAB-R Unit Sizes	Part Number
1.2	2
1.8	4
2.0	5
2.8	7

Character		Nominal Static Torque (lb-in)	List Adder
Size 1.2	4	3 Dynamic	---
	5	5 Holding	---
Size 1.8	4	7 Dynamic	---
	6	15 Dynamic	$20.00
	9	9 Dynamic	$10.00
	5	15 Holding	---
Size 2.0	4	18 Dynamic	---
	5	30 Holding	---
	3	15 Dynamic	---
	6	25 Holding	---
	7	7 Dynamic	---
Size 2.8	4	35 Dynamic	---
	5	50 Holding	---

Characters to insert	Modification
E	Brake release indicator (NC)
F	Brake release indicator (NO)
G	Standard - GGA Friction Material
J	CCW manual release rotation
S	Carrier ring friction disc

Numeral or Letter	Options
1	Standard Unit
A-Z	Reserved for Mounting Plates

Numeral	Enclosure type
0	None
2	Band seal

Table 1: 320-44010 - ☐☐ -JD

Characters to insert	Bore	Keyway Size*		Bores Available			
		Width (in.) x Depth (in.)		Mag Body Size			
				1.2	1.8	2.0	2.8
0A	3/16	N/A	N/A	X			
0B	3/16	1/16	1/32		X		
0C	1/4	N/A	N/A	X			
0D	1/4	1/16	1/32		X	X	X
0E	5/16	N/A	N/A	X			
0F	5/16	1/16	1/32		X	X	X
0G	3/8	N/A	N/A	X			
0H	3/8	3/32	3/64		X	X	X
0J	1/2	1/8	1/16		①	①	①
05	5	*2 mm*	*1 mm*	②	X	X	X
06	6	*2 mm*	*1 mm*	②	X	X	X
07	7	*2 mm*	*1 mm*	②	X	X	X
08	8	*2 mm*	*1 mm*	②	X	X	X
09	9	*3 mm*	*1.4 mm*	②	X	X	X
10	10	*3 mm*	*1.4 mm*		X	X	X
11	11	*4 mm*	*1.8 mm*		X	X	X
12	12	*4 mm*	*1.8 mm*		X	X	X

NOTE: For non-standard bores add $64.00.

① Set screws located 120° from keyway.

② Hubs are provided without keyway.

***Keyseats made to ANSI B17.1 standard.**

Table 1A: 320-44010 - ☐☐ -JX
(Double "D" Bores)

Characters to insert	Bore	Bores Available	
		Mag Body Size	
		1.2	1.8H
0F	5/16	X	X
0H	3/8	X	X

NOTE: Can be used up to 15 lb-in for holding.

Table 2: 320-44010-0H-☐D
Standard Coil Voltage

Character to Insert	Voltage	List Adder*	Current Rating in Amps			
			Size 1.2	Size 1.8	Size 2.0	Size 2.8
C	12 Vdc	-	.632	.826	1.04	1.37
E	24 Vdc	-	.307	.421	.53	.70
G	48 Vdc	-	.158	.216	.27	.36
J	90 Vdc	-	.076	.123	.13	.17
K	103 Vdc	-	.085	.115	.121	.140
L	180 Vdc	-	.039	.060	.069	.09
N	115 Vac	$50.00	.085	.115	.140	.140
P	230 Vac	$50.00	.044	.059	.075	.097
Z	115/230 Vac	$50.00	.085/.044	.115/.059	.140/.075	.140/.097

NOTE: Add $40.00 for non-standard coil voltage
***For external in-line rectifier**
(for internal rectifier, add $30.00 list)

NOTE: 65°C maximum ambient temperature for all external in-line rectifiers

Table 3:
Options 320-44010-0H-J☐

Characters	Options
A	Basic Brake, Magnet Body Mounted, Long Hub
D*	Basic Brake, Pressure Plate Mounted, Short Hub*
G*	Short Hub, Pressure Plate Mounted with Maintained Manual Release*
H	Long Hub with Maintained Manual Release, Size 2.8 Only
X	Double "D" Friction Disc, 1.2H, 1.2D, 1.8H
Y	Option X with Maintained Manual Release Pressure Plate Mounted

*Short hub not required for size 2.8 pressure plate mount.

NOTE: *Final part number may change due to specifications or options selected or other product design considerations. A number such as a 2, 3, 4 etc., in the 12th position is used to designate a unique brake (custom) and can only be assigned by Stearns Design Engineering Department.*

Modifications are available - see AAB Modification Section.

Series 321 & Series 322 Armature Actuated Brakes

BACK TO TABLE OF CONTENTS



Shown: Size 2.8 with thru-shaft & manual release options

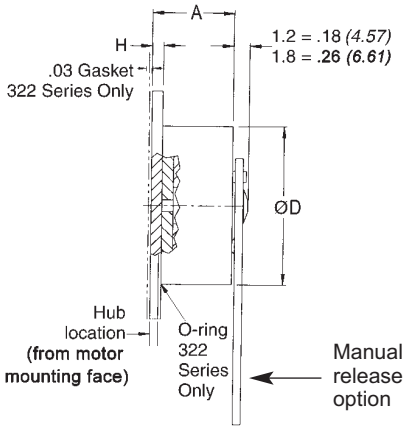


Shown: Size 1.8 flange mount with manual release option

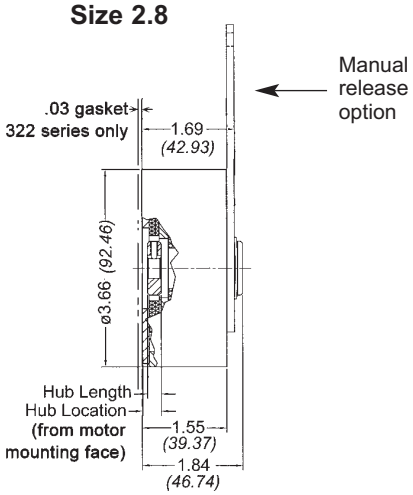
Totally Enclosed Non-Ventilated (TENV) Direct-Acting Brake - Quiet Operation

- ***Torque Rating:*** *3 lb-in through 72 lb-in*
- ***Enclosure Rating:*** *321 Series IP42 322 Series IP54*
- *UR and CUR recognized insulation system - File E-125303; and sizes 1.8 & 2.8 brakes and 48C & 56C motor frame brakes with internal power supply File E-71115*
- *Class B temperature rise with Class H mag wire*
- *Pressure plate mount*
- *Installation and Service Instructions: P/N 8-078-901-00*
- ***Optional:*** *Optional "double D" friction discs are available in 3-7 lb-in dynamic and 3-15 lb-in holding brakes. DD shafts fit the brake directly without a brake hub, no shaft keyway cost and simplify assembly*
- ***Optional:*** *Maintained manual release lever, or non-maintained pull release*
- ***Optional:*** *Through-shaft*
- ***Optional:*** *AC Rectifiers - Internal, or external in-line (availability depends on size)*

Size 1.2 and 1.8



Size 2.8



Dimensions in Inches *(millimeters)*

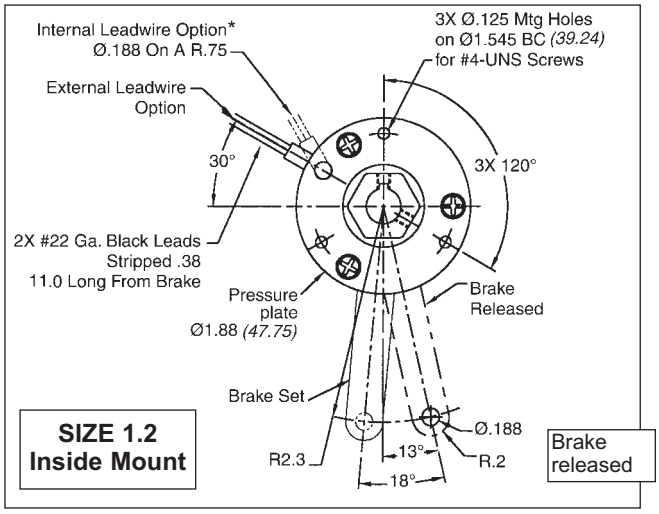
Size	Nominal Static Torque		Basic Model Number	A	H	D		Hub Location	Hub Length
	Lb-in	*Nm*				Series	Mag Body Ø		
1.2 Dynamic	3	*.34*	3-21-24	.904 *(22.962)*	.12 *(3.05)*	321	1.77 *(44.96)*	.02 *(.51)*	.19 *(4.83)*
			3-22-24			322	1.875 *(47.625)*	.05 *(1.27)*	
1.2 Holding	5	*.56*	3-21-25	1.080 *(27.432)*		321	1.77 *(44.96)*	.02 *(.51)*	
			3-22-25			322	1.875 *(47.625)*	.05 *(1.27)*	
1.8 Dynamic	7	*.79*	3-21-44	1.296 *(32.918)*	.12 *(3.05)*	321	2.50 *(63.50)*	.02 *(.51)*	.25 *(6.35)*
			3-22-44			322		.05 *(1.27)*	
1.8 Holding	15	*1.69*	3-21-45			321		.02 *(.51)*	
			3-22-45			322		.05 *(1.27)*	
1.8 Dynamic	15	*1.69*	3-21-46			321		.02 *(.51)*	
			3-22-46			322		.05 *(1.27)*	
2.8 Dynamic	35	*3.95*	3-21-74	–	–	321	3.66 *(92.96)*	.100 *(2.54)*	.25 *(6.35)*
			3-22-74			322		.125 *(3.18)*	
2.8 Dynamic	50	*5.65*	3-21-75	–	–	321	3.66 *(92.96)*	.100 *(2.54)*	.25 *(6.35)*
			3-22-75			322		.125 *(3.18)*	
2.8 Holding	72	*8.14*	3-21-77	–	–	321	3.66 *(92.96)*	.100 *(2.54)*	.25 *(6.35)*
			3-22-77			322		.125 *(3.18)*	

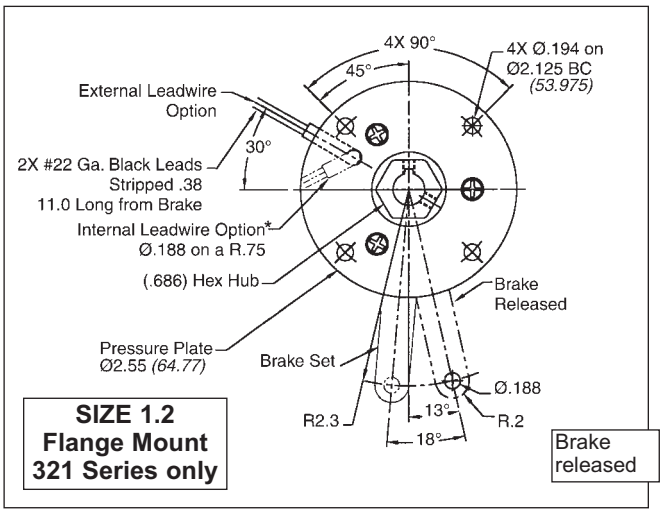
Specifications

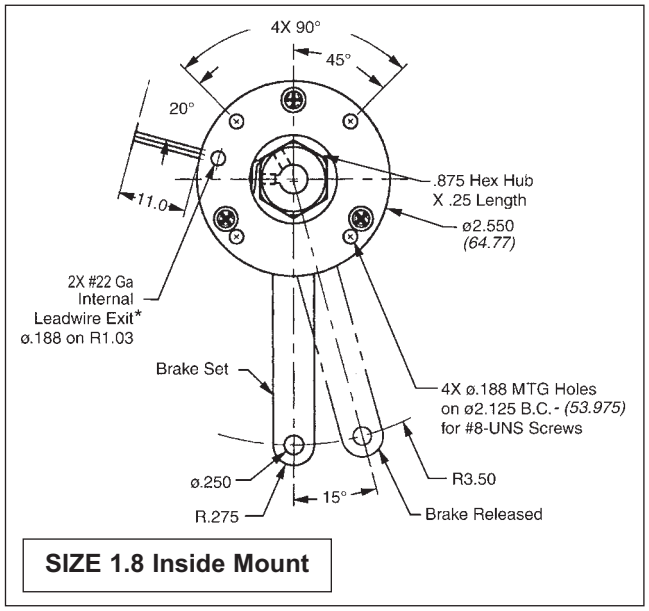
Size	Basic Model Number	Nominal Static Torque Lb-in (*Nm*)	Approx. Weight		Power (watts)	Hub and Disc inertia (Oz-in-sec^2)	Thermal Capacity HP-sec/min	Maximum Bore Size	
			lbs	*kg*				in	*mm*
1.2 Dynamic	3-2X-24	3 (*.34*)	.4	*.18*	7	7.02 x 10^{-3}	Consult Factory	3/8	*9*
1.2 Holding	3-2X-25	5 (*.56*)			9				
1.8 Dynamic	3-2X-44	7 (*.79*)	1.3	*.59*	10	4.8 x 10^{-4}	.26	1/2**	*12***
1.8 Holding	3-2X-45	15 (*1.69*)							
1.8 Dynamic	3-2X-46	15 (*1.69*)							
2.8 Dynamic	3-2X-74	35 (*3.95*)	2.0	*.91*	17	2.3 x 10^{-3}	.17	1/2	*12*
2.8 Dynamic	3-2X-75	50 (*5.65*)	2.0	*.91*	17	2.3 x 10^{-3}		1/2	*12*
2.8 Holding	3-2X-77	72 (*8.14*)	2.0	*.91*	22	2.3 x 10^{-3}		1/2	*12*

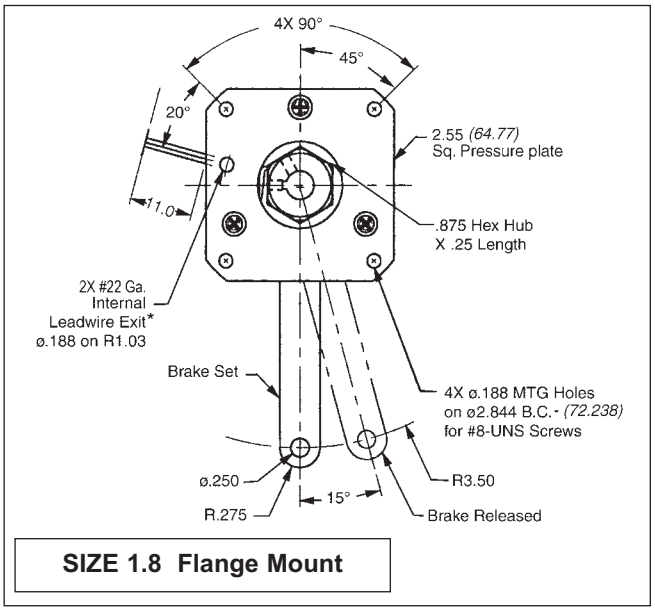
**Set screws located 120° from keyway

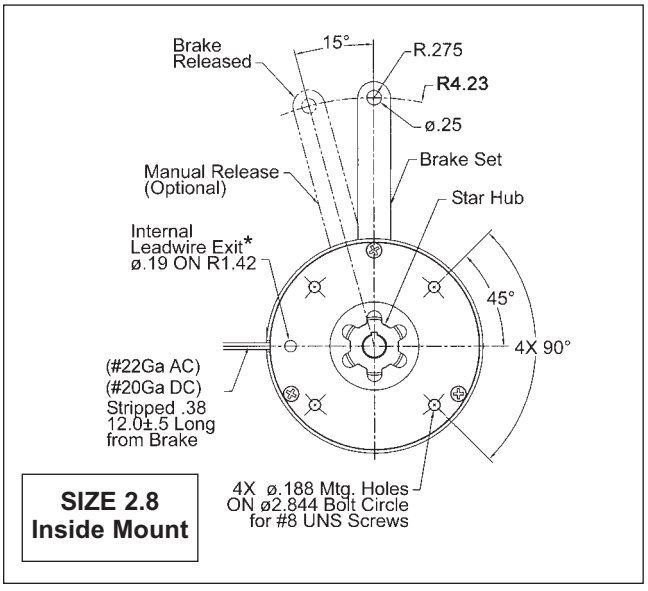
Series 321 & Series 322 Continued

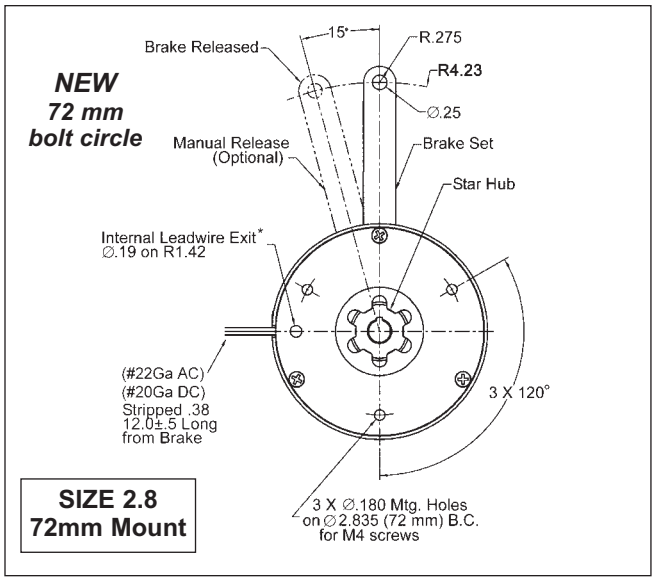










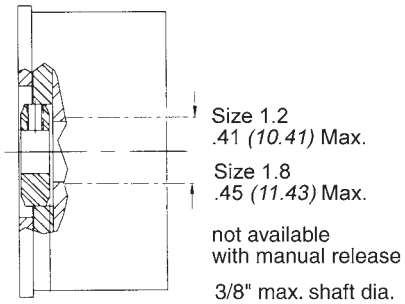


*Also the location for the external lead (on the backside of magnet body) for Series 322 *only.*

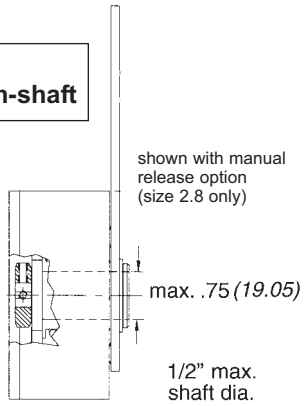
Series 321 & Series 322 Continued Options

THROUGH-SHAFT OPTION

SIZE 1.2 & 1.8
Optional through-shaft - No manual release option



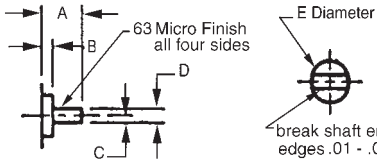
SIZE 2.8
Optional through-shaft



DOUBLE - D DISC OPTION



Double "D" Option





Hubless option with flatted shaft double "D" friction disc

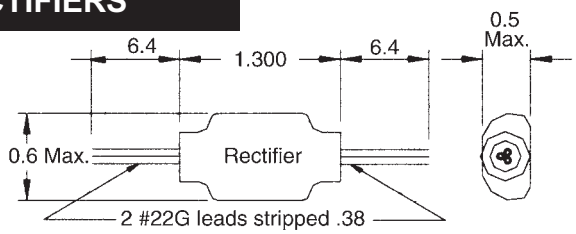
Brake Size	A	B
1.2	.25 + .05/-.00	.075 max.
1.8	.30 + .13/-.00	.075 max.

Shaft Size	C	D	E
5/16	.052	.105 /.103	.3135 /.3115
3/8	.063	.126 /.124	.376 /.374

NOTE: Contact factory for Double "D" disc on brakes greater than 7 lb-in nominal static torque

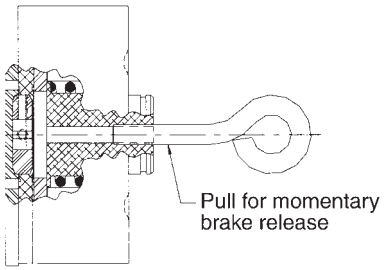
AC RECTIFIERS

External In-line (as shown) or Internal



Internal rectifier is available only on the 1.8 and 2.8 models. external in-line rectifier is a standard option only on the 1.2 model.

NON-MAINTAINED MANUAL RELEASE



BRAKE RELEASE INDICATOR

A mechanical switch which is activated by the manual release lever, and can be used to disconnect power in case of accidental start-up when the brake is manually released.



Series 321 & Series 322 Continued

Pricing (Discount Symbol R2)

Size	321 Series Model External leads*		321 Series List Price DC		322 Series Model External Leads*		322 Series List Price DC		Options List Price Adders			
	Mounting		Standard Brake	With manual release	Mounting		Standard Brake	With manual release	Double "D" disc	Carrier ring disc	Release indicator switch	Through-shaft
	Inside***	Flange			Inside***	Flange						
1.2 Dynamic	3-21-2401G	3-21-2403G	$190	$240	3-22-2401G	N/A**	$210	$260	N/C**	$20	$80	$10
1.2 Holding	3-21-2501G	3-21-2503G	200	250	3-22-2501G	N/A**	220	270	N/C**	N/A	80	10
1.8 Dynamic	3-21-4401G	3-21-440DG	220	280	3-22-4401G	3-22-440DG	242	302	N/C**	20	80	10
1.8 Holding	3-21-4501G	3-21-450DG	250	310	3-22-4501G	3-22-450DG	276	336	N/C**	20	80	10
1.8 Dynamic	3-21-4601G	3-21-460DG	270	325	3-22-4601G	3-22-460DG	296	356	N/A**	N/A**	80	10
2.8 Dynamic	3-21-7401K	N/A**	340	400	3-22-7401K	N/A**	374	434	N/A**	N/A**	80	10
2.8 Dynamic	3-21-7501K	N/A**	380	440	3-22-7501K	N/A**	414	474	N/A**	N/A**	80	10
2.8 Holding	3-21-7701K	N/A**	410	470	3-22-7701K	N/A**	450	510	N/A**	N/A**	80	10
	72 mm mount				72 mm mount							
2.8 Dynamic	3-21-740MK	N/A**	$340	$400	3-22-740MK	N/A**	$374	$434	N/A**	N/A**	$80	$10
2.8 Holding	3-21-750MK	N/A**	380	440	3-22-750MK	N/A**	414	474	N/A**	N/A**	80	10

**N/C =No charge N/A =Not Available
***Mounting bolt circle inside (less than) the outside diameter of magnet body. (BC dimensions shown on page 71)

Ordering Information

Group "3" Armature Actuated Brakes
Series = 321 or 322

3-2X- X X X X X - XX- X X

Options – **Table 3**
Voltages – **Table 2**
Hub Bore and Keyway – **Table 1**
For Double "D" Bores See **Table 1A**

Character	Size
2	1.2
4	1.8
7	2.8

Size	Static Torque (lb-in)	Numeral
1.2	3 Dynamic	4
1.2	5 Holding	5
1.8	7 Dynamic	4
1.8	15 Holding	5
1.8	15 Dynamic	6
2.8	35 Dynamic	4
2.8	50 Dynamic	5
2.8	72 Holding	7

Numeral or Letter	Description	Series
0	Standard Brake External Lead Location	321, 322
A	Internal Lead Location*	321 or 322
6	External leads Thru-Shaft	321
C	Internal Leads* Thru-Shaft	321

Character	Modification
E	Brake release indicator (NC)
F	Brake release indicator (NO)
G	Standard - GGA Friction Material
J	CCW manual release rotation
K	"Star" hub and GGA disc size 2.8
S	Carrier ring friction disc size 1.8

Numeral or Letter	Mounting	Brake Size		
		1.2	1.8	2.8
1	Inside Mount	x	x	x
D	Flange Mount 2.844" Mounting Bolt Circle	x	x	
3	Flange Mount 2.125" Mounting Bolt Circle	x		
M	Body Mount 72 mm Mounting Bolt Circle			x

Table 1: Bore Size

Characters to Insert	Bore	Keyway Size* Width (in.) x Depth (in.)		Bores Available Mag Body Size 1.2	1.8	2.8
0A	3/16	no keyway		x		
0B	3/16	1/16	1/32		x	
0C	1/4	no keyway		x		
0D	1/4	1/16	1/32		x	x
0E	5/16	no keyway		x		
0F	5/16	1/16	1/32		x	x
0G	3/8	no keyway		x		
0H	3/8	3/32	3/64		x	x
0J	1/2	1/8	1/16		①	x
05	*5*	*2 mm*	*1 mm*	②	*x*	*x*
06	*6*	*2 mm*	*1 mm*	②	*x*	*x*
07	*7*	*2 mm*	*1 mm*	②	*x*	*x*
08	*8*	*2 mm*	*1 mm*	②	*x*	*x*
09	*9*	*3 mm*	*1.4 mm*	②	*x*	*x*

NOTE: For non-standard bores add $64.00.
① Set Screws located 120° from keyway
② Hubs are provided without keyway
***Keyseats made to ANSI B17.1 standard**

Table 1A:
(Double "D" Bores)

Characters to Insert	Bore
0F	5/16
0H	3/8

NOTE: Contact factory for Double "D" disc on brakes greater than 7 lb-in nominal static torque. Can be used up to 15 lb-in holding.

Table 3: Options

Characters to Insert	Options
D	Short Hub pressure plate mounted
G	Short Hub with Maintained Manual Release
X	Double "D" Friction Disc
Y	Option X with Maintained Manual Release

Manual release & thru bore size 2.8 only

Table 2: Standard Coil Voltage

Character to Insert	Voltage	List Adder	Current Rating in Amps Size 1.2	Size 1.8	Size 2.8
C	12 Vdc	-	.632	.826	1.37
E	24 Vdc	-	.307	.421	.70
G	48 Vdc	-	.158	.216	.36
J	90 Vdc	-	.076	.123	.17
K	103 Vdc	-	.090	.115	.150
L	180 Vdc	-	.051	.060	.090
N	115 Vac external in-line	$50.00	.090	N/A	N/A
P	230 Vac external in-line	$50.00	.044	N/A	N/A
T*	115 Vac Internal Rectifier	$30.00	N/A	.115	.168*
U*	230 Vac Internal Rectifier	$30.00	N/A	.059	.086*
V	115 Vac external in-line QuickSet	$80.00	.090	.115	.168
W	230 Vac external in-line QuickSet	$80.00	.044	.059	.086
Z	115/230 Vac external in-line	$50.00	.090	.115	.168

*Internal rectifier not available on size 2.8 brake with 72mm bolt circle and 1.2 brake

NOTE: Other voltages available, contact factory. Add $40.00 for non-standard voltages
NOTE: 65°C maximum ambient temperature for all external in-line rectifiers

NOTE: *Final part number may change due to specifications or options selected or other product design considerations. A number such as a 2, 3, 4 etc., in the 12th position is used to designate a unique brake (custom) and can only be assigned by Stearns Design Engineering Department.*

Modifications are available - see AAB Modification Section.

Series 321 & 322 NEMA C
Armature Actuated Brakes

High Cycling Brake



Direct mounting to 48C and 56C motors

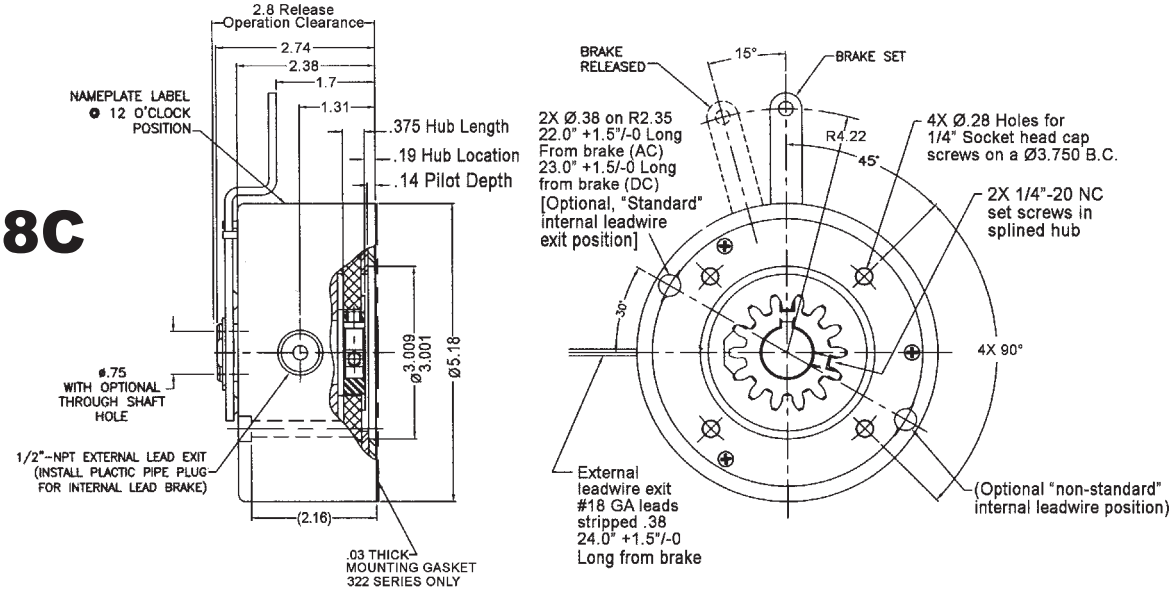
Features

- **TENV totally-enclosed non-ventilated**
  Series 321= IP42 Enclosure, Series 322 = IP54 Enclosure
- *Out-of-box torque - No burnishing required*
- *Class B temperature rise with class H mag wire*
- *Brake housing integrated with mag body creating a heat exchanger that keeps the brake coil cool*
- *Field replaceable coil*
- *Splined hub and friction disc*

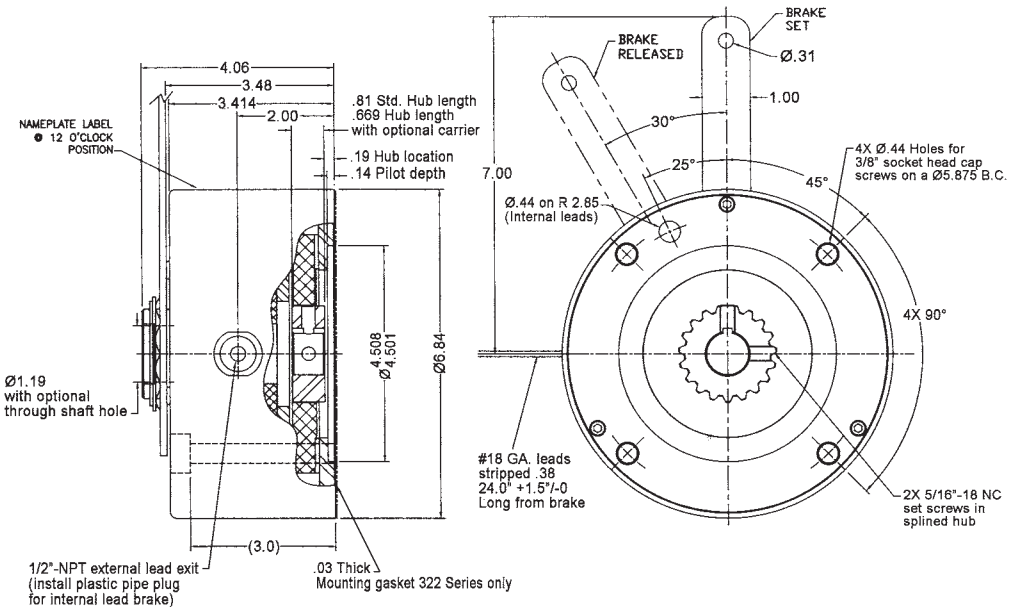
Options

- *Internal rectifier*
- *Quick-set rectifiers - for fast response time even when wired directly across motor*
- *Maintained manual release*
- *Brake release indicator switch*
- *Single point torque adjustment- to 50% of nameplate torque*
- *Through-shaft*
- *Conduit box*
- *Quiet armature actuations*
- *Carrier ring friction disc*

48C



56C



Engineering Specifications/Pricing (Discount Symbol R2)

Motor Frame	321 Series Model Number	Nominal Static Torque Lb-ft (*Nm*)	List Price		322 Series Model Number	List Price		Approx. Weight		Power (watts)	Hub and Disc inertia (Oz-in-sec^2)
			Standard Brake	With manual release		Standard Brake	With manual release	lbs	*kg*		
48C	3-21-83XF	1.5 *(2)*	$720.00	$780.00	3-22-83XF	$976.00	$1,036.00	9.5	*4.3*	20	1.2 x 10^{-2}
	3-21-84XF	3 *(4)*	720.00	780.00	3-22-84XF	976.00	1,036.00				
	3-21-85XF	6 *(8)*	764.00	824.00	3-22-85XF	1,018.00	1,078.00				
	3-21-86XF	8.3 *(11)*	794.00	854.00	3-22-86XF	1,050.00	1,110.00				
56C	3-21-93XG	3 *(4)*	$896.00	$976.00	3-22-93XG	$1,080.00	$1,160.00	23	*10.4*	31	15.5 x 10^{-2}
	3-21-94XG	6 *(8)*	1,090.00	1,170.00	3-22-94XG	1,262.00	1,342.00				
	3-21-95XG	10 *(14)*	1,266.00	1,346.00	3-22-95XG	1,428.00	1,508.00				
	3-21-96XG	15 *(20)*	1,430.00	1,510.00	3-22-96XG	1,582.00	1,662.00				
	3-21-98XG	25 *(34)*	1,642.00	1,722.00	3-22-98XG	1,780.00	1,860.00				

Ordering Information

Group "3" Armature Actuated Brakes — Series = 321 or 322

3-2X- X X X X 0 - XX- X X

Options – **Table 3**
Voltages – **Table 2**
Hub Bore and Keyway – **Table 1**

Character	NEMA frame
8	48C
9	56C

Options = 8th digit	Modification Description	List Price Adder	
		48C	56C
0	Standard brake	-	-
S	Carrier ring friction disc	$200.00	$300.00

Mounting = 7th digit	NEMA frame size
F	48C
G	56C

48C	
Torque = 5th digit	Nominal Static Torque Lb-ft *(Nm)*
3	1.5 *(2)*
4	3 *(4)*
5	6 *(8)*
6	8.3 *(11)*

56C	
Torque = 5th digit	Nominal Static Torque Lb-ft *(Nm)*
3	3 *(4)*
4	6 *(8)*
5	10 *(14)*
6	15 *(20)*
8	25 *(34)*

Lead location & options = 6th digit	Description	List Price Adder	
		48C	56C
0	External leads	-	-
6	External leads & through shaft	$344.00	$344.00
A	Internal leads	-	-
C	Internal leads & through shaft	$344.00	$344.00

Table 1: Bore Sizes

Character to insert	Bore	Keyway	Bores Available
0B	5/8	3/16 x 3/32	48C & 56C
0D	7/8	3/16 x 3/32	56C only
0K	1/2	1/8 x 1/16	48C

Other bore sizes available. Add $252.00 for non-standard bore sizes.

Table 2: Standard Coil Voltage

Character to Insert	Voltage	List Adder	Current Rating in Amps	
			48C	56C
C	12 Vdc	-	1.47	2.44
E	24 Vdc	-	.75	1.26
G	48 Vdc	-	.38	.647
J	90 Vdc	-	.23	.393
R	460 Vac Half Wave Internal	$50.00	.50	.50
V	115 Vac Internal QuickSet	$160.00	.25	.40
W	230 Vac Internal QuickSet	$160.00	.25	.40

Other voltages available. Add $188.00 for non-standard voltage.

Table 3: Options

Characters to Insert	Options
D	Standard Brake
G	With Maintained Manual Release

NOTE: *Final part number may change due to specifications or options selected or other product design considerations. A number such as a 2, 3, 4 etc., in the 12th position is used to designate a unique brake (custom) and can only be assigned by Stearns Design Engineering Department.*

Modifications are available - see AAB Modification Section.

Series 33X
Armature Actuated Brakes

Direct Replacement for European Brakes - *Kebco, Lenze, and Binder

The 33X Series have the following design features:

- *Direct Acting*
- *Torque rating 3 to 300 lb-ft (4 to 400 NM)*
- *UL Recognized Class H coil insulation system to US Standards (UR) and Canadian National Standards (CUR) - File E125303*
- *Spring-set and DC voltage released - AC rectifiers optional*
- *Series 333 torque adjustable*
- *Pre-adjusted air gap for easy assembly*
- *Corrosion resistance*
- *Spline hub for quiet dependable operation*
- *Metric and US Customary bore sizes*

Options:

- *AC rectifiers (full and half wave) See pages 86-89 for rectifier specifications*
- *Band seal (boot)*
- *Tach/encoder Mounting*
- *Manual release - Non-Maintained or Maintained*
- *Shaft seal*
- *Mounting flange*
- *Electronic brake release indicator switch*

Product Overview

333 Series



Static torque from 3 to 300 lb-ft, with nine different sizes ranging from 72mm bolt circle up to 278 mm bolt circle.

Torque can be adjusted down to approximately 50% of the nameplate torque rating.

Shown here with optional non-maintained manual release lever; other options include boot (band seal), end cap plug, through-shaft seal, and many more listed in the AAB Modification Section.

331 Series



Basic brake without the torque adjust option.

Available in torque ratings from 3 to 300 lb-ft (4 to 400 Nm).

Manual release optional, can be provided with non-maintained release lever or maintained release bolts.

Metric mount; also can be ordered with C-face adaptor or as the C-face Enclosed version, and as Severe Duty.

33X Series with C-face Adaptor



Series 331or Series 333 can be provided with a C-face adaptor for motor frames from 48C through 404/405TC, TSC, UC, USC.

All other available modifications for the 33X Series can be ordered for this brake.

33X Series Enclosed

Series 33X with a C-face adaptor and a brake housing. Order as an IP43 Enclosure with or without external manual release:

33B Series for brake without torque adjust
33C Series for brake with torque adjust

OR IP54 Enclosure with the option of internal maintained manual release:

33H Series for brake without torque adjust
33J Series for brake with torque adjust



Also Available.....

330 Series

Magnet body is not machined for a manual release option. See ordering information for the 33X Series brakes.

33X Severe Duty

Any of the 33X Series can be ordered as Severe Duty, appropriate for high-cycle rate applications. See ordering information for the 33X series brakes.

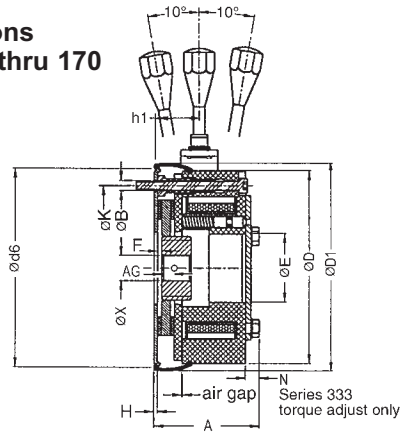
332 Series

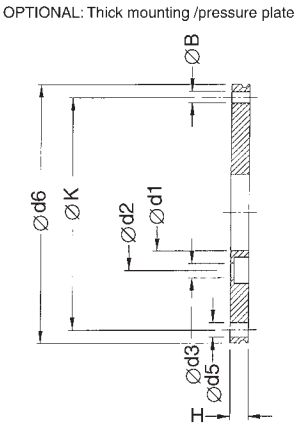
Basic brake with the torque adjust option, and the magnet body not machined for the manual release option. See ordering information for the 33X series brakes.

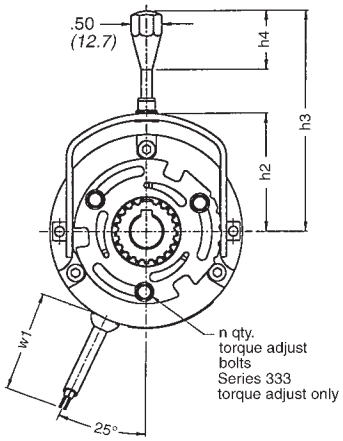
*Kebco is a Registered Trademark of Kebco, Inc. or its affiliates. Lenze is a Registered Trademark of Lenze Power Transmission or its affiliates. Binder is a Registered Trademark of Kendrion or its affiliates.

Series 331 (without torque adjust) & Series 333 (torque adjustable) Armature Actuated Brakes

Dimensions
Sizes 72 thru 170







Size	Basic Model Number	Torque lb-ft (Nm)	D1 Max	ØB	X		C Hub length	ØE	F Recommended Hub Location	AG Set screw location English bores only	A			H		D	ØK	N 333 Series only	n torque adjust bolts 333 series only
					Min. Bore	Max. Bore					Thick Plate	Thin Plate	No Plate	Thick Plate	Thin Plate				
72	33X-14010	3 *(4)*	3.56 *90.4*	*3 x M4*	3/8 *9**	9/16 *15*	0.709 *18*	1.183 *30*	0.070 *1.78*	.355 *9.02*	2.016 *51.20*	1.838 *46.68*	1.780 *45.20*	0.236 *6*	0.058 *1.47*	3.346 *85*	2.835 *72*	0.257 *6.52*	3
90	33X-24010	6 *(8)*	4.48 *113.8*	*3 x M5*	1/2 *9**	3/4 *16, 20***	0.787 *20*	1.183 *30*	0.070 *1.78*	.394 *10.01*	2.275 *57.78*	2.057 *52.24*	1.999 *50.77*	0.276 *7*	0.058 *1.47*	4.016 *102*	3.543 *90*	0.257 *6.52*	4
112	33X-34010	12 *(16)*	5.39 *136.9*	*3 x M6*	5/8 *10**	7/8 *22, 24***	0.787 *20*	1.262 *32*	0.105 *2.67*	.393 *9.98*	2.771 *70.38*	2.475 *62.86*	2.417 *61.38*	0.354 *9*	0.058 *1.47*	5.000 *127*	4.409 *112*	0.287 *7.29*	3
132	33X-44010	25 *(32)*	6.19 *157.2*	*3 x M6*	7/8 *14**	1-1/8 *25, 28***	0.984 *25*	1.380 *35*	0.105 *2.67*	.492 *12.50*	3.001 *76.23*	2.705 *68.71*	2.647 *67.23*	0.354 *9*	0.058 *1.47*	5.787 *147*	5.197 *132*	0.327 *8.30*	4
145	33X-54010	45 *(60)*	6.81 *173*	*3 x M8*	7/8 *14**	1-1/8 *30, 34***	1.181 *30*	1.577 *40*	0.130 *3.30*	.590 *14.99*	3.696 *93.88*	3.321 *84.35*	3.263 *82.88*	0.433 *11*	0.058 *1.47*	6.457 *164*	5.709 *145*	0.366 *9.30*	4
170	33X-64010	60 *(80)*	7.80 *198*	*3 x M8*	1-1/8 *15**	1-3/8 *35, 38***	1.181 *30*	1.852 *47*	0.133 *3.38*	.590 *14.99*	3.781 *96.04*	3.406 *86.51*	3.348 *85.04*	0.433 *11*	0.058 *1.47*	7.480 *190*	6.693 *170*	0.380 *9.65*	4

Size	Basic Model Number	d1	d2	d3	d5	d6	h1			h2 ①	h3 ①	h4	w1
							Thick Plate	Thin Plate	No Plate				
72	33X-14010	0.787 *20*	1.181 *30*	0.177 *4.5*	0.177 *4.5*	3.268 *83*	0.905 *23*	0.727 *18.47*	0.669 *17*	2.05 *52.1*	3.85 *97.8*	1.00 *25.4*	17.5 *444.5*
90	33X-24010	1.181 *30*	1.772 *45*	0.217 *5.5*	0.217 *5.5*	3.937 *100*	0.985 *25*	0.767 *19.48*	0.709 *18*	2.33 *59.2*	4.52 *114.8*	1.00 *25.4*	17.5 *444.5*
112	33X-34010	1.575 *40*	2.205 *56*	0.261 *6.6*	0.261 *6.6*	4.921 *125*	1.338 *34*	1.042 *26.47*	0.984 *25*	2.96 *75.2*	5.08 *129.0*	.950 *24.13*	17.5 *444.5*
132	33X-44010	1.772 *45*	2.441 *62*	0.261 *6.6*	0.261 *6.6*	5.709 *145*	1.200 *31*	0.924 *23.47*	0.866 *22*	3.35 *85.1*	5.47 *138.9*	.950 *24.13*	17.5 *444.5*
145	33X-54010	2.165 *55*	2.913 *74*	0.354 *9*	0.354 *9*	6.299 *160*	1.575 *40*	1.200 *30.48*	1.142 *29*	3.95 *100.3*	6.90 *175.3*	1.25 *31.9*	17.5 *444.5*
170	33X-64010	2.559 *65*	3.307 *84*	0.354 *9*	0.354 *9*	7.283 *185*	1.338 *34*	1.042 *26.47*	0.984 *25*	4.69 *119.1*	7.73 *196.3*	1.25 *31.9*	23.6 *600*

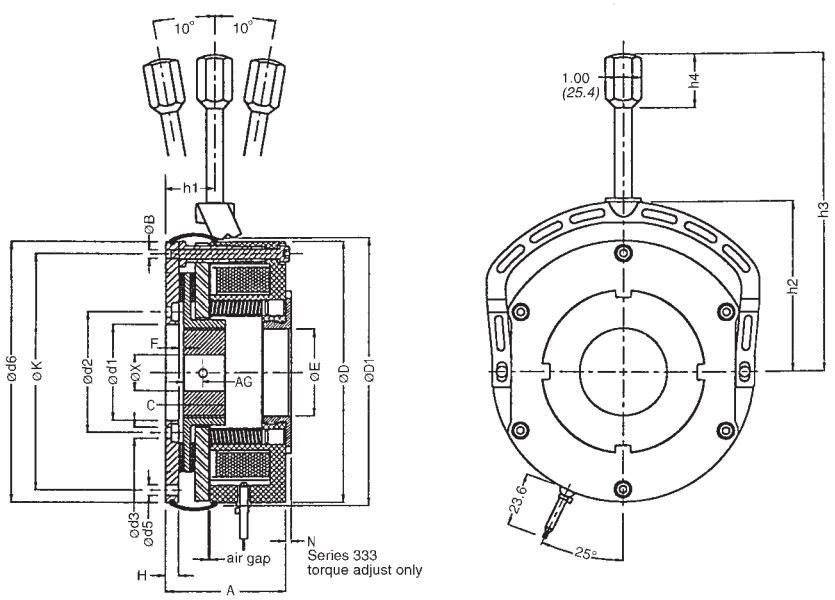
* Without keyway pilot bore. ** Keyway to DIN 6885/3 p9 - standard metric keyway DIN 6885/1 p9.① Size 132: "h2" and "h3" dimensions, contact factory. May vary .09 inch. For verification of manual release dimensions, contact factory.

Specifications - Sizes 72 thru 170/ Unit Pricing (Discount Symbol R3)

Size Bolt Circle *(mm)*	Part Number	Nominal Static Torque	Inertia (Wk^2)		Approx Weight	Max RPM	Power (Watts)	Thermal Capacity Hp-Sec/Min	List Price 333 Torque adjust brake	List Price 331 Without Torque adjust	Adder for thick pressure plate	Subtract for brake without Pressure Plate	Options List Adders			
		lb-ft *(Nm)*	$lb\text{-}ft^2$	$Kgm^2 \times 10^{-4}$	lbs *(Kg)*								Seal (boot) kit	Manual Release	End Cap Plug	Thru-Shaft Seal
72	33X-14010-XX-XX	3 *(4)*	.002	*.84*	2.28 *(1.03)*	3600	24	2	$474.00	$436.00	$104.00	($36.00)	$22.00	$86.00	$20.00	$344.00
90	33X-24010-XX-XX	6 *(8)*	.003	*1.26*	4 *(1.81)*	3600	29	3	524.00	486.00	122.00	(38.00)	24.00	100.00	30.00	344.00
112	33X-34010-XX-XX	12 *(16)*	.005	*2.10*	6.78 *(3.07)*	3600	32	4	726.00	650.00	140.00	(50.00)	28.00	110.00	40.00	344.00
132	33X-44010-XX-XX	25 *(32)*	.011	*4.62*	11.42 *(5.18)*	3600	49	6	864.00	786.00	170.00	(70.00)	40.00	126.00	50.00	344.00
145	33X-54010-XX-XX	45 *(60)*	.019	*7.98*	14.45 *(6.55)*	3600	62	12	1,286.00	1,174.00	238.00	(80.00)	68.00	140.00	90.00	344.00
170	33X-64010-XX-XX	60 *(80)*	.041	*17.22*	22.6 *(10.25)*	3600	76	13	1,660.00	1,534.00	258.00	(92.00)	100.00	160.00	90.00	344.00

Series 331 (without torque adjust) & Series 333 (torque adjustable) Armature Actuated Brakes

Dimensions
Sizes 196 thru 278



Dimensions

Size	Basic Model Number	Torque lb-ft *(Nm)*	D1 Max	B	X		C Hub length	E	F Recommended Hub Location	AG Set screw location English bores only	A		H		D	K	N 333 Series only	
					Min. Bore	Max. Bore					Pressure Plate	No Plate	Pressure Plate	No Plate			Min.	Max.
196	**33X-74020**	110 *(149)*	8.94 *227*	*6 x M8*	1-3/8 *20**	1-5/8 *45, 48***	1.378 *35*	2.836 *72*	0.174 *4.42*	.689 *17.50*	3.902 *99.11*	3.469 *88.11*	0.433 *11*	0	8.543 *217*	7.717 *196*	0.187 *4.75*	0.479 *12.17*
230	**33X-84020**	180 *(240)*	10.38 *263.6*	*6 x M10*	1-5/8 *25**	1-7/8 *45, 50***	1.575 *40*	2.836 *72*	0.216 *5.49*	.790 *20.07*	4.352 *110.54*	3.927 *99.75*	0.433 *11*	0	10.000 *254*	9.055 *230*	0.340 *8.64*	0.740 *18.80*
278	**33X-94020**	300 *(400)*	12.43 *315.7*	*6 x M10*	1-7/8 *25**	2-1/8 *70*	1.969 *50*	2.836 *72*	0.216 *5.49*	.985 *25.02*	4.915 *124.84*	4.438 *112.73*	0.492 *12.5*	0	12.047 *306*	10.945 *278*	0.340 *8.64*	0.730 *18.54*

Size	Basic Model Number	d1	d2	d3	d5	d6	h1		h2	h3	h4
							Pressure Plate	No Plate			
196	**33X-74020**	3.125 *79.4*	3.937 *100*	0.354 *9*	0.354 *9*	8.543 *217*	1.575 *40*	1.142 *29*	5.51 *140*	10.43 *265*	1.75 *44.5*
230	**33X-84020**	3.86 *98*	4.724 *120*	0.433 *11*	0.433 *11*	10.00 *254*	1.850 *47*	1.417 *36*	5.34 *161*	11.26 *286*	1.75 *44.5*
278	**33X-94020**	4.724 *120*	5.906 *150*	0.433 *11*	0.433 *11*	11.654 *296*	2.205 *56*	1.772 *45*	7.36 *187*	13.34 *339*	1.71 *43.4*

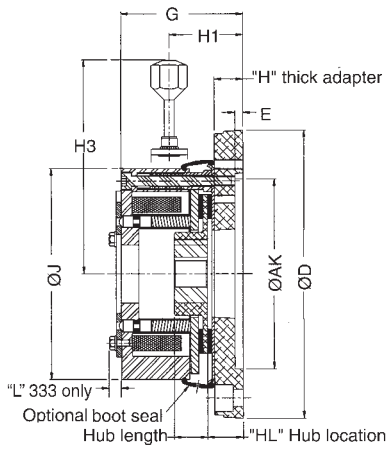
* Without keyway pilot bore. ** Keyway to DIN 6885/3 p9 - standard metric keyway DIN 6885/1 p9

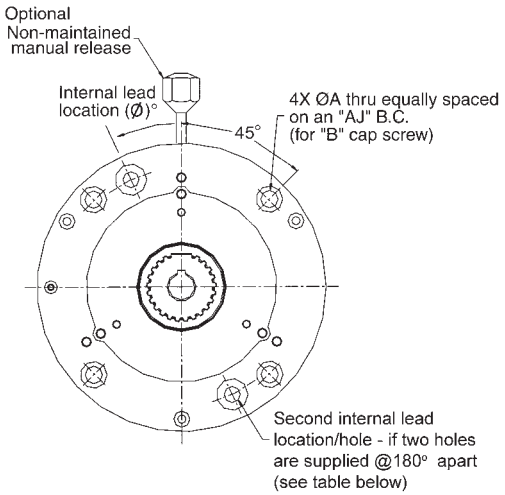
Specifications - Sizes 196 thru 278 / Unit Pricing (Discount Symbol R3)

Size Bolt Circle *(mm)*	Part Number	Nominal Static Torque	Inertia (Wk^2)		Approx Weight	Max RPM	Power (Watts)	Thermal Capacity Hp-Sec/Min	List Price 333 and 331 Series brakes	List Price without Pressure Plate	Options List Adders			
		lb-ft *(Nm)*	lb-ft^2	*Kgm^2 x 10^{-4}*	lbs *(Kg)*						Seal (boot) kit	Manual Release	End Cap Plug	Thru-Shaft Seal
196	**33X-74020-XX-XX**	110 *(150)*	.066	*27.72*	50.00 *(22.7)*	1800	84	22	$3,074.00	$2,674.00	126.00	300.00	100.00	752.00
230	**33X-84020-XX-XX**	180 *(240)*	.163	*68.46*	47.00 *(21.3)*	1800	102	28	4,072.00	3,514.00	150.00	368.00	120.00	752.00
278	**33X-94020-XX-XX**	300 *(400)*	.401	*168.42*	75.00 *(34.0)*	1800	112	30	8,786.00	7,986.00	180.00	550.00	150.00	752.00

Series 331 & Series 333 Armature Actuated Brakes
C-Face Mounted

BACK TO TABLE OF CONTENTS





Model Number	Size	NEMA Frame	A	AJ	AK	B	D	E	G	H	HL	Hub Length	H1	H3	J	L	Internal Lead Hole Location
3-3X-140F0	72	48C	.28	3.75	3.0	1/4	5.50	.19	2.07	.50	.54	.709	1.22	3.85	3.35	.257	(2) @ 60°/180° apart
3-3X-240F0	90*	48C	.28	3.75	3.0	1/4	5.50	.19	2.30	.50	.55	.787	1.25	4.52	3.96	.257	(2) @ 60°/180° apart
3-3X-240G0	90	56C	.41	5.875	4.50	3/8	6.83	.19	2.48	.68	.73	.787	1.43	4.52	3.96	.257	(2) @ 25°/180° apart
3-3X-340G0	112	56C, 145TC	.41	5.875	4.50	3/8	6.83	.19	2.86	.68	.74	.787	1.72	5.08	4.97	.287	(2) @ 25°/180° apart
3-3X-440G0	132	56C, 145TC	.41	5.875	4.50	3/8	6.83	.19	3.05	.68	.74	.984	1.59	5.47	5.79	.327	(2) @ 25°/180° apart
3-3X-440H0	132	182-256TC△	.56	7.25	8.50	1/2	9.25	.19	3.37	1.00	.81	.984	1.91	5.47	5.79	.327	(1) @ 25°
3-3X-540G0	145*	145TC	.41	5.875	4.50	3/8	6.83	.19	3.63	.68	.92	1.181	1.87	6.90	6.45	.366	(2) @ 25°/180° apart
3-3X-540H0	145	182-256TC △	.56	7.25	8.50	1/2	9.25	.19	3.95	1.00	.94	1.181	2.19	6.90	6.45	.366	(1) @ 25°
3-3X-640H0	170*	182-256TC △	.56	7.25	8.50	1/2	9.25	.19	4.03	1.00	.94	1.181	2.04	7.73	7.47	.380	(1) @ 15°
3-3X-740H0	196	182-256TC	.53	7.25	8.50	1/2	8.90	.19	5.0	1.30	1.50	1.378	2.14	10.43	8.54	**	None
3-3X-740K0	196	324/326TC-△ 404/405TC	.66	11.0	12.50	5/8	13.25	.19	5.38	1.50	1.67	1.378	2.69	10.43	8.54	**	(2) @ 25°***
3-3X-840H0	230*	182-256TC △	.53	7.25	8.50	1/2	10.00	.19	5.62	1.00	1.22	1.58	2.42	11.26	10.00	**	None
3-3X-840K0	230	324/326TC-△ 404/405TC	.66	11.0	12.50	5/8	13.25	.19	6.10	1.50	1.72	1.58	2.94	11.26	10.00	**	(2) @ 25°***
3-3X-940K0	278*	324/326TC-404/405TC	.66	11.0	12.50	5/8	13.25	.19	6.75	1.60	1.82	1.97	3.38	13.34	12.05	**	(2) @ 25°***

*On these sizes, the brake diameter is larger than the adaptor mounting/bolt circle.

**L min. & max: size 196 = .187 min. & .479 max.
size 230/278 = .340 min. & .730 max.

***On each side of the 12:00 position (the location of second hole is not shown on above drawing)

△ Frame shaft size may require derate of a larger brake. Confirm hub bore.

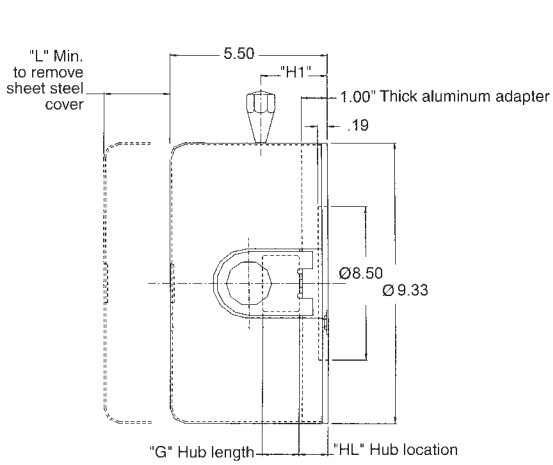
Available Frames/Sizes and Unit Pricing Discount Symbol R3

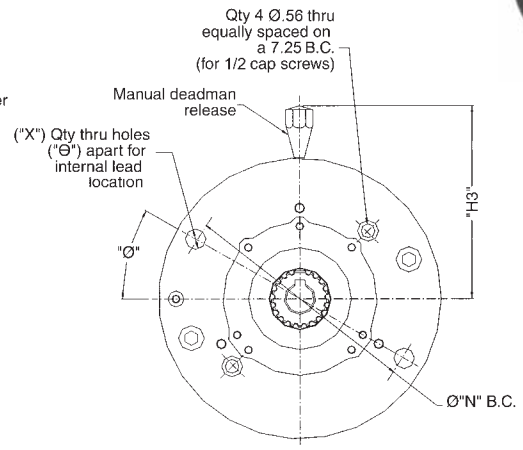
Model Number	Size	Nominal Static Torque		NEMA Frame Size△	Approximate Weight		List Price 333 torque adjust brake	List Price 331 without torque adjust
		Lb-Ft	*Nm*		Lbs	*Kg*		
3-3X-140F0-XX-XX	72	3	*4*	48C	2.76	*1.25*	$554.00	$516.00
3-3X-240F0-XX-XX	90	6	*8*	48C	4.48	*2.03*	604.00	566.00
3-3X-240G0-XX-XX	90	6	*8*	56C	5.24	*2.38*	604.00	566.00
3-3X-340G0-XX-XX	112	12	*16*	56C	8.02	*3.64*	826.00	750.00
3-3X-440G0-XX-XX	132	25	*32*	56C	14.00	*6.36*	1,112.00	1,034.00
3-3X-440H0-XX-XX	132	25	*32*	182TC-256TC	17.52	*7.95*	1,460.00	1,382.00
3-3X-540G0-XX-XX	145	45	*60*	56C	16.14	*7.32*	2,270.00	2,158.00
3-3X-540H0-XX-XX	145	45	*60*	182TC-256TC	20.55	*9.32*	2,382.00	2,270.00
3-3X-640H0-XX-XX	170	60	*80*	182TC-256TC	35.00	*15.89*	3,710.00	3,584.00
3-3X-740H0-XX-XX	196	110	*150*	182TC-256TC	55.00	*25.00*	4,140.00	4,140.00
3-3X-740K0-XX-XX	196	110	*150*	324-365/404-405TC/TSC/UC/USC	72.30	*32.79*	4,858.00	4,858.00
3-3X-840H0-XX-XX	230	180	*240*	182TC-256TC	65.55	*29.76*	6,950.00	6,950.00
3-3X-840K0-XX-XX	230	180	*240*	324-365/404-405TC/TSC/UC/USC	88.30	*40.05*	7,718.00	7,718.00
3-3X-940K0-XX-XX	278	300	*400*	324-365/404-405TC/TSC/UC/USC	140.00	*63.50*	9,130.00	9,130.00

Series 331 & Series 333
Armature Actuated Brakes
C-Face with Brake Housing



IP43 Enclosure



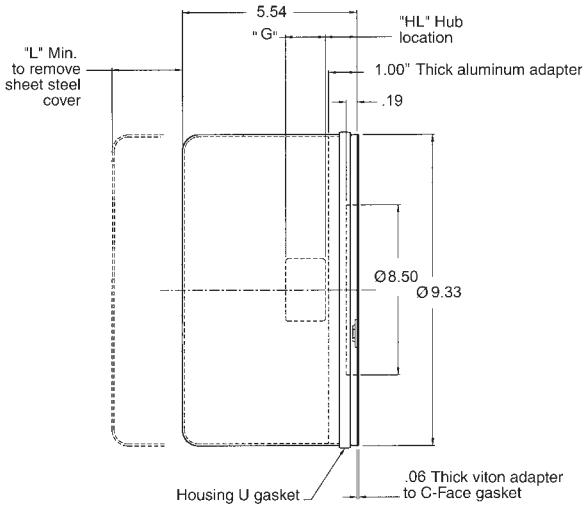


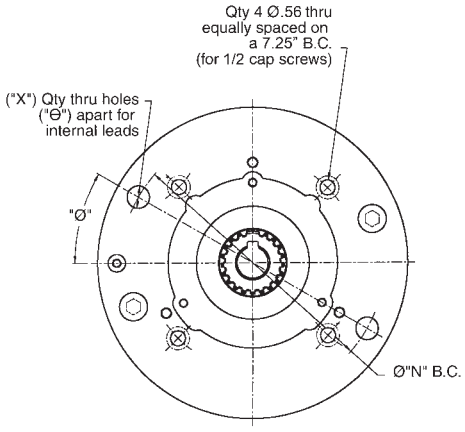
Dimensions/ Unit Pricing IP43 — Discount Symbol R3

Model Number	Size	Nominal Static Torque Lb-Ft (*Nm*)	NEMA Frame*	HL	G	H1	H3	L	Internal lead location X, Ø and O on "N" Bolt circle	Approximate Weight Lbs (*Kg*)	List Price 33C torque adjust	List Price 33B without torque adjust	Manual Release Adder
33X-441H0	132	25 (*32*)	182TC-256TC	1.16	.984	1.94	6.35	2.88	(1) @ 65° on R3.81	20.14 (*9.1*)	$1,610.00	$1,532.00	$126.00
33X-541H0	145	45 (*60*)	182TC-256TC	1.19	1.181	2.22	6.90	3.50	(1) @ 65° on R3.81	23.17 (*10.5*)	2,620.00	2,508.00	140.00

For sizes 196 through 278 with C-Face and housing, see Series 350 or Series 360.

IP54 Enclosure (No manual release/Optional Internal manual release)





Dimensions/ Unit Pricing IP54 — Discount Symbol R3

Model Number	Size	Nominal Static Torque Lb-Ft (*Nm*)	NEMA Frame*	HL	G	L	Internal lead location X, Ø and O on N B.C.	Approximate Weight Lbs (*Kg*)	List Price 33J torque adjust	List Price 33H without torque adjust	Internal Manual Release Adder
33X-444H0	132	25 (*32*)	182TC-256TC	1.16	.984	2.88	(1) @ 65° on R3.81	25 (*11.35*)	$2,358.00	$2,280.00	$126.00
33X-544H0	145	45 (*60*)	182TC-256TC	1.19	1.181	3.50	(1) @ 65° on R3.81	29 (*13.16*)	3,676.00	3,564.00	140.00
33X-644H0	170	60 (*80*)	182TC-256TC	1.19	1.181	3.50	(1) @ 65° on R3.81	36 (*16.34*)	5,572.00	5,446.00	160.00

*For NEMA 48C and 56C mounting, see pages 77-78, Series 321/322 NEMA C.

Series 331 & Series 333 Continued

Ordering Information

Group "3" Armature Acting Brake — 333- 4 4 1 1 0 - O D - K C

Metric Mount

Options **Table 3**

Voltages - **Table 2**

Hub bore and keyseat - **Table 1**

Numeral	Description
0	No torque adjust, mag body not machined for manual release
1	No torque adjust
2	With torque adjust, mag body not machined for manual release
3	With torque adjust
B	Housing with conduit hole, no torque adjust (Size 72 - 145)
C	Housing with conduit hole, with torque adjust
H	IP54 housing, no torque adjust (Size 72 - 170)
J	IP54 housing, with torque adjust (Size 72 - 170)

Numeral	Modifications
0	Standard

Numeral	Mounting Style
0	Less pressure plate
1	Thin pressure plate (Size 72 - 170 only)
2	Thick pressure plate
F	NEMA 48C (Size 72 & 90)
G	NEMA 56C (Size 90, 132, & 112)
H	NEMA 180/210/250 TC (Size 132, 145, 170, 196 & 230)
J	NEMA 280 TC/UC (Size 196)
K	NEMA 320/360/400 TC/UC (Size 196, 230, 278)

Numeral	Enclosure Type
0	Standard
1	Seal (boot) kit thru bore
2	Seal (boot) and end cap plug
3	Seal (boot) and through-shaft seal
4	IP54 Enclosure

Numeral	AAB-E Unit Sizes
1	72
2	90
3	112
4	132
5	145
6	170
7	196
8	230
9	278

Numeral	Description
2	Reduced torque with air gap shim
3	Reduced torque (severe duty- long life)
4	Standard
5	Size 90 Only; 8.34 lb-ft holding applications only
6	Std torque with air gap shim

Table 1 - Hub Bores 333-14010- * * -EA

NOTE: See page 100 for recommended minimum bore size by torque

Bore (in)	Character to insert	Keyway Size*		Available Bores Brake Size								
				1	2	3	4	5	6	7	8	9
		Width (in)	Depth (in)	72	90	112	132	145	170	196	230	278
3/8	0V	3/32	3/64	std								
1/2	0K	1/8	1/16	std	std							
9/16	0N	1/8	1/16	non std	non std							
5/8	0B	3/16	3/32		std	std	non std					
3/4	0C	3/16	3/32		non std	non std	non std					
7/8	0D	3/16	3/32			std	std	std	non std			
1	0L	1/4	1/8				non std	std	non std			
1-1/8	0E	1/4	1/8				std	std	std	non std		
1-1/4	0F	1/4	1/8						non std	non std		
1-3/8	0G	5/16	5/32						std	std	non std	non std
1-1/2	0M	3/8	3/16							std	non std	non std
1-5/8	0H	3/8	3/16							std	std	non std
1-3/4	0I	3/8	3/16								std	non std
1-7/8	0J	1/2	1/4								std	std
2	0L	1/2	1/4									non std
2-1/8	0N	1/2	1/4									std
Metric		*Width (mm)*	*Depth (mm)*	*Metric Bores Supplied Without Set Screws, circlip recommended*								
11	11	*4*	*1.8*	std		non std						
14	14	*5*	*2.3*	std	std	std	non std	non std				
15	15	*5*	*2.3*	non std	std	std	non std	non std	non std			
16	16	*5*	*2.3*		non std	non std	non std	non std	non std			
20	20	*6*	*2.8*		std**	std	non std	non std	non std	non std**		
22	22	*6*	*2.8*			std**	non std	non std	non std	non std		
24	24	*8*	*3.3*				std	non std	non std	non std		
25	25	*8*	*3.3*				std	non std	std	non std	non std**	non std**
28	28	*8*	*3.3*				non std**	non std	std	non std	non std	non std
30	30	*8*	*3.3*					std	std	std	std	std
34	34	*10*	*3.3*					std**	non std	non std	non std	non std
35	35	*10*	*3.3*						non std	std	std	std
38	38	*10*	*3.3*						std**	std	std	non std
40	40	*12*	*3.3*							std	std	std
42	42	*12*	*3.3*							non std	std	non std
45	45	*14*	*3.8*							non std	std	std
48	48	*14*	*3.8*							std**	non std	non std
49	49	*14*	*3.8*								non std	non std
50	50	*14*	*3.8*								std**	std
55	55	*16*	*4.3*									std
60	60	*18*	*4.4*									std
70	70	*20*	*4.9*									std

NOTE: Add the following for non-standard bores: • Sizes 72 through 132 = $252.00 • Sizes 145 through 196 = $296.00 • Sizes 230 & 278 = $592.00.

*Standard U.S. Keyseats made to ANSI B17.1 standard. Standard metric Keyseat DIN 6885/1 p9.

** Keyseat to DIN 6885/3 p9.

Table 2 - STD Coil Voltage 333-14010-14- * A

Character to insert	Coil Voltage	Current Rating in Amps								
		1	2	3	4	5	6	7	8	9
		72	90	112	132	145	170	196	230	278
B	414/432 Vdc	0.06	0.07	0.09	0.12	0.16	0.22	0.25	0.26	0.29
C	12 Vdc	2.13	2.66	2.27	3.50	3.90	5.60	6.40	8.30	N/A
E	24 Vdc	1.10	1.28	1.16	1.80	1.84	2.80	3.30	4.27	3.85
J	90 Vdc	0.28	0.32	0.29	0.45	0.72	0.70	0.82	1.05	1.19
K	103 Vdc	0.21	0.24	0.33	0.51	0.53	0.80	0.75	0.96	1.08
L	180 Vdc	0.15	0.17	0.15	0.23	0.38	0.36	0.42	0.54	0.61
M	205 Vdc	0.11	0.12	0.17	0.27	0.27	0.41	0.38	0.49	0.56
S	258 Vdc	0.09	0.10	0.14	0.21	0.23	0.33	0.34	0.40	0.44
N*	115 Vac	0.21	0.24	N/A	N/A	N/A	N/A	N/A	N/A	N/A
P*	230 Vac	0.11	0.12	0.17	.27	N/A	N/A	N/A	N/A	N/A
V**	115 Vac quickset	0.21	0.24	N/A	N/A	N/A	N/A	N/A	N/A	N/A
W**	230 Vac quickset	0.11	0.12	0.17	N/A	N/A	N/A	N/A	N/A	N/A

*In-line rectifier. Add $92.00 to brake list price.

**In-line quickset rectifier. Add $140.00 to brake list price.

Contact factory for non-standard coils.
Add the following for non-std. coil voltage
- Sizes 72 through 112 = $188.00
- Sizes 132 through 170 = $216.00
- Sizes 196 through 278 = $308.00

For separate AC rectifiers see pages 89-92

Table 3 - Options 333-14010-14-E *

Character to insert	Description/Options
A	Basic brake
C	Option A with non-maintained release
J	Steel hub for press-fit applications
K	Steel hub, non-maintained release
L	Internal manual release, non-maintained
R	Maintained manual release (bolts)

Modifications are available- see AAB Modification Section

Series 350 Armature Actuated Brakes

BACK TO TABLE OF CONTENTS



Brake with IP56 Aluminum Cover



Brake showing space heater and release indicator location



Reverse view showing adapter mounting plate orientation

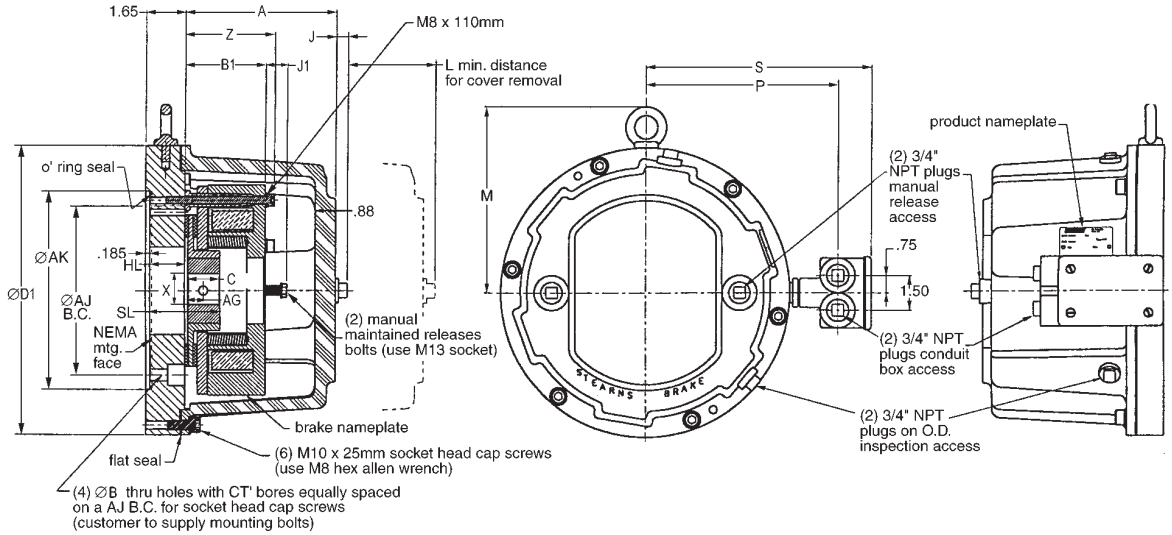
Features

- *Torque rating 102 - 400 Nm, 75 - 300 lb-ft*
- *Universal mounting*
- *Class H insulation*
- *Maintained manual release*
- *Corrosion resistance (stainless steel external hardware)*
- *IP56 enclosure protection (available in ductile cast iron or aluminum cover)*
- *ABS, CSA and CE certification*
- *Simple wear adjustment with access hole for air gap inspection*
- *Metric and US Customary bore sizes*
- *C-Face mounting - various adapter plates available for 182TC through 405TSC frame mounting*
- *Splined hub for quiet dependable operation*
- *Installation Instructions/Parts List: P/N 8-078-895-00*

Standard Options

- *AC rectifier (see pages 86-89)*
- *Tach/encoder mounting*
- *Space Heater 115, 230 or 460 Vac*
- *Thru-shaft*
- *IEC D and C Flange*
- *Conduit Box- specify F1 or F2 location (F1 location shown)*

F1 Conduit Box location shown.
F2 location on left side facing brake housing.



Size		NEMA frame	ØB	Torque		AJ	AK	Mount Bolt	X				D1**	D1***	B1	Z	L	M	S	P	J1	A**	A***	J	C Hub length	HL Hub Location	AG set screw location
									Min. Bore		Max. Bore																
				lb-ft	Nm				in	*mm*	in	*mm*															
7	196	182TC-256TSC	.53	75	*102*	7.250	8.500	1/2"-13	1.375	*20*	1.625	*48**	12.38	15.75	3.57	3.97	4.6	8.00	9.68	8.25	.93	6.47	6.73	.50	1.378	1.63	.689 *17.50*
7	196	182TC-256TSC	.53	110	*150*	7.250	8.500	1/2"-13	1.375	*20*	1.625	*48**	12.38	15.75	3.57	3.97	4.6	8.00	9.68	8.25	.93	6.47	6.73	.50	1.378	1.63	.689 *17.50*
7	196	284TC-286TSC	.53	110	*150*	9.000	10.500	1/2"-13	1.375	*20*	1.625	*48**	12.38	15.75	3.57	3.97	4.6	8.00	9.68	8.25	.93	6.47	6.73	.50	1.378	1.63	.689 *17.50*
7	196	324TC-405TSC	.66	110	*150*	11.000	12.500	5/8"-18	1.375	*20*	1.625	*48**	15.75	15.75	3.57	3.97	4.6	9.63	11.38	9.94	.93	6.73	6.73	.50	1.378	1.63	.689 *17.50*
8	230	284TC-286TSC	.53	180	*240*	9.000	10.500	1/2"-13	1.625	*25*	1.875	*50**	15.75	15.75	4.00	4.46	5.0	9.63	11.38	9.94	.93	6.73	6.73	.25	1.575	1.63	.790 *20.07*
8	230	324TC-405TSC	.66	180	*240*	11.000	12.500	5/8"-11	1.625	*25*	1.875	*50**	15.75	15.75	4.00	4.46	5.0	9.63	11.38	9.94	.93	6.73	6.73	.25	1.575	1.63	.790 *20.07*
9	278	324TC-405TSC	.66	300	*400*	11.000	12.500	5/8"-11	1.875	*25*	2.125	*70*	15.75	15.75	4.00	5.08	5.0	9.63	11.38	9.94	.97	6.73	6.73	.25	1.969	1.63	.985 *25.02*

*Key to DIN 6885/3p9-Standard Metric Keyway DIN 6885/1p9
D1** & A** for Aluminum Cover
D1*** & A*** for Ductile Iron Cover

Component Materials:
- Adapter plate - steel (zinc plate)
- Splined hub - steel (zinc plate)
- Splined carrier - aluminum
- Armature - steel (zinc plate)
- Magnet body - steel (zinc plate) Hardware - steel (corrosion resistant plating or stainless)
- Cover: Size 196 - 182T thru 286TS NEMA - Aluminum (anodized) (additional paint optional) Size 196 - 324T thru 405TS NEMA - Cast Iron (primed) (additional paint optional)
- Size 230 - 284T thru 405TS NEMA - Cast Iron (primed) (additional paint optional)
- Size 278 - 324T thru 405TS NEMA - Cast Iron (primed) (additional paint optional)

Series 350 Continued

BACK TO TABLE OF CONTENTS

UnitSpecifications/Pricing (Discount Symbol R5)

Size	NEMA Frame	Nominal Static Torque		Part Number		Weight/lbs		Max RPM	Thermal Capacity Hp-Sec/Min	List Price	Options				
		lb-ft	*Nm*	Ductile Cast Iron	Aluminum Cover	Ductile Iron	Aluminum				Electronic Brake Release Indicator*	Space Heater	Terminal Strip	IP56 Conduit Box	IP67 Conduit Box
196	182TC-256TSC	75	*102*	351-734HX-XX-XX	355-734HX-XX-XX	–	103	1800	22	$8,532.00	$660.00	$416.00	$240.00	$410.00	$720.00
196	182TC-256TSC	110	*150*	351-744HX-XX-XX	355-744HX-XX-XX	–	103	1800	22	8,932.00	660.00	416.00	240.00	410.00	720.00
196	284TC-286TSC	110	*150*	351-744JX-XX-XX	355-744JX-XX-XX	–	103	1800	22	9,330.00	660.00	416.00	240.00	410.00	720.00
196	324TC-405TSC	110	*150*	351-744KX-XX-XX	355-744KX-XX-XX	134	128	1800	22	9,732.00	660.00	416.00	240.00	410.00	720.00
230	284TC-286TSC	180	*240*	351-844JX-XX-XX	355-844JX-XX-XX	208	178	1800	28	9,818.00	660.00	416.00	240.00	410.00	720.00
230	324TC-405TSC	180	*240*	351-844KX-XX-XX	355-844KX-XX-XX	208	178	1800	28	10,418.00	660.00	416.00	240.00	410.00	720.00
278	324TC-405TSC	300	*400*	351-944KX-XX-XX	355-944KX-XX-XX	219	189	1800	30	13,210.00	660.00	416.00	240.00	410.00	720.00

*Remote mount device

Ordering Information

Part number example: 355-744JCOMEA

Group "3" Armature Acting Brake (Direct acting with a DC Coil)

Mounting Design	
Numeral	**Design**
5	Pressure Plate Mount

Numeral	Brake Cover Type
1	Ductile Iron
5	Aluminum

Numeral/ Alpha	Magnet Body Size	Torque lb-ft
7	196	110
8	230	180
9	278	300

	Torque/Modification
3	Reduced Torque
4	Standard Torque

Numeral	Enclosure
4	IP 56 (standard)
E	IP 56 conduit box with terminal strip*
G	IP56 conduit box*
H	IP67 conduit box* with terminal strip
M	IP67 conduit box*

*Specify F1 or F2 location for conduit box modification

Options **Table 3**

Voltages - **Table 2**

Hub bore and keyset - **Table 1**

Additional Options	
Standard Brake	0
Space Heater 115	1
Space Heater 230	2
Space Heater 460	3
Brake release indicator NO/NC	4
Brake release indicator NO/NC Space Heater 115	5
Brake release indicator NO/NC Space Heater 230	6
Brake release indicator NO/NC Space Heater 460	7

Mounting	
NEMA 180/210/250 C-face	H
NEMA 280 C-face	J
NEMA 320/400 C-face	K
NEMA 440 C-face Mt*	L
NEMA 500 C-face Mt*	M
IEC 132 C-face Mt*	S
IEC 160 C-face Mt*	T
IEC 132 D-face Mt*	U
IEC 160 D-face Mt*	V
IEC 180 D-face Mt*	W
IEC 200 D-face Mt*	X
IEC 225 D-face Mt*	Y

*Contact factory for pricing on these mounting options

Table 1 - Hub Bores

NOTE: See page 100 for recommended minimum bore sizes by torque

Character to insert	Bore	Keyway Size*		Bores Available Unit Size		
		Width (in.)	Depth (in.)	196	230	278
0G	1.375	5/16	5/32	X		
0M	1.500	3/8	3/16	X		
0H	1.625	3/8	3/16	X	X	
0I	1.750	3/8	3/16		X	
0J	1.875	1/2	1/4		X	X
0L	2.000	1/2	1/4			X
0N	2.125	1/2	1/4			X
Metric	*Bore*	*Width*	*Depth*	***196***	***230***	**278**
20	*20*	—	—	X		
30	*30*	*8*	*3.3*	X		X
35	*35*	*10*	*3.3*	X	X	
38	*38*	*10*	*3.3*	X	X	
40	*40*	*12*	*3.3*	X	X	X
42	*42*	*12*	*3.3*	X	X	
45	*45*	*14*	*3.8*	X	X	X
48	*48*	*14*	*3.8*	X		
50	*50***	*14*	*3.8***		X	
50	*50*	*14*	*3.8*			X
55	*55*	*16*	*4.3*			X
60	*60*	*18*	*4.4*			X
70	*70*	*20*	*4.9*			X

*Standard U.S. keyseats made to ANSI B17.1 standard. Standard metric keyseat DIN 6885/1 p9.
**Keyseat to DIN 6885/3 p9.

Table 2 - Coil Voltage

Character to Insert	Coil Voltage	Current Rating 7	8	9
		196	230	278
E	24 Vdc	3.30	4.27	3.85
J	90 Vdc	.82	1.05	1.19
K	103 Vdc	.75	.96	1.08
L	180 Vdc	.42	.54	.61
M	205 Vdc	.38	.49	.56
B	414/432 Vdc	.24	.26	.28

Other voltages available - consult factory
For AC rectifiers see pages 86-89

Table 3 - Additional Options

No manual release	A
Maintained release (standard)	R

NOTE: *Final part number may change due to specifications or options selected or other product design considerations. A number such as a 2, 3, 4 etc., in the 12th position is used to designate a unique brake (custom) and can only be assigned by Stearns Design Engineering Department.*

Modifications are available - see AAB Modification Section.

Series 360 Armature Actuated Brakes (Magnet Body Mounted)

BACK TO TABLE OF CONTENTS



*Shown with **optional** conduit box*



Reverse view showing adapter mounting plate orientation



Brake showing space heater and release indicator location

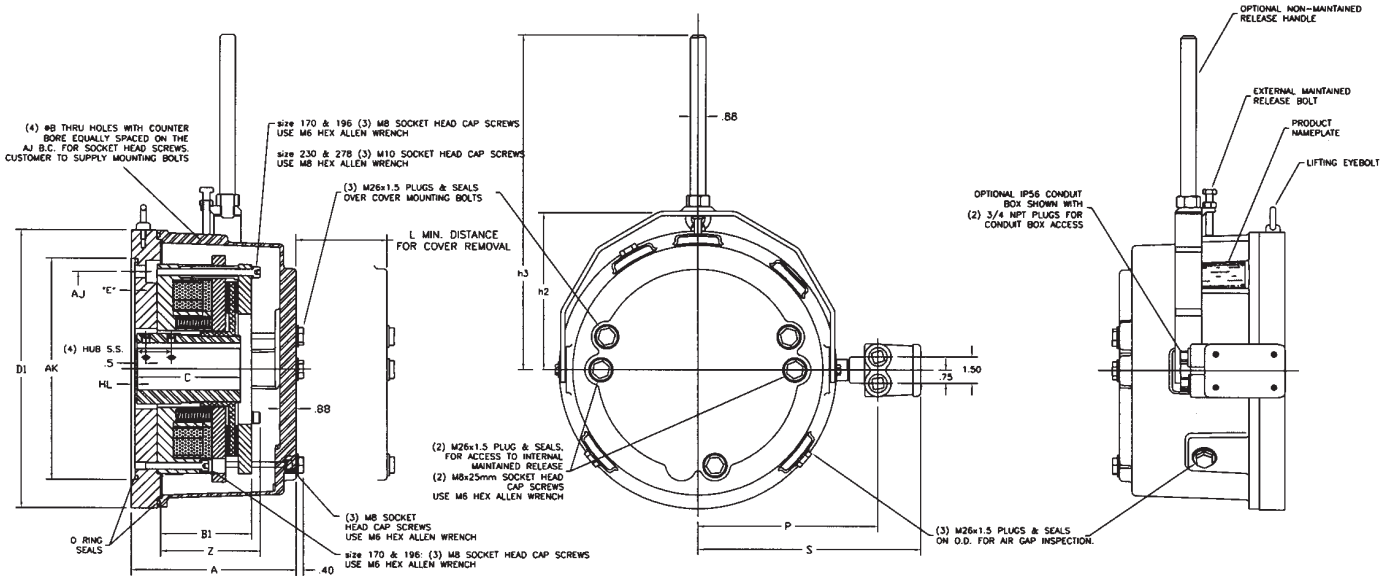
Features

- *Universal mounting*
- *Internal maintained manual release*
- *IP56 enclosure*
- *ABS, CE, and CSA Certification*
- *Brake gaskets are captive (O-Ring), so parts are not lost during maintenance*
- *Stainless Steel nameplate (exterior)*
- *Modular brake assembly Install and remove brake without having to readjust air gaps*
- *Class H insulation*
- *Installation Instructions and Parts List: P/N 8-078-898-00*

Standard Brake Options

- *AC Rectifier (see pages 86-89)*
- *Tach/encoder mounting*
- *Space Heater*
- *Electronic brake release indicator*
- *Contact Factory for Electronic Wear Indicator*
- *Thru-Shaft*
- *Optional external non-maintained/maintained manual release*
- *Optional IP56 or IP67 conduit box mounted on adapter plate. Wiring is not disturbed when brake housing is removed*

F1 Conduit Box location shown.
F2 location on left side facing brake housing.



Dimensional Data Sizes 170 through 278

Size		Model	NEMA Frame	Torque		ØB	AJ	AK	Mount Bolt	D1	E	B1	Z	L	h2	h3	S	P	A	HL Hub Location	C Hub Length	S.S. Location
				lb-ft	*Nm*																	
6	170	36X-6	182-256TC	35	47	.53	7.25	8.50	1/2"-13	10.38	.185	3.57	3.94	3.8	6.00	16.1	9.54	7.09	6.70	.19	4.64	1.63
6	170	36X-6	182-256TC	60	*80*		7.25	8.50		10.38	.185						9.54	7.09	6.70			
6	170	36X-6	284-286TC	60	*80*		9.00	10.50		10.76	.190						10.25	7.81	6.90			
7	196	36X-7	182-256TC	110	*149*	.53	7.25	8.50	1/2"-13	11.81	.185	3.72	4.12	4.3	6.70	16.6	10.25	7.81	6.90	.19	4.70	1.75
7	196	36X-7	284-286TC	110	*149*	.53	9.00	10.50														
8	230	36X-8	284-286TC	180	*240*	.53	9.00	10.50	1/2"-13	13.63	.190	4.45	4.94	5.2	8.25	17.9	11.19	10.94	8.27	.19	5.20	2.12
8	230	36X-8	324TC-405TSC	180	*240*	.69	11.00	12.50	5/8"-11													
9	278	36X-9	324TC-405TSC	300	*400*	.69	11.00	12.50	5/8"-11	15.68	.190	5.12	5.60	5.8	9.20	18.8	12.19	11.94	9.69	.19	5.82	2.12
9	278	36X-9	444-445TC	300	*400*	.69	14.00	16.00		16.56							12.63	12.38				

Note: Dimensions for estimating purposes only.

***Component Materials* for 361-X Series:**
- Adapter plate - steel (zinc phosphate, prime & paint)
- Splined hub - steel (zinc plate)
- Armature - steel (normalized)
- Pressure Plate - steel (normalized)
- Magnet body - steel (zinc plated)
- Housing - ductile iron (primed & painted):
- Hardware - steel (corrosion resistant plated or stainless)

Series 360 Continued

BACK TO TABLE OF CONTENTS

Specifications/Unit Pricing (Discount Symbol R5)

Size	NEMA Frame	Nominal Static Torque		Model Number	Thermal Capacity Hp-Sec/Min	Approx weight lbs.	List Price	External Maintained/Deadman Manual Release	Electronic Brake Release Indicator	Space Heater	Terminal Strip	IP-56 Conduit Box	IP-67 Conduit Box
		lb-ft	Nm										
170	182-256TC	35	*47*	3-61-634H0	14	101	$6,390.00	$500.00	$660.00	$416.00	$240.00	$410.00	$720.00
170	182-256TC	60	*80*	3-61-644H0			6,790.00	500.00	660.00	416.00	240.00	410.00	720.00
170	284-286TC	60	*80*	3-61-644J0			7,190.00	500.00	660.00	416.00	240.00	410.00	720.00
196	182-256TC	75	*102*	3-61-734H0	20	120	8,532.00	600.00	660.00	416.00	240.00	410.00	720.00
196	182-256TC	110	*150*	3-61-744H0			8,932.00	600.00	660.00	416.00	240.00	410.00	720.00
196	284-286TC	110	*150*	3-61-744J0			9,330.00	600.00	660.00	416.00	240.00	410.00	720.00
230	284-286TC	180	*240*	3-61-844J0	26	176	9,818.00	600.00	660.00	416.00	240.00	410.00	720.00
230	324TC/364-365TC	180	*240*	3-61-844K0			10,418.00	600.00	660.00	416.00	240.00	410.00	720.00
278	324TC/364-365TC	300	*400*	3-61-944K0	28	280	13,210.00	600.00	660.00	416.00	240.00	410.00	720.00
278	444TC	300	*400*	3-61-944L0			13,830.00	600.00	660.00	416.00	240.00	410.00	720.00

Ordering Information

Part number example: 361-744JCOMES

Group "3" Armature Acting Brake (Direct acting with a DC Coil)

Mounting Design	
Numeral	Design
6	Magnet Body Mount

Numeral	Brake Cover Type
1	Ductile Iron

Numeral/ Alpha	Magnet Body Size	Torque lb-ft
6	170	60
7	196	110
8	230	180
9	278	300

	Torque/Modification
3	Reduced Torque
4	Standard Torque

Numeral	Enclosure
4	IP56 Enclosure (standard)
E	IP56 conduit box with terminal strip*
G	IP56 conduit box*
H	IP67 conduit box* with terminal strip
M	IP67 conduit box*

*Specify F1 or F2 location for conduit box modification

Additional Options	
Standard Brake	0
Space Heater 115	1
Space Heater 230	2
Space Heater 460	3
Brake release indicator Switch NO/NC	4
Brake release indicator NO/NC Space Heater 115	5
Brake release indicator NO/NC Space Heater 230	6
Brake release indicator NO/NC Space Heater 460	7
Wear indicator NO NO	A
Wear indicator NO/NC Space Heater 115	B
Wear indicator NO/NC Space Heater 230	C
Wear indicator NO/NC Space Heater 460	D

Options **Table 3**

Voltages - **Table 2**

Hub bore and keyset - **Table 1**

Mounting/Size	
NEMA 180/210/250 C-face	H
NEMA 280 C-face	J
NEMA 320/400 C-face	K
NEMA 440 C-face Mt*	L
NEMA 500 C-face Mt*	M
IEC 132 C-face Mt*	S
IEC 160 C-face Mt*	T
IEC 132 D-face Mt*	U
IEC 160 D-face Mt*	V
IEC 180 D-face Mt*	W
IEC 200 D-face Mt*	X
IEC 225 D-face Mt*	Y

*Contact factory for pricing on these mounting options

Table 1 - Hub Bores

NOTE: See page 100 for recommended minimum bore sizes by torque

Character to insert	Bore	Keyway Size*		Bores Available			
		Width (in.)	Depth (in.)	Unit Size			
				170	196	230	278
0E	1.125	1/4	1/8	X			
0F	1.250	1/4	1/8	X			
0G	1.375	5/16	5/32	X	X		
0M	1.500	3/8	3/16	X	X		
0H	1.625	3/8	3/16	X	X	X	
0I	1.750	3/8	3/16		X	X	
0J	1.875	1/2	1/4		X	X	X
0L	2.000	1/2	1/4			X	X
0N	2.125	1/2	1/4				X
0R	2.375	5/8	5/16				X
Metric	***Bore***	***Width***	***Depth***	***170***	***196***	***230***	***278***
30	*30*	*8*	*3.3*	X	X		
35	*35*	*10*	*3.3*	X	X	X	
38	*38*	*10*	*3.3*	X	X	X	
40	*40*	*12*	*3.3*	X	X	X	X
42	*42*	*12*	*3.3*		X	X	
45	*45*	*14*	*3.8*		X	X	X
48	*48*	*14*	*3.8*		X	X	X
50	*50*	*14*	*3.8*			X	X
55	*55*	*16*	*4.3*				X
60	*60*	*18*	*4.4*				X

*Standard U.S. keyseats made to ANSI B17.1 standard. Metric keyseats to DIN 6885/1 p9.

Table 2 - Coil Voltage

Character to Insert	Coil Voltage	Current Rating			
		6	7	8	9
		170	196	230	278
E	24 Vdc	2.80	4.27	3.85	3.85
J	90 Vdc	.70	1.05	1.19	1.19
K	103 Vdc	.80	.96	1.08	1.08
L	180 Vdc	.36	.54	.61	.61
M	205 Vdc	.41	.49	.56	.56
S	258 Vdc	.33	.34	.40	.44
B	414/432 Vdc	.22	.26	.28	.28

Other voltages available - consult factory

For AC rectifiers see pages 89-92

Table 3 - Additional Options

Standard - Internal Maintained Manual Release	R
External Non-Maintained (deadman) and Maintained Manual Release	S

NOTE: *Final part number may change due to specifications or options selected or other product design considerations. A number such as a 2, 3, 4 etc., in the 12th position is used to designate a unique brake (custom) and can only be assigned by Stearns Design Engineering Department.*

Modifications are available - see AAB Modification Section.

AC Rectifiers for use with Armature Actuated Brakes

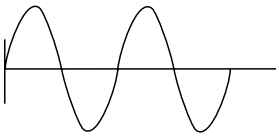


Product Overview

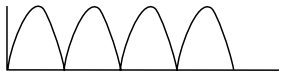
NOTE: For brake response times with and without AC rectifiers see page 97.

Full Wave

Input



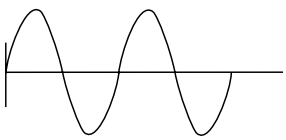
Output



A rectifier in which both positive and negative half-cycles of the incoming (AC) signal are rectified to produce a unidirectional (DC) current through the load. The DC output voltage of a full wave rectifier is $V_{DC=}$ .90V_{AC}.
Maximum operating voltage is +10% of nominal, frequency 50/60 Hz, maximum ambient temperature range of -40˚C to 65˚C

Half Wave

Input



Output



A rectifier in which only alternate half-cycles of the incoming (AC) signal are rectified to produce a unidirectional (DC) current through the load. The DC output voltage of a half wave rectifier is $V_{DC=}$ .45V_{AC}.
Maximum operating voltage is +10% of nominal, frequency 50/60 Hz, maximum ambient temperature range of -40°C to 65°C

Combination Full and Half Wave

Provides option of utilizing either full or half wave rectification
Maximum operating voltage is +10% of nominal, frequency 50/60 Hz.
Maximum ambient temperature range is -40°C to 65°C

TOR-AC Full and Half Wave

Provides coil turn off nearly as fast as DC side switching. Includes line filter for AC drive applications or whenever electrical filtering is required to protect the rectifier from high-frequency electrical line pulses. Must be switched on/off by a switch in an AC lead of the TOR-AC. Maximum operating voltage +10% of nominal, frequency 50/60 Hz.
Maximum ambient temperature range is -40°C to 65°C

QuickSet

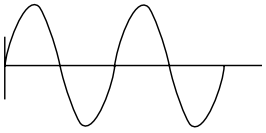
A rectifier that provides a quick brake response time even when the rectifier is permanently wired across the windings of an AC motor. The QuickSet Rectifier detects the decaying, motor generated voltage that occurs when power is removed from the motor circuit, and interrupts brake coil current in response. QuickSet Rectifiers can be specified full wave or half wave.
Operating voltage is ±10% of nominal, frequency 50/60 Hz.
Maximum ambient temperature range is -40°C to 65°C

QuickSet/QuickRelease

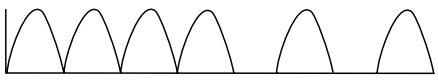
A rectifier that provides a timed, full wave rectified "over-excitation" brake release function, followed by continuous, half wave rectified brake released "holding" function, when used in conjunction with an appropriate brake coil voltage rating.

USED AS WATTSAVER: Provides a timed, full wave rectified brake release function, followed by continuous, half wave rectified brake released "wattsaver" function, when used in conjunction with an appropriate brake coil voltage rating. The Wattsaver serves to reduce the electrical power consumption and dissipation of the brake in the released state.
Operating voltage is ±10% of nominal, frequency 50/60 Hz.
Maximum ambient temperature varies by part number - see information by part number on following pages.

Input

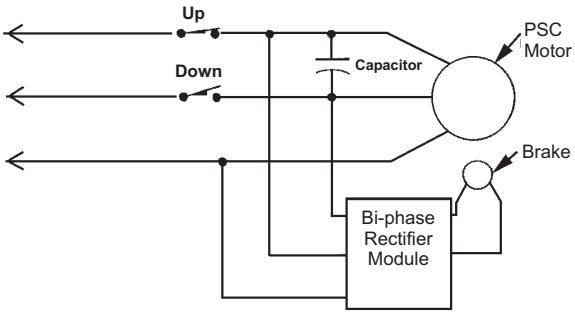


Output



Bi-Phase Rectifiers

A rectifier that is typically used in single phase, reversing, permanent split capacitor (PSC) motor applications. A single phase, reversing, PSC motor typically has two windings of equivalent resistance. The winding which serves as the main winding is connected directly across the power line, the winding which serves as the auxiliary winding is connected in series with a run capacitor across the power line. The direction of rotation is reversed by interchanging the function of the two windings. The Bi-Phase Rectifier provides the same voltage to the brake coil regardless of the direction of rotation of the motor. The Bi-Phase Rectifier has five leads and comes in standard response and QuickSet versions. Bi-Phase Rectifiers are application specific. Please contact factory for more information.



AC Rectifiers Continued
Selection & Pricing

BACK TO TABLE OF CONTENTS

Discount Symbol R3

115 Vac Input Voltage

**At 50 Vdc coil voltage, this rectifier can be used on brake sizes 72-112. At 103 Vdc coil voltage, this rectifier can be used on brake sizes 72-196. At all other listed coil voltages, this rectifier can be used on any brakes size.

Full Wave

Brake Sizes	Part Number	AC Input 50/60 Hz	DC Output	Brake Coil Voltage/Letter Designation	Switching	Connection	Max Current (amps)	List Price
72-196	412029101K	115	103	K or J	ac or dc side or connect across motor terminals	ac leads dc terminal block	.8	$92.00
ALL	412029201K	115	103	K or J	ac or dc side or connect across motor terminals	ac terminal block dc terminal block	1.6	$140.00
ALL	412029203K	115	103	K or J	ac or dc side or connect across motor terminals	ac leads dc leads	1.6	$140.00

Combination Full and Half Wave

Brake Sizes	Part Number	AC Input	DC Output	Brake Coil Voltage/ Letter Designation	Switching	Connection	Max Current (amps)	List Price
**	412049101K	115/230 460/575	50/103 207/259 414/517	50 Vdc = G 207 Vdc = M 414 Vdc = B 103 Vdc = K 259 Vdc = S 517 Vdc = A	ac or dc side or connect across motor terminals	ac terminal block dc terminal block	.8	$180.00

Quick Set/Quick Release or 103 Vdc Wattsaver

Brake Sizes	Part Number	AC Input	DC Output	Brake Coil Voltage/ Letter Designation	Switching	Connection	Max Current (amps)	List Price
72-112	412019611K	115	103 Vdc over-excitation	G	ac side only or connect across motor terminals	ac terminal block dc terminal block	2.0	$960.00
			50 Vdc Sustaining				1.0	

230 Vac Input Voltage

**At 50 Vdc coil voltage, this rectifier can be used on brake sizes 72-112. At 103 Vdc coil voltage, this rectifier can be used on brake sizes 72-196. At all other listed coil voltages, this rectifier can be used on any brakes size.

Full Wave

Brake Sizes	Part Number	AC Input 50/60 Hz	DC Output	Brake Coil Voltage/Letter Designation	Switching	Connection	Max Current (amps)	List Price
ALL	412029101K	230	207	M	ac or dc side or connect across motor terminals	ac leads dc terminal block	.8	$92.00
ALL	412029201K	230	207	M	ac or dc side or connect across motor terminals	ac terminal block dc terminal block	1.6	$140.00
ALL	412029203K	230	207	M	ac or dc side or connect across motor terminals	ac leads dc leads	1.6	$140.00

Combination Full and Half Wave

Brake Sizes	Part Number	AC Input	DC Output	Brake Coil Voltage/ Letter Designation	Switching	Connection	Max Current (amps)	List Price
**	412049101K	115/230 460/575	50/103 207/259 414/517	50 Vdc = G 207 Vdc = M 414 Vdc = B 103 Vdc = K 259 Vdc = S 517 Vdc = A	ac or dc side or connect across motor terminals	ac terminal block dc terminal block	.8	$180.00

TOR-AC Rectifier with Line Filter, Full Wave

Brake Sizes	Part Number	AC Input 50/60 Hz	DC Output	Brake Coil Voltage/ Letter Designation	Switching	Connection	Max Current (amps)	List Price
ALL	412029401K 412029402K	230	207	M	ac side only	Terminals Leadwires	.6	$230.00

QuickSet

Brake Sizes	Part Number	AC Input 50/60 Hz	DC Output	Brake Coil Voltage/ Letter Designation	Switching	Connection	Max Current (amps)	List Price
ALL	412029601K	230	207	M	NONE-connect across motor terminals	ac terminal block dc terminal block	.6	$240.00

QuickSet/QuickRelease or 205 Vdc Wattsaver

Brake Sizes	Part Number	Max Ambient Temp	AC Input 50/60 Hz	DC Output	Brake Coil Voltage/ Letter Designation	Switching	Connection	Max Current (amps)	List Price
72-230	412029301K	65°C	230	207 Vdc over-excitation	K or J	ac side only or connect across motor terminals	ac terminal block dc terminal block	2.0	$960.00
				103 Vdc sustaining				1.0	

AC Rectifiers Selection/Pricing Continued

BACK TO TABLE OF CONTENTS

Discount Symbol R3

460 Vac Input Voltage

**At 50 Vdc coil voltage, this rectifier can be used on brake sizes 72-112. At 103 Vdc coil voltage, this rectifier can be used on brake sizes 72-196. At all other listed coil voltages, this rectifier can be used on any brakes size.

Half Wave

Brake Sizes	Part Number	AC Input 50/60 Hz	DC Output	Brake Coil Voltage/Letter Designation	Switching	Connection	Max Current (amps)	List Price
ALL	412049301K	400	180	L	ac or dc side or connect across motor terminals	ac terminal block dc terminal block	.8	$92.00
		460	207	M				

Combination Full and Half Wave

Brake Sizes	Part Number	AC Input	DC Output	Brake Coil Voltage/ Letter Designation	Switching	Connection	Max Current (amps)	List Price
**	412049101K	115/230 460/575	50/103 207/259 414/517	50 Vdc = G 103 Vdc = K 207 Vdc = M 259 Vdc = S 414 Vdc = B 517 Vdc = A	ac or dc side or connect across motor terminals	ac terminal block dc terminal block	.8	$180.00

TOR-AC with Line Filter

Brake Sizes	Part Number	AC Input	DC Output	Brake Coil Voltage/Letter Designation	Switching	Connection	Max Current (amps)	List Price
ALL	412049404K	460	414	B / Full	ac side only	Terminals	0.3	$204.00
ALL	412049405K	460	414	B / Full	ac side only	Leadwires	0.3	$204.00
ALL	412049411K	460	207	M / Half	ac side only	Terminals	0.3	$204.00
ALL	412049412K	460	207	M / Half	ac side only	Leadwires	0.3	$204.00
ALL	412049413K	460	207	M / Half	ac side only	Terminals	0.6	$374.00
ALL	412049414K	460	207	M / Half	ac side only	Leadwires	0.6	$374.00

QuickSet

Brake Sizes	Part Number	AC Input	DC Output	Brake Coil Voltage/ Letter Designation	Switching	Connection	Max Current (amps)	List Price
ALL	412049801K	460	414	B Fullwave	NONE-connect across motor terminals	ac terminal block dc terminal block	.3	$240.00
ALL	412049811K	460	207	M Halfwave	NONE-connect across motor terminals	ac terminal block dc terminal block	.6	$240.00

QuickSet/QuickRelease or 414 Vdc Wattsaver

Brake Sizes	Part Number	Max Ambient Temp	AC Input 50/60 Hz	DC Output	Brake Coil Voltage/ Letter Designation	Switching	Connection	Max Current (amps)	List Price
72-230	412049601K	45°C	460	414 Vdc over-excitation	M	ac side only or connect across motor terminals	ac terminal block dc terminal block	1.0	$960.00
				207 Vdc sustaining				0.5	

575 Vac Input Voltage

**At 50 Vdc coil voltage, this rectifier can be used on brake sizes 72-112. At 103 Vdc coil voltage, this rectifier can be used on brake sizes 72-196. At all other listed coil voltages, this rectifier can be used on any brakes size.

Half Wave

Brake Sizes	Part Number	AC Input 50/60 Hz	DC Output	Brake Coil Voltage/Letter Designation	Switching	Connection	Max Current (amps)	List Price
ALL	412059101K UL E71115	400	180	L	ac side only or connect across motor terminals	ac leads dc terminal block	.8	$92.00
		575	259	S				
ALL	412059103K	400	180	L	ac side only or connect across motor terminals	ac leads dc leads	.8	$92.00
		575	259	S				

Combination Full and Half Wave

Brake Sizes	Part Number	AC Input	DC Output	Brake Coil Voltage/ Letter Designation	Switching	Connection	Max Current (amps)	List Price
**	412049101K	115/230 460/575	50/103 207/259 414/517	50 Vdc = G 103 Vdc = K 207 Vdc = M 259 Vdc = S 414 Vdc = B 517 Vdc = A	ac or dc side or connect across motor terminals	ac terminal block dc terminal block	.8	$180.00

QuickSet

Brake Sizes	Part Number	AC Input 50/60 Hz	DC Output	Brake Coil Voltage/ Letter Designation	Switching	Connection	Max Current (amps)	List Price
ALL	412059811K	575	258	S	NONE-connect across motor terminals	ac terminal block dc terminal block	.6	$240.00

TOR-AC with Line Filter - Half Wave

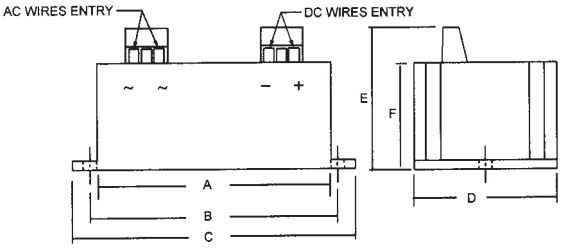
Brake Sizes	Part Number	AC Input 50/60 Hz	DC Output	Brake Coil Voltage/ Letter Designation	Switching	Connection	Max Current (amps)	List Price
ALL	412059411K	575	259	S	ac side only	terminals	.6	$204.00
	412059412K					leadwires		

AC Rectifiers Continued

Rectifier Dimensions

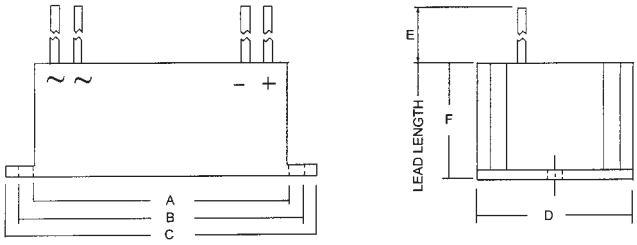
Tape Mount

Part Number	Length	Width	Ht	Connection	
				AC	DC
4-1-20291-01K	1.4	0.6	1.0	Leadwire, 7” long	Terminal
4-1-20292-01K	1.38	1.06	0.94	Terminal	Terminal
4-1-20292-03K	1.38	1.06	0.9	Leadwire, 2.5” long	Leadwire, 2.5” long
4-1-20491-01K	2.25	1.25	1.0	Terminal	Terminal
4-1-20591-03K	1.4	0.75	0.9	Leadwire, 7” long	Leadwire, 7” long
4-1-20591-01K	1.4	0.75	1.0	Leadwire, 7” long	Terminal



Terminal location or connection may differ from sketch
Flange or Tape Mount

Part Number	A	B	C	D	E	F
4-1-20293-01K	4.6	5	5.5	3.3	2.03	1.25
4-1-20294-01K	3	3.5	4	2	2	1.5
4-1-20296-01K	3	3.5	4	3	2	1.5
4-1-20493-01K	2	2.5	3	1.5	1.6	1
4-1-20494-04K	3	3.5	4	2	2	1.5
4-1-20494-11K	3	3.5	4	2	2	1.5
4-1-20494-13K	3	3.5	4	2	2	1.5
4-1-20496-01K	4.6	5	5.5	3.3	2	1.25
4-1-20498-01K	3	3.5	4	3	2	1.5
4-1-20498-11K	2	2.38	2.6	2	2.1	1.3
4-1-20594-11K	3	3.5	4	2	2	1.5
4-1-20598-11K	2	2.38	2.6	2	2.1	1.3
4-1-20196-11K	4.6	5	5.5	3.3	2.03	1.25

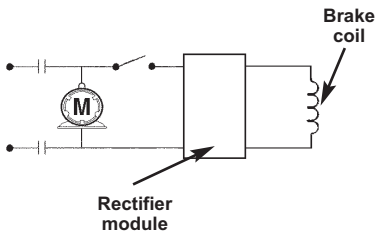


Part Number	A	B	C	D	E	F	Mount
4-1-20494-01K	2.3			1.32	6	0.86	Tape
4-1-20294-02K	3	3.5	4	2	6	1.5	Flange
4-1-20494-05K	3	3.5	4	2	6	1.5	Flange
4-1-20494-12K	3	3.5	4	2	6	1.5	Flange
4-1-20494-14K	3	3.5	4	2	6	1.5	Flange
4-1-20594-12K	3	3.5	4	2	6	1.5	Flange

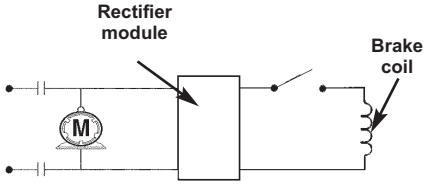
Wiring Diagrams/Switching

NOTE: For brake response times with and without AC rectifiers see page 101

AC Side Switching

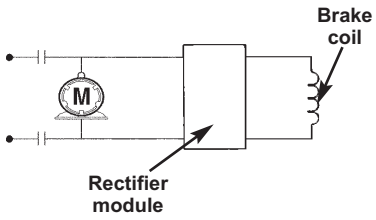


DC Side Switching



Use DC side switching with the following Rectifiers ONLY: 4-1-20291-01K, 4-1-20292-01K, 4-1-20292-03K, 4-1-20493-01K, 4-1-20491-01K

Connected Across Motor Terminals (No switching)



Electronic Brake Release Indicator (Proving Switch)
Armature-Actuated Brake Series

Indicates when the brake is released by sensing the change in the brake coil current waveform.
For use with the Series 333/350/360 brakes



Features

- *Mount in remote location (control cabinet)*
- *Operating temperature -40°C through 65°C*
- *Not susceptible to common problems of mechanical switches, such as mechanical fatigue, tolerances, and vibration.*
- *Relay contacts are silver-cadmium oxide*
- *Utilize either normally-open contacts (UL rated 2-20A, inductive or resistive, at 12-240 VAC and CSA rated 10A, inductive or resistive at 240 VAC) or normally-closed contacts (UL rated 2-10A, inductive or resistive, at 12-240 VAC and CSA rated 10A, inductive or resistive, at 240 VAC)*

Wiring Instructions: See sheet P/N 8-178-000-03

Brake Operation

When electrical power is applied to the armature-actuated brake coil, the armature is attracted by the electromagnetic force generated by the magnet body, which overcomes spring action. This allows the friction disc to rotate freely. When electrical power is interrupted, the electromagnetic force is removed and the pressure spring mechanically forces the armature plate to clamp the friction disc between itself and the pressure plate. This develops torque to stop or hold the load.

Switch Operation

When the brake armature is pulled in to the magnet body to release the brake, a change in the brake coil current waveform occurs. By tracking this change in the brake coil current, the electronic switch indicates when the brake is released.

Ordering Information

List Price	Discount Symbol
$330.00	R3

Part Number Example: 4 - 4 - 0 7 0 9 0 - X X

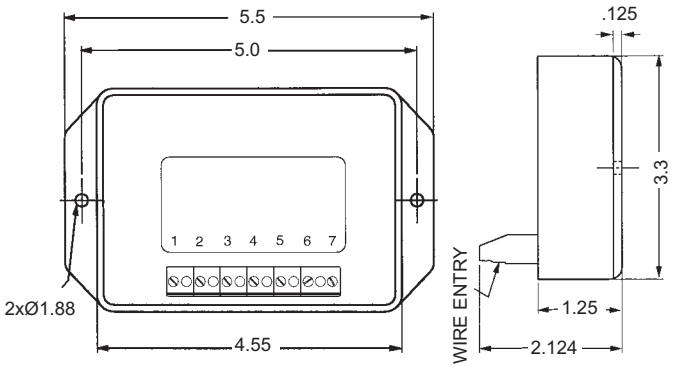
DC Voltage*	Characters To Insert
24	024
90	090
103	103
180	180
205	205
258	258
414	414

*Standard voltages listed. For other voltages, contact factory.

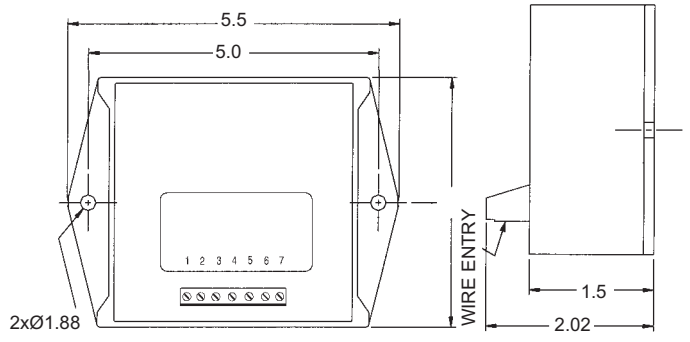
Specify brake model number. The last 2 digits of the switch part number will depend upon the brake size

Dimensions

414V Unit



24V thru 240V Units



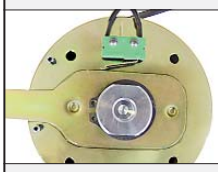
*Standard voltages listed. For other voltages, contact factory.

NOTE: Cannot be used with half-wave rectifier. Use with full-wave or TOR-AC full-wave rectifier only.

Armature Actuated Brake Modifications

BACK TO TABLE OF CONTENTS

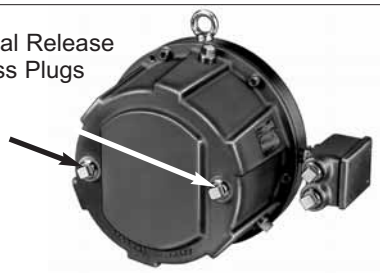
Series 320/321/322

<table>
<tr><th>Modification</th><th>Series</th><th>Brake Size</th><th>List Price</th></tr>
<tr><td colspan="4">Maintained Manual Release</td></tr>
<tr><td>  </td><td>320/321/322</td><td>1.2
1.8
2.0
2.8</td><td>$50.00
$60.00
$60.00
$60.00</td></tr>
<tr><td colspan="4">Non-Maintained Manual Release</td></tr>
<tr><td>  </td><td>320/321/322</td><td>1.2
1.8
2.0
2.8</td><td>$50.00
$60.00
$60.00
$60.00</td></tr>
<tr><td colspan="4">Brake Release Indicator Switch</td></tr>
<tr><td> 
Manual release engaged</td><td>320/321/322</td><td>ALL</td><td>$80.00</td></tr>
<tr><td colspan="4">AC Rectifiers, In-Line</td></tr>
<tr><td>  </td><td>310/320/321/322</td><td>ALL (Except Quick Set)
Quick Set</td><td>$50.00
$80.00</td></tr>
<tr><td>AC Rectifiers, Internal</td><td>320/321/322</td><td>1.8 and 2.8</td><td>$30.00</td></tr>
<tr><td colspan="4">Encoder Mount</td></tr>
<tr><td>  </td><td>310/320/321/322 tapped holes in magnet body for tether mount</td><td></td><td>$50.00</td></tr>
<tr><td colspan="4">Through-Shaft</td></tr>
<tr><td rowspan="2">  </td><td>320</td><td>See catalog pg.</td><td>N/C</td></tr>
<tr><td>321/322</td><td>ALL
(through-shaft combined with manual release only available on size 2.8)</td><td>$10.00</td></tr>
<tr><td colspan="4">Mounting Plates</td></tr>
<tr><td>  </td><td>320/321/322</td><td colspan="2"><table><tr><th>Size</th><th>Bolt Circle</th><th>List Price</th></tr><tr><td>1.2</td><td>2.5/2.62”</td><td>$40.00</td></tr><tr><td>1.8, 2.8</td><td>3.5”</td><td>$30.00</td></tr><tr><td>1.8, 2.8</td><td>3.5”, 2.5” register</td><td>$60.00</td></tr><tr><td>2.0</td><td>2.844”</td><td>$40.00</td></tr></table></td></tr>
<tr><td>Double “D” Disc</td><td></td><td></td><td></td></tr>
<tr><td>  </td><td>320/321/322</td><td>1.2, 1.8, and 2.0
Contact factory for Double “D” disc on brakes rated greater than 7 lb-in</td><td>No charge</td></tr>
<tr><td>Carrier Ring Disc</td><td>320/321/322</td><td>1.8</td><td>$20.00</td></tr>
</table>

Armature Actuated Brake Modifications

BACK TO TABLE OF CONTENTS

Series 333/350/360

Modification	Series	Brake Size	List Price Adder
Maintained Manual Release			
 	333	ALL	size 72 $86.00 size 90 $100.00 size 112 $110.00 size 132 $126.00 size 145 $140.00 size 170 $160.00 size 196 $300.00 size 230 $368.00 size 278 $550.00
Manual Release Access Plugs 	350/360	ALL	Standard feature
Non-Maintained Manual Release			
333  360 	333	ALL	size 72 $86.00 size 90 $100.00 size 112 $110.00 size 132 $126.00 size 145 $140.00 size 170 $160.00 size 196 $300.00 size 230 $368.00 size 278 $550.00
	360	ALL	size 170 $500.00 size 196-278 $600.00
Electronic Brake Release Indicator Switch			
	333/350/360	ALL	$660.00
Electronic Wear Indicator Switch	333/350/360	ALL	$660.00
AC Rectifiers, In-Line	333	size 72-90 115 Vac size 72-112 230 Vac	$92.00 standard in-line $140.00 in-line quickset
AC Rectifiers, Separate	333/350/360	ALL	see rectifier pages
Conduit Box			
	333/350/360	ALL	$410.00
	350/360 with IP67 conduit box	ALL	$720.00

Series 333/350/360 Modifications

Modification	Series	Brake Size	List Price
Band Seal (Boot)			
	333	ALL	size 72 $22.00 size 90 $24.00 size 112 $28.00 size 132 $40.00 size 145 $68.00 size 170 $100.00 size 196 $126.00 size 230 $150.00 size 278 $180.00
End Cap Plug			
	333	ALL	size 72 $20.00 size 90 $30.00 size 112 $40.00 size 132 $50.00 size 145 $90.00 size 170 $90.00 size 196 $100.00 size 230 $120.00 size 278 $150.00
Space Heater			
	333/350/360	ALL	Sizes 72-112 $232.00 Sizes 132-278 $416.00
Tach Machining			
	333 tapped holes in magnet body for tether mount	ALL	$50.00
	350/360 Machining on brake housing	ALL	Size 170 $1,628.00 Sizes 196-278 $2,040.00
Through-Shaft			
	333 through-shaft seal in magnet body	ALL	Sizes 72-170 $352.00 Sizes 196-278 $752.00
	350/360 through-shaft hole in housing with shaft seal	ALL	$752.00

Technical Data

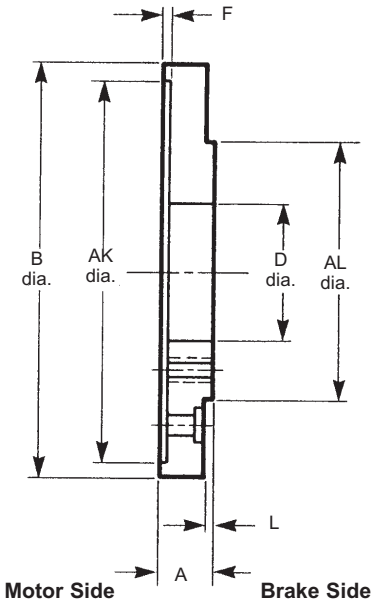
SAB Motor Frame Adapter Dimensions

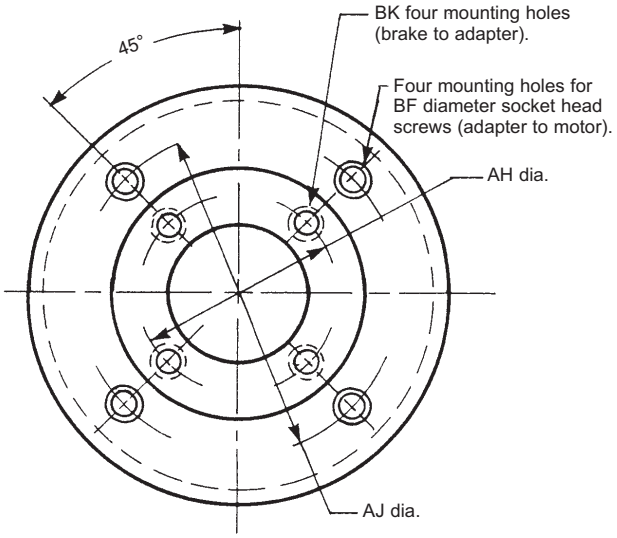
Selection

To select an adapter for a specific brake, refer to the *Motor Frame Adapter* Tables as shown in the brake series sections of this Catalog. After selecting the adapter stock number, refer to the Tables below for dimensions.

All adapters are constructed with an opening for internal lead wire connection, corresponding to the NEMA standard location for the motor frame size.

Screws for mounting adapter to motor must be provided by customer. Socket head cap screws are supplied for mounting brake to adapter.





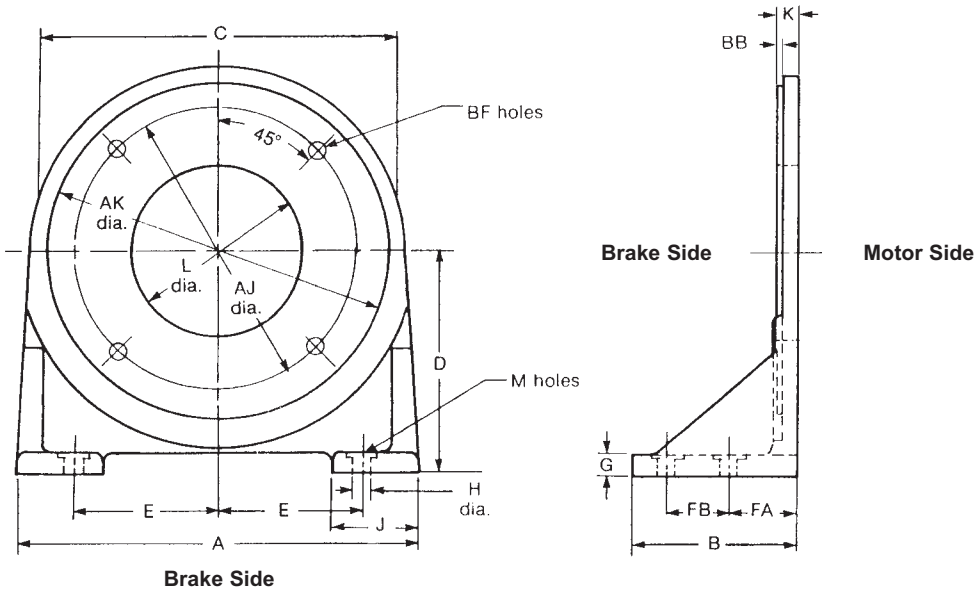
Dimensions for estimating only. For installation purposes, request certified prints.

Brake Series	Torque (lb-ft)	Adapter Stock Number	Dimensions in Inches (Dimensions in Millimeters)											Add'l Shaft Length Req'd	List Price	Discount Symbol
			A	AH	AJ	AK	AL	B	BF	BK Hole	D	F	L			
56,000	1.5 - 6	5-55-5041-00	1.25 (31.75)	5.88 (149.22)	7.25 (184.15)	8.500 8.502 (215.900) (215.951)	4.497 4.500 (114.325) (114.275)	9.00 (228.60)	.50 (12.70)	3/8 - 16 x 1/2 deep	4.00 (101.60)	.19 (4.76)	.12 (3.18)	.94 (23.88)	$700	B4
65,300*		5-55-5046-00														
56,000 and 56,800*	10 - 25	5-55-5043-00													$700	B4
87,000 and 87,800*	6 - 105	5-55-7046-00	1.06 (26.99)	7.25 (184.15)	11.00 (279.40)	12.501 12.504 (317.525) (317.602)	8.499 8.497 (215.875) (215.849)	13.00 (330.20)	.62 (15.88)	1/2 - 13 through	4.12 (104.78)	.19 (4.76)	.38 (9.52)	.87 (22.10)	$875	B2
87,300		5-55-7054-00													$1,850	
87,000 and 87,800*	6 - 105	5-55-7055-00	1.00 (25.40)		9.00 (228.60)	10.500 10.502 (266.700) (266.751)	8.499 8.497 (215.875) (215.849)	11.00 (279.40)	**		6.25 (158.75)		.25 (6.35)	.81 (20.57)	$450	B2
87,300*		5-55-7045-00													$1,800	
87,000, 87,800* and 87,300*	6 - 105	5-55-7043-00	.75 (19.05)	7.25 (184.15)	5.88 (149.35)	4.502 4.507 (114.35) (114.48)	8.499 8.497 (215.875) (215.849)	8.75 (222.25)	.62 (15.75)	1/2 - 13 through	4.00 (101.60)	.19 (4.76)	.25 (6.35)	.56 (14.23)	$1,300	B2
81,000	125 - 130	5-55-2045-00	1.06 (26.99)	11.00 (279.40)	14.00 (355.60)	16.002 16.005 (406.451) (406.527)	12.499 12.496 (317.475) (317.398)	16.50 (419.10)	.62 (15.88)	5/8 - 11 through	9.75 (247.65)	.19 (4.76)	.25 (6.35)	.87 (22.10)	$1,875	C1
81,000	125 - 230	5-55-2041-00	1.12 (28.58)	11.00 (279.40)	7.25 (184.15)	8.500 8.502 (215.900) (215.951)	12.499 12.496 (317.475) (317.398)	12.499 12.496 (317.475) (317.398)	.50 (12.70)	5/8 -11 through	6.00 (152.40)	.19 (4.76)	---	.93 (23.62)	$1,325	C1
81,000		5-55-2043-00			9.00 (228.60)	10.500 10.502 (266.700) (266.751)					7.75 (196.85)			.93 (23.62)		C1
82,000 and 82,300*	125 - 440	5-55-2046-00	1.94 (49.21)	11.00 (279.40)	14.00 (355.60)	16.002 16.005 (406.451) (406.527)	12.499 12.496 (317.475) (317.398)	16.50 (419.10)	.62 (15.88)	5/8 - 11 x 1 deep	9.50 (241.30)	.19 (4.76)	.25 (6.35)	1.75 (44.45)	$1,875	C1
82,000 and 82,300*		5-55-2042-00	1.38 (34.92)		7.25 (184.15)	8.500 8.502 (215.900) (215.951)		13.25 (336.55)	.50 (12.70)	5/8 -11 through	6.00 (152.40)			1.19 (30.23)	$1,325	C1
82,000 and 82,300*		5-55-2044	1.38 (34.92)		9.00 (228.60)	10.500 10.502 (266.700) (266.751)		13.25 (336.55)			7.75 (196.85)			1.19 (30.23)	$2,075	C1
86,000	500 - 1000	5-55-6041-00	1.56 (38.69)	14.00 (355.60)	11.00 (379.40)	12.500 12.504 (317.500) (317.602)	16.000 15.995 (406.400) (406.273)	16.19 (441.16)	.62 (15.88)	5/8 - 11 x 3/4 deep	8.62 (219.08)	.19 (4.76)	.25 (6.35)	1.37 (34.80)	$2,800	C1

* 1/2-13 flat head screws are supplied with adapter.

** When adding an adapter to a hazardous location brake, refer to the "mounting requirements" on the product page for the recommended brake series for accommodating adapters.

Foot Mounting Kits



Kits include the foot mounting bracket and hardware to fit the BF mounting holes.

Dimensions for estimating only. For installation purposes, request certified prints.

Brake Series	Torque	Foot Mounting Kit Number	Dimensions in Inches *(Dimensions in Millimeters)*																		Wgt.	List Price	Discount Symbol
			A	AJ	AK	B	BB	BF No.	BF Thd.	C	D	E	FA	FB	G	H	J	K	L	M No.	lbs.		
56,000	1.5-25	5-55-5023-00	7.00 (177.80)	5.88 (149.22)	4.499 / 4.498 (114.275 / 114.249)	2.38 (60.32)	.12 (3.18)	2	3/8-16	6.50 (165.10)	3.50 (88.90)	2.88 (73.02)	1.50 (38.10)	–	.38 (9.52)	.41 (10.32)	1.50 (38.10)	.50 (12.70)	2.50 (63.50)	2	4.5	$500.00	B4
87,000	6-105	5-55-7021-00	8.62 (219.08)	7.25 (184.15)	8.499 / 8.498 (215.875 / 215.849)	3.00 (76.20)	.25 (6.35)	4	1/2-13	8.62 (218.95)	5.00 (127.00)	3.56 (90.49)	2.00 (50.80)	–	.38 (9.52)	.53 (13.49)	1.62 (41.28)	.56 (14.29)	5.75 (146.05	2	7	575.00	B2
81,000	125-230	5-55-2022-00	15.50 (393.70)	11.00 (279.40)	12.499 / 12.498 (317.475 / 317.449)	7.00 (177.80)	.25 (6.35)	4	5/8-11	13.25 (336.55)	8.50 (215.90)	6.88 (174.62)	2.00 (50.80)	4.00 (101.60)	.62 (15.88)	.69 (17.46)	3.00 (76.20)	.88 (22.22)	9.00 (228.60)	4	40	1,325.00	C1
82,000	125-550																						
86,000	500-1000	5-55-6021-00	18.25 (463.55)	14.00 (355.60)	16.000 / 15.995 (406.400 / 406.273)	8.00 (203.20)	.22 (5.56)	4	5/8-11	17.00 (431.80)	10.88 (276.22)	6.38 (161.92)	3.38 (85.72)	3.00 (76.20)	1.00 (25.40)	.81 (20.64)	4.12 (104.78)	1.22 (30.96)	8.50 (215.90)	4	75	3,900.00	C1

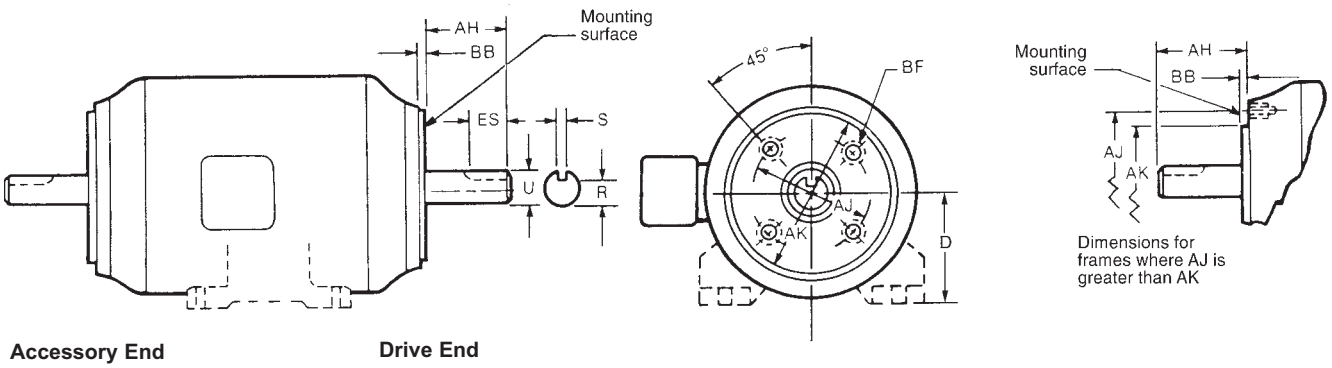
Dimensions for C-Face Brake Motor Systems

BACK TO TABLE OF CONTENTS

Brakes Externally Wired to Motor

C-face motor with double shaft extension.

Stearns Disc Brakes are designed to mount on standard C-face motors having the same dimensions and tolerances on the accessory end as on the drive end. They also mount on foot mounting brackets and machine mounting faces having the same mounting dimensions and tolerances. Some motor accessory end C-face may differ from the drive end.



Accessory End **Drive End**

Drive End Dimensions (Inches)

Frame Designation	AJ	AK	BB Min.	BF Hole			U	AH	Keyseat			Base to Centerline D
				Number	Tap Size	Bolt Penetration Allowance			R	ES Min.	S	
42C	3.750	3.000	0.16	4	1/4-20	. . .	0.375	1.312	0.328	. . .	flat	2.62
48C	3.750	3.000	0.16	4	1/4-20	. . .	0.500	1.69	0.453	. . .	flat	3.00
56C	5.875	4.500	0.16	4	3/8-16	. . .	0.625	2.06	0.517	1.41	0.188	3.50
143TC and 145TC	5.875	4.500	0.16	4	3/8-16	0.56	0.875	2.12	0.771	1.41	0.188	3.50
182TC and 184TC	7.250	8.500	0.25	4	1/2-13	0.75	1.125	2.62	0.986	1.78	0.250	4.50
182TCH and 184TCH	5.875	4.500	0.16	4	3/8-16	0.56	1.125	2.62	0.986	1.78	0.250	4.50
213TC and 215TC	7.250	8.500	0.25	4	1/2-13	0.75	1.375	3.12	1.201	2.41	0.312	5.25
254TC and 256TC	7.250	8.500	0.25	4	1/2-13	0.75	1.625	3.75	1.416	2.91	0.375	6.25
284TC and 286TC	9.000	10.500	0.25	4	1/2-13	0.75	1.875	4.38	1.591	3.28	0.500	7.00
284TSC and 286TSC	9.000	10.500	0.25	4	1/2-13	0.75	1.625	3.00	1.416	1.91	0.375	7.00
324TC and 326TC	11.000	12.500	0.25	4	5/8-11	0.94	2.125	5.00	1.845	3.91	0.500	8.00
324TSC and 326TSC	11.000	12.500	0.25	4	5/8-11	0.94	1.875	3.50	1.591	2.03	0.500	8.00
364TC and 365TC	11.000	12.500	0.25	8	5/8-11	0.94	2.375	5.62	2.021	4.28	0.625	9.00
364TSC and 365TSC	11.000	12.500	0.25	8	5/8-11	0.94	1.875	3.50	1.591	2.03	0.500	9.00
404TC and 405TC	11.000	12.500	0.25	8	5/8-11	0.94	2.875	7.00	2.450	5.65	0.750	10.00
404TSC and 405TSC	11.000	12.500	0.25	8	5/8-11	0.94	2.125	4.00	1.845	2.78	0.500	10.00
444TC and 445TC	14.000	16.000	0.25	8	5/8-11	0.94	3.375	8.25	2.880	6.91	0.875	11.00
444TSC and 445TSC	14.000	16.000	0.25	8	5/8-11	0.94	2.375	4.50	2.021	3.03	0.625	11.00
500 Frame Series	14.500	16.500	0.25	4	5/8-11	0.94	. . .	. . .	. . .	. . .	. . .	12.50

Tolerances (Inches)

AK Dimension, Face Runout, Permissible Eccentricity of Mounting Rabbet

AK Dimension	Tolerance on AK Dimension		Maximum Face Runout	Maximum Permissible Eccentricity of Mounting Rabbet
	Plus	Minus		
Less than 12	0.000	0.003	0.004	0.004
12 and Larger	0.000	0.005	0.007	0.007

Shaft Extension Diameters

Shaft Diameter	Tolerances	
	Plus	Minus
0.2500 to 1.5000, inclusive	0.000	0.0005
Over 1.5000 to 6.500, inclusive	0.000	0.001

Width of Shaft Extension Keyseats

Width of Keyseat	Tolerances	
	Plus	Minus
0.188 to 0.750, inclusive	0.002	0.000
Over 0.750 to 1.500, inclusive	0.003	0.000

Shaft Runout

Shaft Diameter	Maximum Permissible Shaft Runout
0.3750 to 1.625, inclusive	0.002
Over 1.625 to 6.500, inclusive	0.003

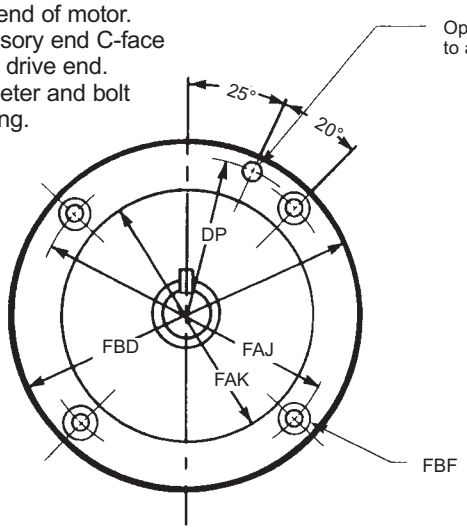
SOURCE: ANSI/NEMA Standards Publication No. MG 1-1987; Part 4 and Part 11.

Dimensions for C-Face AC Brake Motor System (cont.)

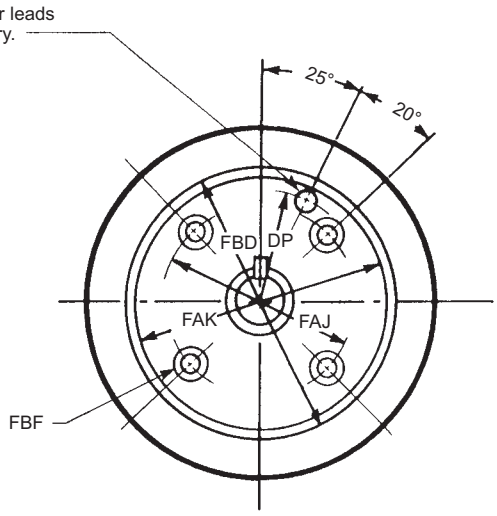
BACK TO TABLE OF CONTENTS

Accessory End

FC face mounting for accessories, including brakes, on the end opposite the drive end of motor. Some motor accessory end C-face may differ from the drive end. Confirm shaft diameter and bolt circle before ordering.



143TFC to 184TFC Frames, Inclusive



213TFC to 326TFC Frames, Inclusive

Dimensions (Inches)

Frame Designation	FAJ	FAK	FBD Max.	FBF Hole			Hole for Accessory Leads	
				Number	Tap Size	Bolt Penetration Allowance	DP	Diameter
143TFC and 145TFC	5.875	4.500	6.50	4	3/8-16	0.56	2.81	0.41
182TFC and 184TFC	5.875	4.500	6.50	4	3/8-16	0.56	2.81	0.41
213TFC and 215TFC	7.250	8.500	9.00	4	1/2-13	0.75	3.81	0.62
254TFC and 256TFC	7.250	8.500	10.00	4	1/2-13	0.75	3.81	0.62
284TFC and 286TFC	9.000	10.500	11.25	4	1/2-13	0.75	4.50	0.62
324TFC and 326TFC	11.000	12.500	14.00	4	5/8-11	0.94	5.25	0.62

NOTE: Standards have not been developed for the shaft extenison diameter and length, and keyseat dimensions.

Tolerances* (Inches)

FAK Dimension, Face Runout, Permissible Eccentricity of Mounting Rabbet

FAK Dimension	Tolerance on FAK Dimension		Maximum Face Runout	Maximum Permissible Eccentricity of Mounting Rabbet
	Plus	Minus		
Less than 12	0.000	0.003	0.004	0.004
12 and Larger	0.000	0.005	0.007	0.007

* Tolerance requirement on 56,X00 and 87,000 Series Brake kits is .015 T.I.R. (total indicated runout shaft to motor register face).

Shaft Runout

Shaft Diameter	Maximum Permissible Shaft Runout
0.3750 to 1.625, inclusive	0.002
Over 1.625 to 6.500, inclusive	0.003

SOURCE: ANSI/NEMA Standards Publication No. MG 1-1987; Part 4 and Part 11.

Stearns Recommended Minimum Shaft Diameter by Torque

Minimum recommended shaft size considers a keyed C1045 steel shaft under *dynamic* use in a typical spring set brake application.

Torque ft-lb	Minimum Shaft (inches)
0.50	0.250
0.75	0.250
1.5	0.375
3	0.500
6	0.500
10	0.625
15	0.750
25	0.875
35	1.000
50	1.125

Torque ft-lb	Minimum Shaft (inches)
75	1.250
105	1.375
125	1.375
175	1.625
230	1.750
330	2.000
440	2.125
500	2.375
750	2.500
1000	2.750

Torque Nm	Minimum Shaft (mm)
4 Nm	ø10 mm
8 Nm	ø13 mm
16 Nm	ø16 mm
32 Nm	ø20 mm
60 Nm	ø25 mm
80 Nm	ø28 mm
150 Nm	ø34 mm
240 Nm	ø39 mm
400 Nm	ø47 mm

Set and Release Times

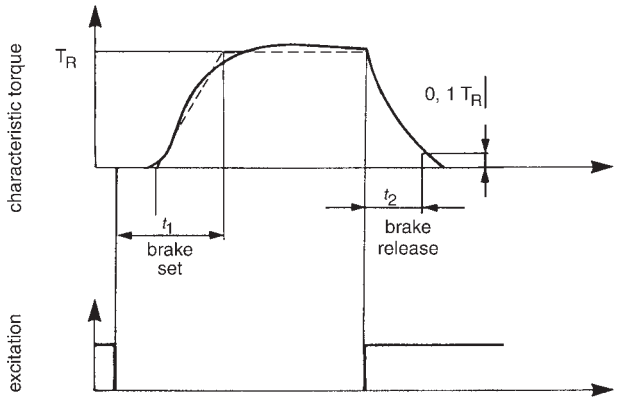
BACK TO TABLE OF CONTENTS

The models listed below were tested for typical set and release times. Times listed below are defined as follows:

T1 = Total set time to 80% of rated static torque

T2 = Release time, measured as the time from when the power is applied to the brake to the time that the solenoid plunger or armature is fully seated.

NOTE: Times will vary with the motor used, and brakes tested with factory-set air gap. The times shown should be used as a guide only.



SAB T1/T2 Time in Milliseconds

Series	Static Torque lb-ft	Coil Size	T1 AC	T2 AC
56,000	1 1/2 – 25	K4, K4, K4+, M4+	25	14
87,000	10,15, 25,50	5 & 6	42	20
87,000	35,75,105	8	48	20
81,000 82,000	All	9	56	27

Brake and motor are switched separately.
All brakes tested in horizontal position.
Coil is energized for >24 hours before testing.
Ambient temperature 70°F at time of test.

AAB Series 310/311/320/321 Times in Milliseconds

Series	310 DC Side Switching					
Size	**1.79**	**2.0**	**2.87**	**3.35**	**4.25**	**5.0**
T1	3	6	9	14	13	22
T2	20	43	48	110	120	195
Series	**311 DC Side Switching**					
Size	**3.38**	**4.75**	**5.0**			
T1	43	48	96			
T2	12	74	35			
Series	**320 DC Side Switching**					
Size	**1.2**	**1.8**	**2.0**	**2.8**		
T1	14	43	16	27		
T2	24	26	35	34		
Series	**320 Full wave rectifier/AC Side Switching**					
Size	**1.2**	**1.8**	**2.0**	**2.8**		
T1	31	97	52	78		
T2	27	29	40	42		
Series	**321 DC Side Switching**			**321 AC Side Switching**		
Size	**1.2**	**1.8**	**2.8**	**1.2**	**1.8**	**2.8**
T1	13	16	20	45	77	131
T2	18	27	49	16	25	26

AAB Series 333 Times in Milliseconds

Size	Applied Voltage/Type of Switching	T1	T2
72	DC side switching	23	35
	230 Vac/ac side switching/full wave	103	39
	460 Vac/ac side switching/half wave	98	34
90	DC side switching	19	73
	230 Vac/ac side switching/full wave	113	72
	460 Vac/ac side switching/half wave	114	73
	230 Vac connected across motor full wave	357	72
	230 Vac connected across motor /quickset	42	72
112	DC side switching	155	39
	230 Vac/ac side switching/full wave	547	43
	460 Vac/ac side switching/half wave	501	54
132	DC side switching	119	100
	230 Vac/ac side switching/full wave	833	101
	460 Vac/ac side switching/half wave	803	106
145	DC side switching	185	186
	230 Vac/ac side switching/full wave	999	192
	460 Vac/ac side switching/half wave	1007	209
	230 Vac connected across motor full wave	1689	192
	230 Vac connected across motor /quickset	368	192
	460 Vac/ac side switching/half wave/With air gap shim	629	223
170	DC side switching	129	163
	230 Vac/ac side switching/full wave	1130	174
	460 Vac/ac side switching/half wave	1140	175
196	DC side switching	96	263
	230 Vac/ac side switching/full wave	920	264
	460 Vac/ac side switching/half wave	957	274
230	DC side switching	131	264
	230 Vac/ac side switching/full wave	1299	236
	460 Vac/ac side switching/half wave	1303	276
	Tor-Ac 230 Vac/ac side switching/full wave	169	295
	Tor-Ac 230 Vac/ac side switching/full wave/ With air gap shim	122	327
	230 Vac connected across motor quickset/quickrelease/with air gap shim	122	145
278	DC side switching	182	388
	230 Vac/ac side switching/full wave	1807	389
	460 Vac/ac side switching/half wave	1689	366

Conversions

BACK TO TABLE OF CONTENTS

English-Metric Conversion Factors

Multiply the base unit by the factor shown to obtain the desired conversion.

Measurement	Base Unit	Factor	Conversion
Length	inch, in *(millimeter, mm)*	25.4 .03937	*(millimeter, mm)* inch, in
Torque	pound-feet, lb-ft *(newton-meter, Nm)* pound-inch, lb-in *(newton-meter, Nm)* ounce-inch, oz-in *(newton-meter, Nm)*	1.355818 .73756 .113 8.85 .007062 141.611	*(newton-meter, Nm)* pound-feet, lb-ft *(newton-meter, Nm)* pound-inch, lb-in *(newton-meter, Nm)* ounce-inch, oz-in
Moment of Inertia	pound-feet squared, lb-ft² *(kilogram-meter squared, kgm²)*	.04214 23.73	*(kilogram-meter squared, kgm²)* pound-feet squared, lb-ft²
Kinetic Energy	foot-pound, ft-lb *(joule, J)*	1.355818 .73756	*(joule, J)* foot-pound, ft-lb
Weight	pound, lb *(kilogram, kg)*	.453592 2.20462	*(kilogram, kg)* pound, lb
Horsepower (English)	horsepower, hp *(kilowatt, kW)*	.7457 1.341	*(kilowatt, Kw)* horsepower, hp
Thermal Capacity	horsepower-seconds per minute, hp-sec/min *(watts, W)*	12.42854 .08046	*(watts W)* horsepower-seconds per minute, hp-sec/min
Temperature	degrees Fahrenheit,°F *(degrees Celsius, °C)*	(°F – 32) x 5/9 (°C x 9/5) + 32	*(degrees Celsius, °C)* degrees Fahrenheit, °F

English-English Conversion Factors for Thermal Capacity

Base Unit	Multiply by	To Obtain
horsepower	60.0	hp-sec/min
ft-lb/sec	.109	hp-sec/min
ft-lb/min	.0018	hp-sec/min
in-lb/sec	.009	hp-sec/min
in-lb/min	.00015	hp-sec/min

Decimal Equivalents of Fractions

Decimal Equivalent (Inches)		Fraction (Inches)
2-Place	3-Place	
.02	.016	1/64
.03	.031	1/32
.05	.047	3/64
.06	.062	1/16
.08	.078	5/64
.09	.094	3/32
.11	.109	7/64
.12	.125	1/8
.14	.141	9/64
.16	.156	5/32
.17	.172	11/64
.19	.188	3/16
.20	.203	13/64
.22	.219	7/32
.23	.234	15/64
.25	.250	1/4
.27	.266	17/64
.28	.281	9/32
.30	.297	19/64
.31	.312	5/16
.33	.328	21/64
.34	.344	11/32
.36	.359	23/64
.38	.375	3/8

Decimal Equivalent (Inches)		Fraction (Inches)
2-Place	3-Place	
.39	.391	25/64
.41	.406	13/32
.42	.422	27/64
.44	.438	7/16
.45	.453	29/64
.47	.469	15/32
.48	.484	31/64
.50	.500	1/2
.52	.516	33/64
.53	.531	17/32
.55	.547	35/64
.56	.562	9/16
.58	.578	37/64
.59	.594	19/32
.61	.609	39/64
.62	.625	5/8
.64	.641	41/64
.66	.656	21/32
.67	.672	43/64
.69	.688	11/16
.70	.703	45/64
.72	.719	23/32
.73	.734	47/64
.75	.750	3/4

Decimal Equivalent (Inches)		Fraction (Inches)
2-Place	3-Place	
.77	.766	49/64
.78	.781	25/32
.80	.797	51/64
.81	.812	13/16
.83	.828	53/64
.84	.844	27/32
.86	.859	55/64
.88	.875	7/8
.89	.891	57/64
.91	.906	29/32
.92	.922	59/64
.94	.938	15/16
.95	.958	61/64
.97	.969	31/32
.98	.984	63/64
1.00	1.000	1

SINPAC Switches: Brief Operating Description

BACK TO TABLE OF CONTENTS

For over 75 years, single-phase motors have utilized a mechanical centrifugal switch to switch the start circuit. Inherent characteristics of a mechanical device have made these switches prone to various problems, including tolerances, tolerance build-ups, mechanical fatigue, vibration and a host of others that can lead to switch failures and/or performance inconsistency.

Our challenge was to design a reliable solid-state switch to replace the mechanical switch and actuator mechanism, and duplicate the function of connecting and disconnecting the start circuit at particular speeds with the additional benefits of a solid-state device. After considerable research, we decided a successful electronic motor starting switch could be created by sensing the voltages present in the main and start windings.

Until the rotor of a single-phase motor begins to rotate, there is no coupling between its start winding and main winding. When the rotor begins to turn, the main winding induces flux in the rotor, which then induces a voltage in the start winding. The voltage induced in the start winding is directly proportional to motor speed.

In Stearns SINPAC Electronic Switches, the voltage across a motor's main winding and the voltage across its start winding are sampled and fed to a comparator. The logic circuitry is designed so that the electronic switch interrupts the start circuit current after the motor has accelerated to the speed at which cut out voltage is developed, generally 75 to 80% of synchronous motor speed. The logic circuitry then shuts down the switch's power stage, which consists of a triac or inverse parallel SCR's. This function is referred to as "cut out." When the start circuit is disconnected, the main winding field then drives the motor's rotor to its running speed.

If the motor encounters an overload, and the motor speed falls to approximately 50% of its synchronous speed, the SINPAC Switch automatically reconnects the motor's start circuit. This function is referred to as "cut in." Cut in detection circuitry constantly monitors start winding voltage. When the motor's speed falls to the cut in point, the detection circuit causes the control logic to energize the SINPAC Switch's power output stage. The motor then goes through its normal startup procedure, with the start circuit being switched out at a motor speed approximately 75 to 80% of synchronous speed.

SINPAC Switches are potted and completely sealed, making it impervious to dust, dirt and moisture. The unique speed sensing circuit provides a universal design which allows a few switches to work on most standard motor designs regardless of manufacturer.

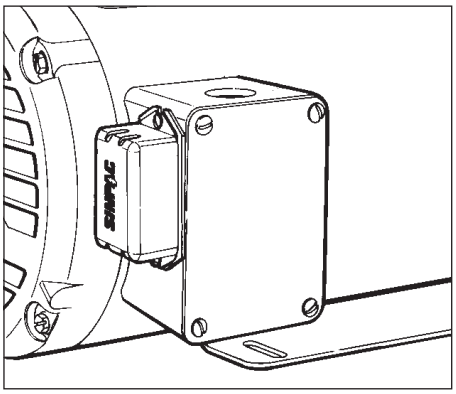
Acceptance by Motor Manufacturers

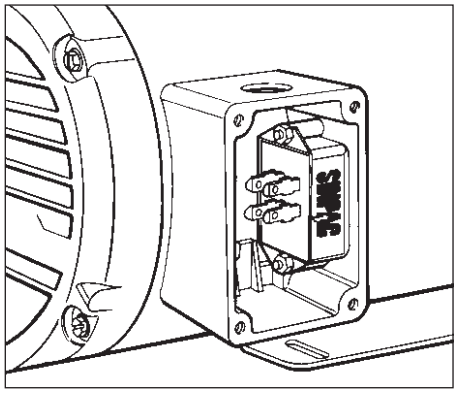
US and foreign motor manufacturers have tested and retested the SINPAC Switch for reliability and quality. Today, many of these manufacturers have begun installing SINPAC Switches on their standard motor lines with more companies ready to make the changeover.

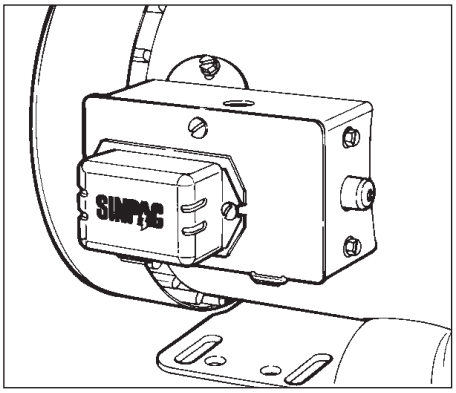
UL Recognition

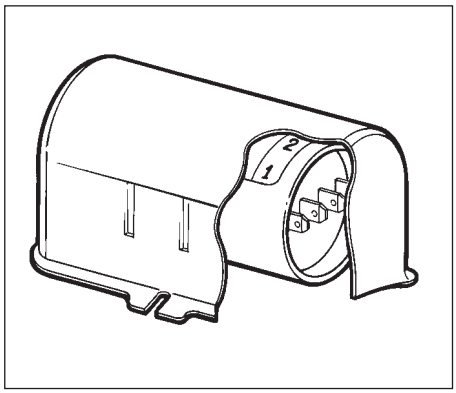
Most SINPAC Switches have already been recognized under the Component Program of Underwriters Laboratories, Inc. (E-71115). In addition, all switches have internal surge protection which is tested according to ANSI/IEEE C62.41 – 1991 Category A3. CSA Certification LR-6254.

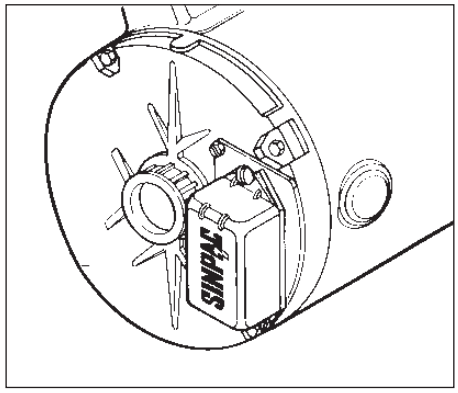
Mounting Options

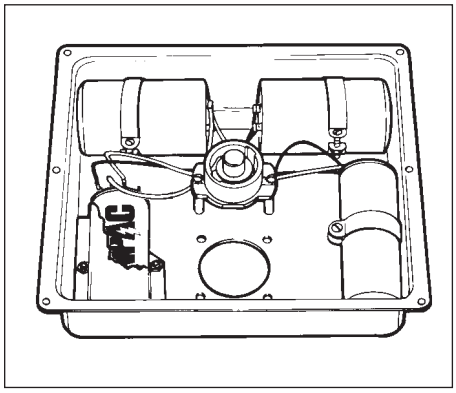






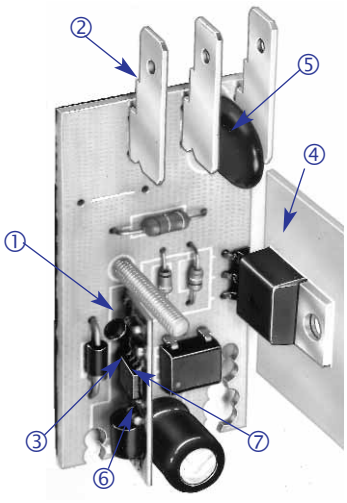






Sinpac Design Features

BACK TO TABLE OF CONTENTS



① ***Electrically Protected.*** Designed to filter out electrical noise, so there is no concern of random switch malfunction.

② ***Reduced Installation Time.*** Easy accessible 1/4 inch terminals and mounting, reduce the amount of time required to install SINPAC Switches or to change out mechanical switches.

③ ***Restart Capability.*** When motor speed drops below 50% of synchronous speed, the start winding is brought back into the circuit to reinitiate starting torque.

④ ***Soldered Heat Sink.*** High cycling.

⑤ ***Transient Protection.*** Transient protection tested per ANSI/IEEE C62.41 - 1991 Category A3.

⑥ ***Universal Design.*** 50/60 Hz operation. Will work on 2, 4 or 6 pole motors of any manufacturer. Reduced inventory.

⑦ ***Line Voltage Compensation.*** No modifications or changes are required for line voltage variations. SINPAC Switches will operate in areas susceptible to *brown-outs* or low voltage due to long wiring runs.

ADDITIONAL FEATURES

- **Operating Temperature:** -40°C to 65 °C (-40 °F to 149°F) [for operation between 65°C and 85°C (149°F and 185°F), consult factory.]
- **Operating Voltage:** 115 Vac SINPAC Switch: 90-130 Vac. For dual voltage motor equipped with center-tapped main winding: 90-130 Vac or 180-265 Vac. 230 Vac SINPAC Switch: 190-255 Vac.

Typical Applications

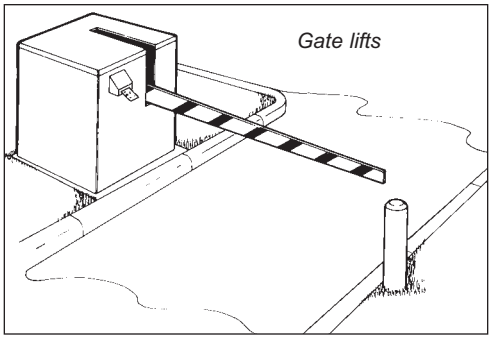
Stearns SINPAC Switches are ideal for applications requiring reliable switching of the start circuit in single-phase motors.

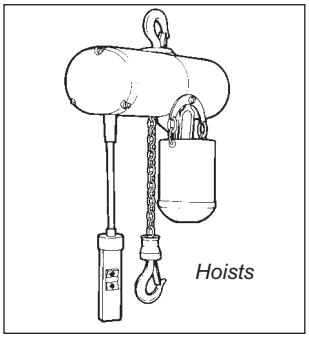
Mechanical switches are prone to various problems including mechanical fatigue, tolerances, tolerance build-ups and vibration which can lead to performance inconsistency.

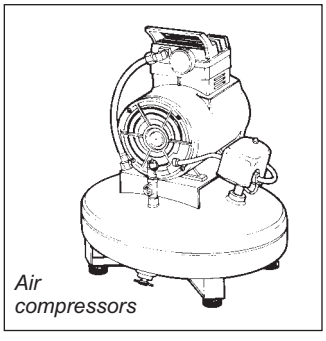
Electronic SINPAC Switches solve all those problems which reduce production downtime in hundreds of applications. Some of these applications are illustrated below:

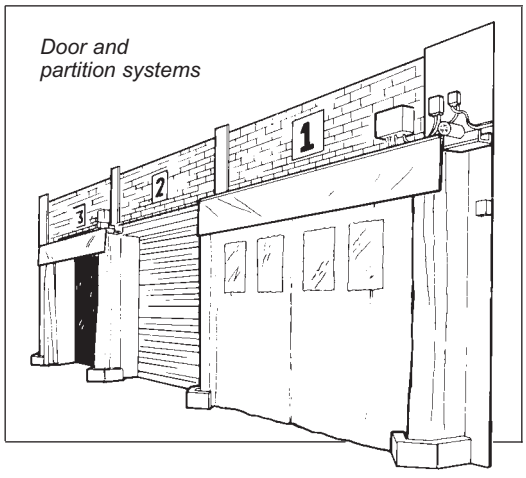
Some additional applications include:

- Grain Dryers
- Water Equipment
- Power Tools
- Commercial Dryers
- Commercial Washing Machines
- Ice Makers
- Gas Pumps
- Floor Washers
- Bottle Washing Machines
- Floor Sanders
- Poultry Feeding Systems
- Fans, Blowers
- Grinding Machines
- Milking Machines
- Winches
- 50/60 Hz
- Paint Sprayers
- Pressure Sprayers
- Vibrators
- Auger Drives
- Door Openers
- Sump Pumps
- Diaphragm Pumps
- Hermetic Motors
- Rotary Compressors
- Refrigeration Compressors
- Heat Pumps
- Jet Pumps
- Food Processing

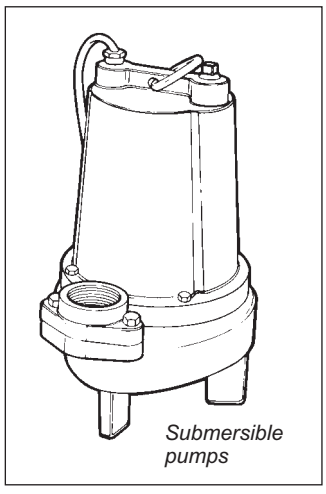

Gate lifts

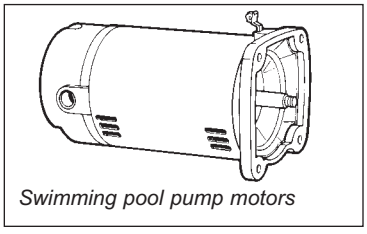

Hoists

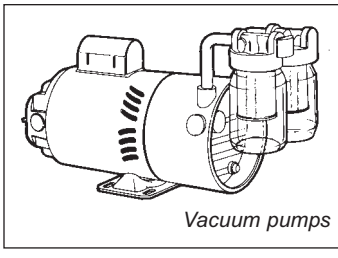

Air compressors



Door and partition systems


Submersible pumps


Swimming pool pump motors


Vacuum pumps

SINPAC Switches: Selection

Motor hp ratings are typical. For an accurate selection procedure, measure start winding current during a normal start or at locked rotor and select a SINPAC Switch with higher maximum current rating than that measured.

1. Be sure switch series matches motor type.
2. Be sure switch voltage rating matches (start) circuit voltage rating.
3. Selection can be based on actual measurement of start winding current ortwo times the motor nameplate FLA rating.
4. Switch current rating must match or exceed the motor start winding current requirements. Always select a SINPAC Switch with the next higher current rating for:
   a) High cycling applications.
   b) Long acceleration time.
   c) High ambients: Greater than 55°C.
5. To assure proper motor operation, the voltage across the start winding must reach the SINPAC Switch cut out reference voltage between 70% to 85% of motors synchronous speed.
   Caution: SINPAC Switches are line voltage compensated. Changes in the line voltage will not effect system operation unless an overload condition causes reduced running speed, along with reduced voltage across the start winding.
6. Higher current switches can be used in place of lower rated switches of the same series.

SINPAC Electronic Switch Catalog Numbering System

CV – 16 – 165

Start Winding Voltage
blank = 115, ***2*** = 230

Series
CVR = Capacitor Start and Capacitor Start/Capacitor Run Motors, ***PV*** = Split Phase Only,
CV - Capacitor Start Only, ***VR*** = Capacitor Start/Capacitor Run Only, ***IR*** = Capacitor Start Instant Reverse

Cut Out Voltage (Cut In PV)

Maximum Current Rating

4–7–21016–11–U01

Electronics

7 = SINPAC Switch

1 = PV Series - Split Phase Only
2 = CV Series - Capacitor Start Only
3 = Made-To-Order (MTO)*
4 = CVR Series - Capacitor Start and Capacitor Start/Capacitor Run
5 = IR Series - Capacitor Start Only
6 = Timer - Fixed Timer Split Phase or Capacitor Start
7 = VR Series - Capacitor Start/ Capacitor Run Only

1 = 115 Start Circuit Voltage
2 = 230 Start Circuit Voltage

0 = Standard
A = Inductor

Amps (max. current)
16, 25, 35, 40, 50, 70, or 80

1 = Standard, ***2*** = Standard, ***K*** = Kit

115 V SINPAC Switch
A = 130 VCO, ***B*** = 147 VCO, ***0*** = 165 VCO
0 = 400 mS Timing Interval, 30 V Cut In
D = 180 VCO
F = 400 mS Timing Interval, 10 V Cut In
J = 155 VCO Hybrid 6B
K = 165 VCO Hybrid 6
L = 130 VCO 15 VCI
P = 800 mS Timing Interval, 30 V Cut In
R = 115 VCO
T = 600 mS Timing Interval, 10 V Cut In
V = 210 VCO
W = 200 mS Timing Interval, 30 V Cut In
Y = 200 mS Timing Interval, 10 V Cut In

230 V SINPAC Switch
C = 260 VCO, ***0*** = 310 VCO, ***E*** = 410 VCO
H = 400 mS Timing Interval, 60 V Cut In
M = 340 VCO, ***S*** = 350 VCO
T = 600 mS Timing Interval, 60 V Cut In

U = UL Recognized, ***N*** = Not UL

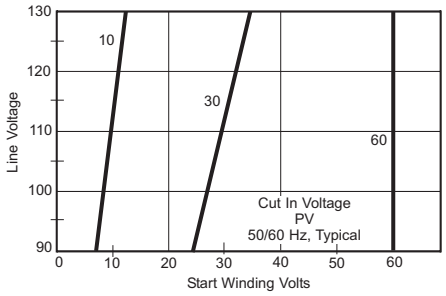
Package Style
11 = Metal Can 2.48 x 1.38 x .81
12 = Metal Can 2.67 x 1.78 x .86
15 = Capacitor Case 1.822 dia. x 3.372 long
16 = Metal Can 2.75 x 2.0 x 1.125
17 = Capacitor Case 2.572 dia. x 4.372 long
19 = Capacitor Case 1.447 dia. x 3.372 long
20 = Capacitor Case 1.447 dia. x 2.760 long
21 = Board Only

*__NOTE:__ For part numbers beginning with 473 (these are OEM specials), the remaining digits of this numbering system do not apply.

SINPAC Switches: Line Voltage Compensation Charts

PV Series

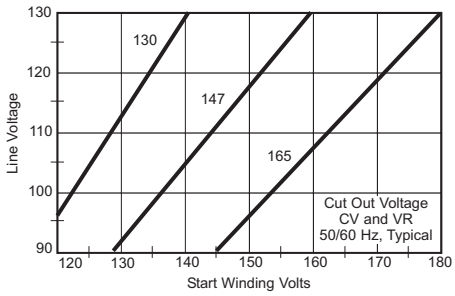
Induced voltage across the start winding is directly proportional to motor speed and line voltage. All SINPAC Switches use this voltage to switch the start winding out of the circuit. Your motor with a SINPAC Switch must generate a voltage that is 20% greater than the switch cut in voltage to assure cut out of the start winding. Refer to the chart below.

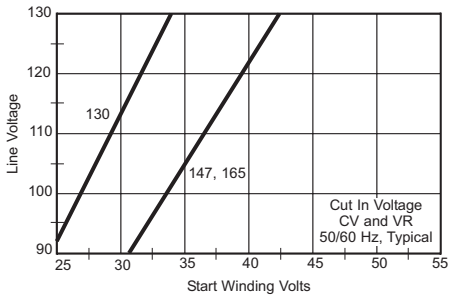


CV , VR , CVR, and IR Series

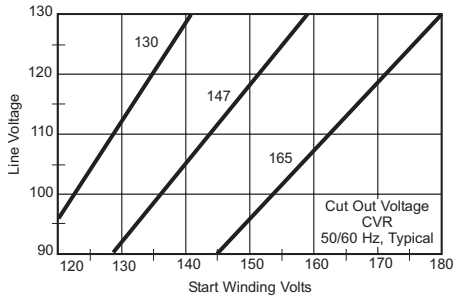
Induced voltage across the start winding is directly proportional to motor speed and line voltage. All SINPAC Switches use this voltage to switch the start capacitor out of the circuit. Your motor with a SINPAC Switch must generate a voltage that is 20% greater than the switch cut out voltage to assure cut out of the start capacitor. Refer to charts below.

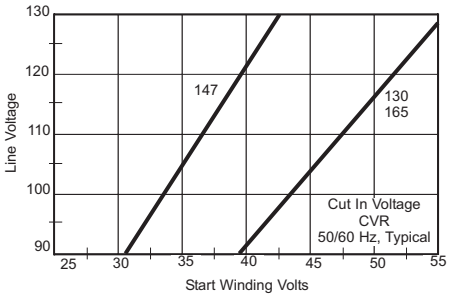
CV and VR



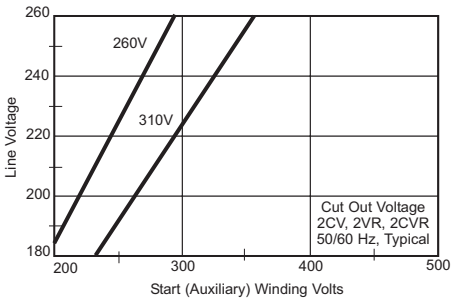


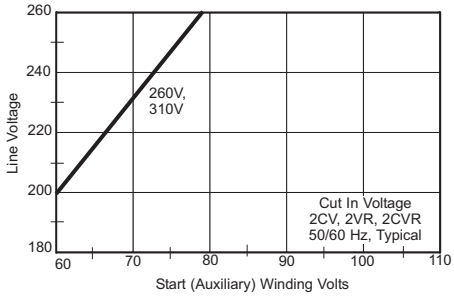
CVR



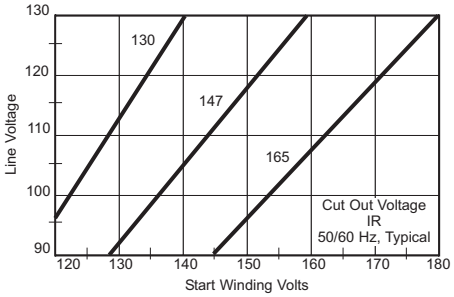


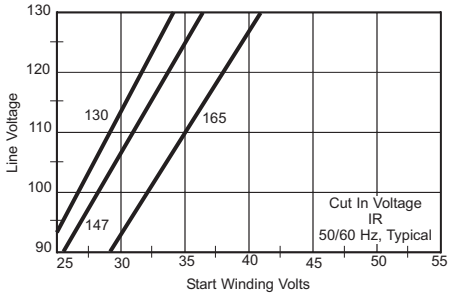
2CV , 2VR , and 2CVR





IR SERIES





PV and 2PV Series for 115 Vac, 230 Vac or 115/230 Vac Dual Voltage Split Phase Motors

BACK TO TABLE OF CONTENTS

Basic Operation

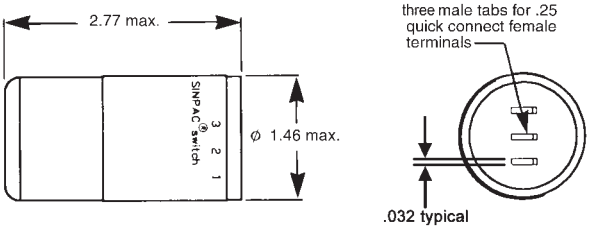
The PV Series SINPAC uses a pulse sampling technique to monitor RPM-sensitive information (induced voltage) across the motor start winding. After the initial timing period, solid-state logic will sample the induced voltage across the start winding and will repeat this sequence until the voltage across the start winding is above the cut-in reference value. The SINPAC logic circuit continues to monitor the RPM-sensitive information (induced voltage) on the start winding. If the SINPAC logic detects that the motor RPM drops below a certain point, it automatically recloses the solid-state switch reconnecting the start winding. Both the initial timing period and cut-in reference value can be modified to meet specific applications.



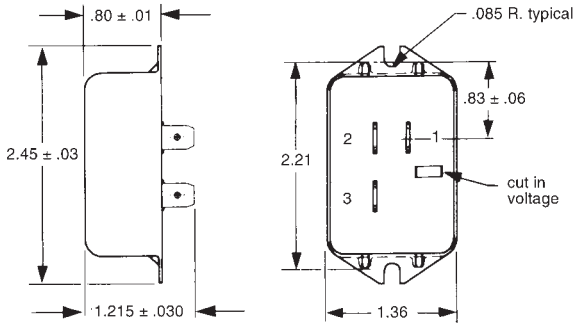
Typical Maximum Motor hp	Typical Full Load Motor Nameplate Current Rating (amps)		Switch Rating and Permissible Maximum Start Winding Current (amps)	Start Circuit Voltage	Catalog Number	Part Number	Timing Interval* (sec.)	Cut In Voltage Typical	Package Style
	115 Volts	115/230 Volts							
1/3	8	8/4	16	115	PV-16-10	4-7-11016-11-UF1	.4	10	11
1/3	8	8/4	16	115	–	4-7-11016-20-UF1	.4	10	20
1/3	8	8/4	16	115	PV-16-30	4-7-11016-11-U01	.4	30	11
1/3	8	8/4	16	115	–	4-7-11016-20-U01	.4	30	20
1/2	–	8	16	230	2PV-16-60	4-7-12016-11-NH1	.4	60	11
1/2	12	12/6	25	115	PV-25-10	4-7-11025-11-UF1	.4	10	11
1/2	12	12/6	25	115	–	4-7-11025-20-UF1	.4	10	20
1/2	12	12/6	25	115	PV-25-30	4-7-11025-11-U01	.4	30	11
1/2	12	12/6	25	115	–	4-7-11025-20-U01	.4	30	20
3/4	20	20/10	40	115	PV-40-30	4-7-11040-11-U01	.4	30	11
3/4	20	20/10	40	115	–	4-7-11040-20-U01	.4	30	20

*NOTE FOR PV SWITCH APPLICATIONS: Please contact the factory for available other timing intervals or cut in voltages.

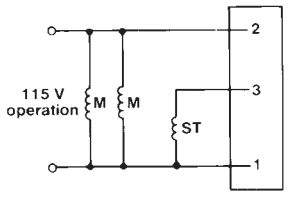
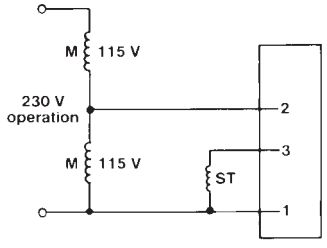
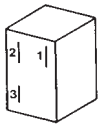
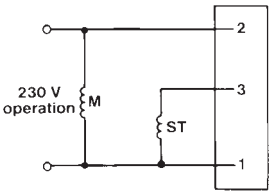
-20 Enclosure



-11 Enclosure



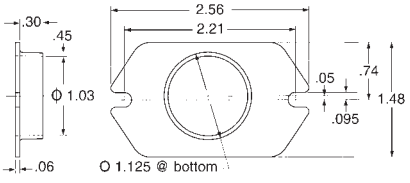
Wiring Diagram

Catalog Number	SINPAC Switch Rating	115 Volt 50/60 Hz Motor Operation	230 Volt 50/60 Hz Motor Operation
PV-16 PV-25 PV-40 *Connect to Split Phase Motors*			
2PV-16 *Connect to Split Phase Motors*		*Not Applicable*	

M – Motor main winding, **ST** – Motor start winding

Dimensions are for estimating only. Drawings for customer reference are available upon request.

Gasket for -11 Enclosure



CV Series for 115 Vac or 115/230 Vac Dual Voltage Capacitor Start Motors



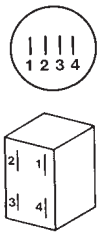
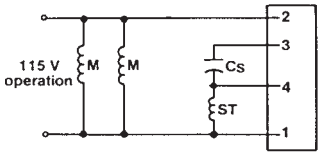
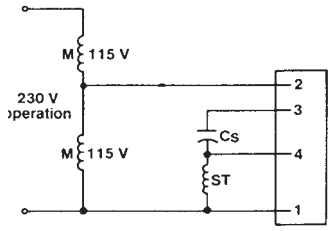
Basic Operation

Capacitor start motors require a method to extract speed data from the voltage across the motor start winding. By comparing the start winding RPM-sensitive voltage with the main AC input voltage (which serves as a reference voltage), the switch determines when the start circuit should be energized. The electronic switch interrupts the start circuit current after the motor has accelerated to the cut out speed, and reconnects the start circuit whenever the motor speed has fallen to cut in speed (usually about 50% of synchronous motor speed).

Typical Maximum Motor hp	Typical Full Load Motor Nameplate Current Rating (amps)		Switch Rating and Permissible Maximum Start Capacitor Current (amps)	Start Circuit Voltage	Catalog Number	Part Number*	Cut Out Voltage Typical	Cut In Voltage Typical	Package Style
	115 Volts	115/230 Volts							
1/2	8	8/4	16	115	CV-16-130	4-7-21016-XX-UA1	130	30	11 or 20
1/2	8	8/4	16	115	CV-16-147	4-7-21016-XX-UB1	147	37	11 or 20
1/2	8	8/4	16	115	CV-16-165	4-7-21016-XX-U02	165	37	11 or 20
1	12	12/6	25	115	CV-25-130	4-7-21025-XX-UA1	130	30	11 or 20
1	12	12/6	25	115	CV-25-147	4-7-21025-XX-UB1	147	37	11 or 20
1	12	12/6	25	115	CV-25-165	4-7-21025-XX-U02	165	37	11 or 20
2	20	20/10	40	115	CV-40-130	4-7-21040-XX-UA1	130	30	11 or 20
2	20	20/10	40	115	CV-40-147	4-7-21040-XX-UB1	147	37	11 or 20
2	20	20/10	40	115	CV-40-165	4-7-21040-XX-U02	165	37	11 or 20
3	25	25/12.5	50	115	CV-50-130	4-7-21050-XX-UA1	130	30	12 or 20
3	25	25/12.5	50	115	CV-50-147	4-7-21050-XX-UB1	147	37	12 or 20
3	25	25/12.5	50	115	CV-50-165	4-7-21050-XX-U02	165	37	12 or 20

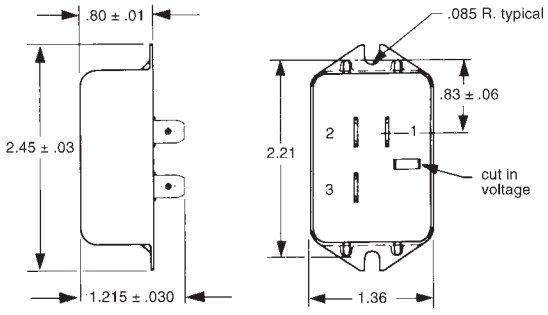
*Specify package style in place of XX in part number. Can be ordered as -11 or -20 style; 50-amp can be ordered as -12 or -20 style.

Wiring Diagram

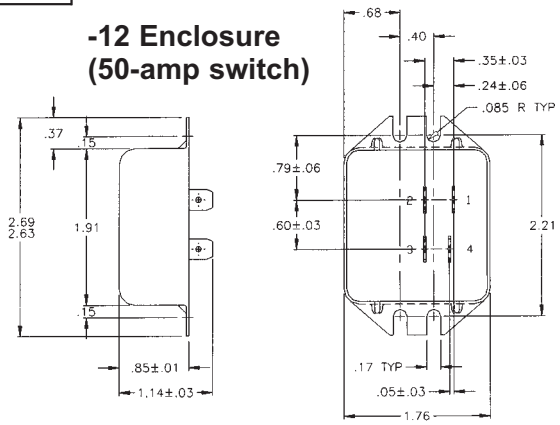
Catalog Number	SINPAC Switch Rating	115 Volt 50/60 Hz Motor Operation	230 Volt 50/60 Hz Motor Operation
CV-16 CV-25 CV-40 CV-50 *Connect to Capacitor Start Motors*			

Cs – Start Capacitor, **M** – Motor main winding, **ST** – Motor start winding

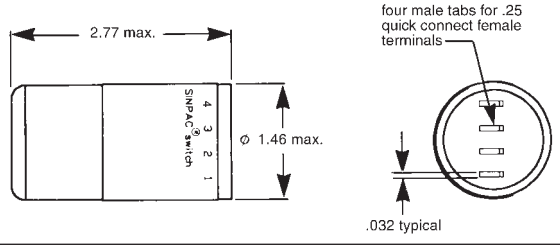
-11 Enclosure



-12 Enclosure (50-amp switch)



-20 Enclosure



Dimensions are for estimating only. Drawings for customer reference are available upon request.

VR Series for 115 Vac or 115/230 Vac Dual Voltage Capacitor Start/Capacitor Run Motors

BACK TO TABLE OF CONTENTS

Basic Operation

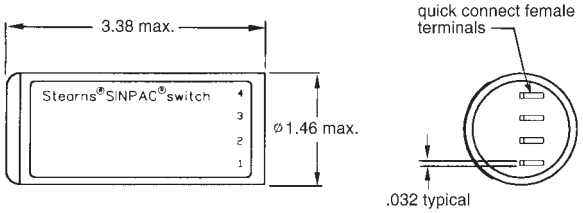


Capacitor start/capacitor run motors provide continuous voltage sensing information which can be used to extract speed data from the voltage across the motor start winding. By comparing this start winding RPM-sensitive voltage to the main AC input voltage (which serves as a reference voltage), the switch determines when the start circuit should be de-energized. The electronic switch interrupts the start circuit current after the motor has accelerated to the cut out voltage (speed), and reconnects the start circuit whenever the speed sensitive circuit senses the motor voltage (speed) has decreased to a preselected cut in voltage (RPM) level.

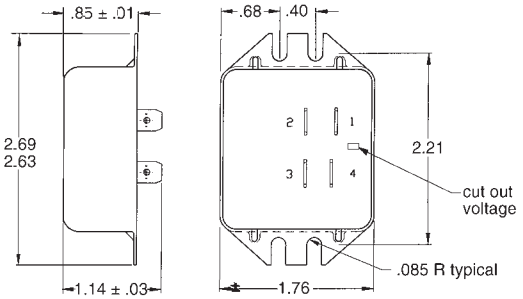
Capacitor start/capacitor run motors exhibit current transients and higher voltages across the start switch. These electrical stresses occur due to the switching of the two capacitors (start and run) that are connected in parallel during motor start and may have different voltages at time of restart. These stresses occur at restart with both mechanical and electronic start switches. The VR switch features circuitry designed to eliminate the effects of these conditions.

Typical Maximum Motor hp	Typical Full Load Motor Nameplate Current Rating (amps)		Switch Rating and Permissible Maximum Start Capacitor Current (amps)	Start Circuit Voltage	Catalog Number	Part Number	Cut Out Voltage Typical	Cut In Voltage Typical	Package Style
	115 Volts	115/230 Volts							
1/2	8	8/4	16	115	VR-16-130	4-7-71016-12-UA1	130	30	12
1/2	8	8/4	16	115	–	4-7-71016-19-UA1	130	30	19
1/2	8	8/4	16	115	VR-16-147	4-7-71016-12-UB1	147	37	12
1/2	8	8/4	16	115	–	4-7-71016-19-UB1	147	37	19
1/2	8	8/4	16	115	VR-16-165	4-7-71016-12-U01	165	37	12
1/2	8	8/4	16	115	–	4-7-71016-19-U01	165	37	19
2	20	20/10	40	115	VR-40-130	4-7-71040-12-UA1	130	30	12
2	20	20/10	40	115	–	4-7-71040-19-UA1	130	30	19
2	20	20/10	40	115	VR-40-147	4-7-71040-12-UB1	147	37	12
2	20	20/10	40	115	–	4-7-71040-19-UB1	147	37	19
2	20	20/10	40	115	VR-40-165	4-7-71040-12-U01	165	37	12
2	20	20/10	40	115	–	4-7-71040-19-U01	165	37	19
3	25	50/25	50	115	VR-50-130	4-7-71050-12-UA1	130	30	12
3	25	50/25	50	115	–	4-7-71050-19-UA1	130	30	19
3	25	50/25	50	115	VR-50-147	4-7-71050-12-UB1	147	37	12
3	25	50/25	50	115	–	4-7-71050-19-UB1	147	37	19
3	25	50/25	50	115	VR-50-165	4-7-71050-12-U01	165	37	12
3	25	50/25	50	115	–	4-7-71050-19-U01	165	37	19

-19 Enclosure

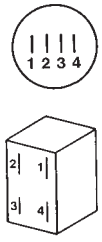
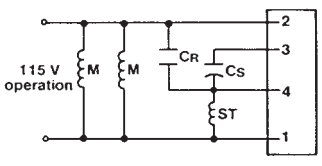
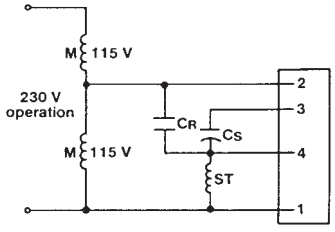


-12 Enclosure

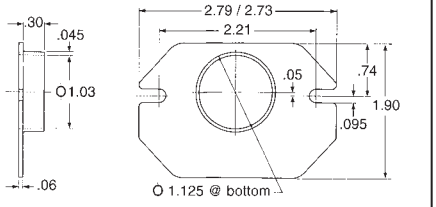


Dimensions are for estimating only. Drawings for customer reference are available upon request.

Wiring Diagram

Catalog Number	SINPAC Switch Rating	115 Volt 50/60 Hz Motor Operation	230 Volt 50/60 Hz Motor Operation
VR-16 VR-40 VR-50 *Connect to Capacitor Start/ Capacitor Run Motors*			

Gasket



CVR Series for 115 Vac or 115/230 Vac Dual Voltage Capacitor Start and Capacitor Start/Capacitor Run Motors

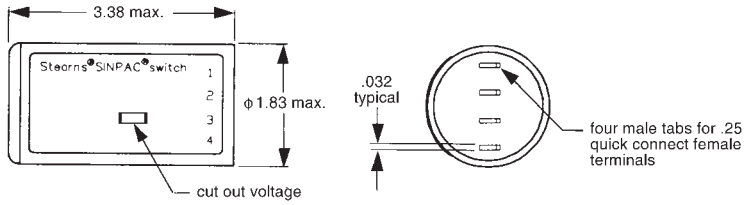
Basic Operation



Capacitor start/capacitor run motors and capacitor start motors provide continuous voltage sensing information which can be used to extract speed data from the voltage across the motor start winding. By comparing this start winding RPM-sensitive voltage to the main AC input voltage (which serves as a reference voltage), the switch determines when the start circuit should be de-energized. The electronic switch interrupts the start circuit current after the motor has accelerated to the cut out voltage (speed), and reconnects the start circuit whenever the speed sensitive circuit senses the motor voltage (speed) has decreased to a preselected cut in voltage (RPM) level.

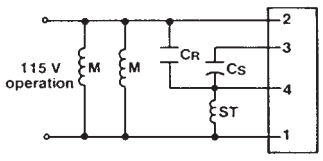
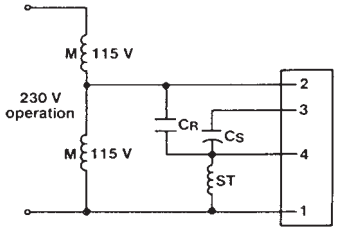
Capacitor start/capacitor run motors exhibit current transients and higher voltages across the start switch. These electrical stresses occur due to the switching of the two capacitors (start and run) that are connected in parallel during motor start and may have different voltages at time of restart. These stresses occur at restart with both mechanical and electronic start switches. The CVR switch has additional circuitry to eliminate the effects of these conditions.

Typical Maximum Motor hp	Typical Full Load Motor Nameplate Current Rating (amps)		Switch Rating and Permissible Maximum Start Capacitor Current (amps)	Start Circuit Voltage	Catalog Number	Part Number	Cut Out Voltage Typical	Cut In Voltage Typical	Package Style
	115 Volts	230 Volts							
3-5	50	–	80	115	CVR-80-130	4-7-41080-15-NA1	130	50	15
3-5	50	–	80	115	CVR-80-147	4-7-41080-15-NB1	147	45	15
3-5	50	–	80	115	CVR-80-165	4-7-41080-15-N01	165	50	15



Dimensions are for estimating only. Drawings for customer reference are available upon request.

Wiring Diagram

Catalog Number	SINPAC Switch Rating	115 Volt 50/60 Hz Motor Operation	230 Volt 50/60 Hz Motor Operation
CVR-80 *Connect to Capacitor Start/ Capacitor Run Motors*			

C_S– Start capacitor, **M** – Motor main winding, **C_R** – Run capacitor, **ST** – Motor start winding

2CV Series for 230 Vac Capacitor Start Motors
2VR and 2CVR Series for Capacitor Start/Capacitor Run Motors

Basic Operation

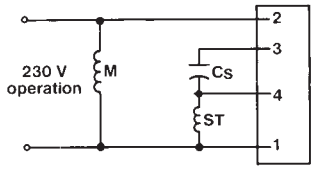
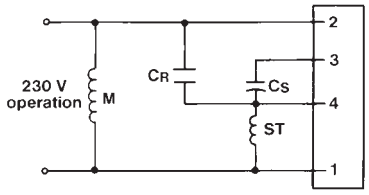


Capacitor start/capacitor run motors and capacitor start motors provide continuous voltage sensing information which can be used to extract speed data from the voltage across the motor start (auxiliary) winding. By comparing this start (auxiliary) winding RPM-sensitive voltage to the main AC input voltage (which serves as a reference voltage), the switch determines when the start circuit should be de-energized. The electronic switch interrupts the start circuit current after the motor has accelerated to the cut out speed, and reconnects the start circuit whenever the motor speed has decreased to a preselected cut in RPM level.

Capacitor start/capacitor run motors exhibit current transients and higher voltages across the start switch. This electrical stress is due to the voltage differential which may exist between the start and run capacitors at the instant of switch closure. This stress phenomenon occurs with both mechanical and electronic type start switches. SINPAC Switches have voltage detection circuitry to minimize the effects of these conditions.

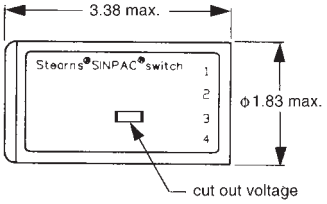
Motor Type	Typical Max. Motor hp	Typical Full Load Motor Nameplate Current Rating (amps)		Switch Rating and Permissible Maximum Start Capacitor Current (amps)	Start Circuit Voltage	Catalog Number	Part Number	Cut Out Voltage Typical	Cut In Voltage Typical	Package Style
		115 Volts	230 Volts							
Capacitor start only	3 3	– –	17 17	35 35	230 230	2CV-35-260 2CV-35-310	4-7-22035-15-UC1 4-7-22035-15-U01	260 310	70 70	15 15
Capacitor start only	5 5	– –	25 25	50 50	230 230	2CV-50-260 2CV-50-310	4-7-22050-15-UC1 4-7-22050-15-U01	260 310	70 70	15 15
Capactitor start capacitor run	3 3	– –	17 17	35 35	230 230	2VR-35-260 2VR-35-310	4-7-72035-15-UC1 4-7-72035-15-U01	260 310	70 70	15 15
Capactitor start capacitor run	5 5	– –	25 25	50 50	230 230	2VR-50-260 2VR-50-310	4-7-72050-15-UC1 4-7-72050-15-U01	260 310	70 70	15 15
Capacitor start AND capacitor start capacitor run	7 1/2 7 1/2	– –	35 35	70 70	230 230	2CVR-70-260 2CVR-70-310	4-7-42070-17-NC1 4-7-42070-17-N01	260 310	70 70	17 17

Wiring Diagram

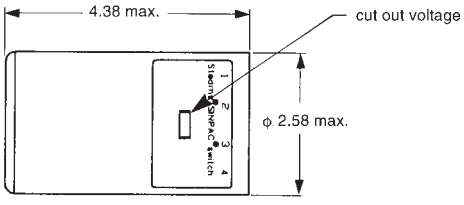
Catalog Number	SINPAC Switch Rating	115 Volt 50/60 Hz Motor Operation	230 Volt 50/60 Hz Motor Operation
2CV 2CVR *Connect to Capacitor Start Motors*	230 Volts	*Not Applicable*	
2VR 2CVR *Connect to Capacitor Start/ Capacitor Run Motors*		*Not Applicable*	

C_S– Start capacitor, **M** – Motor main winding, **C_R** – Run capacitor, **ST** – Motor start winding

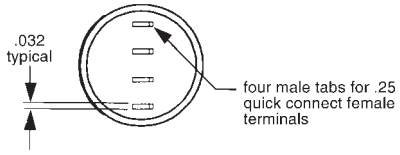
-15 Enclosure



-17 Enclosure



End view -15 and -17



Dimensions are for estimating only. Drawings for customer reference are available upon request.

IR Series for Instant Reversing 115 Vac or 115/230 Vac Dual Voltage Capacitor Start Motors

Basic Operation

Bidirectional motors - those that can rotate in either direction – are of two classes: *1. Reversing motors*, which can change from full speed in one direction to full speed in the opposite direction. *2. Reversible motors*, which can be reversed only when the motor is not running, or is running below cut out speed. Some motor manufacturers distinguish between quick reversing and instant reversing. A quick reversing motor requires a time delay of approximately 1/25th of a second or more for the switching circuitry to react. An instant reversing motor requires absolutely no time delay. The standard SINPAC Switch can be used on reversible and reversing motors. The SINPAC IR Series Switch provides the function of a direction sensing centrifugal switch and makes a reversible capacitor start motor into an instant reversing motor.

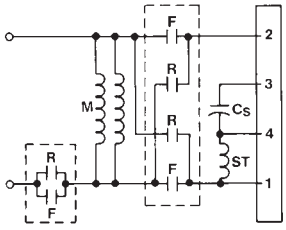
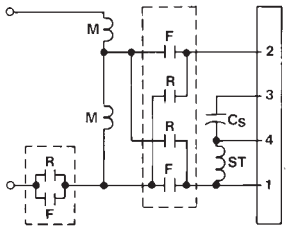
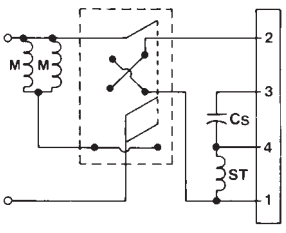
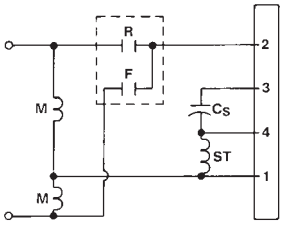
In order to reverse a single-phase motor, it is necessary to reverse the polarity of either the start or main winding, but not both at the same time. The reversal of the winding is accomplished with an external reversing switch or contactor that is not part of the SINPAC Switch. SINPAC Instant Reverse Switch is not dependent upon how quickly the user operates the reversing switch, but only that the reversing switch did change states, i.e., forward to reverse, or vice versa. The SINPAC Switch detects the change in the phase shift between the main and start windings, and the logic circuit instantly actuates the starting switch, causing the start circuit to be reconnected to line voltage. This connection causes the motor to decelerate and then reaccelerate in the opposite direction. The SINPAC IR Series Switch interrupts the start circuit current after the motor has accelerated to the cut out speed, and reconnects the start circuit whenever the circuit senses the motor speed has fallen to cut in speed (usually about 50% of synchronous motor speed).

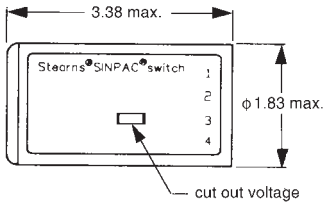


Typical Maximum Motor hp	Typical Full Load Motor Nameplate Current Rating (amps)		Switch Rating and Permissible Maximum Start Capacitor Current (amps)	Start Circuit Voltage	Catalog Number	Part Number	Cut Out Voltage Typical	Cut In Voltage Typical	Package Style
	115 Volts	115/230 Volts							
1/2	12	12/6	25	115	IR-25-130	4-7-51025-15-UA1	130	30	15
1/2	12	12/6	25	115	IR-25-147	4-7-51025-15-UB1	147	33	15
1/2	12	12/6	25	115	IR-25-165	4-7-51025-15-U01	165	37	15
2	20	20/10	40	115	IR-40-130	4-7-51040-15-UA1	130	30	15
2	20	20/10	40	115	IR-40-147	4-7-51040-15-UB1	147	33	15
2	20	20/10	40	115	IR-40-165	4-7-51040-15-U01	165	37	15

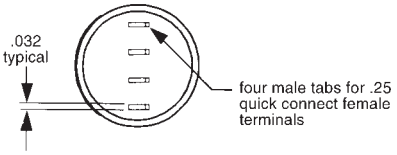
Contact factory on IVR series for capacitor start/capacitor run motors.

Wiring Diagram

Catalog Number	SINPAC Switch Rating	115 Volt 50/60 Hz Motor Operation	230 Volt 50/60 Hz Motor Operation
IR-25 IR-40 *Connect to Instant Reverse Start Motors*	115 Volts 	**115 Volt Operation Dual Voltage Motor Using Two Full Voltage 2 or 3 Pole Single-Phase Reversing Contactors with Mechanical Interlock** *(Electrical Interlock Optional)*  Reversing contacts are not part of SINPAC Switch.	**230 Volt Operation Dual Voltage Motor Using Two Full Voltage 2 or 3 Pole Single-Phase Reversing Contactors with Mechanical Interlock** *(Electrical Interlock Optional)*  Reversing contacts are not part of SINPAC Switch.
		 Drum switch is not part of SINPAC Switch.	 Reversing contacts are not part of SINPAC Switch.



Dimensions are for estimating only. Drawings for customer reference are available upon request.



C_S– Start capacitor, **M** – Motor main winding, **ST** – Motor start winding, **F** – Forward, **R** – Reverse

TENV/IP54 Super-Mod® Clutch-Brake Modules

BACK TO TABLE OF CONTENTS

Imagine a totally-enclosed, non-ventilated clutch-brake ready to work right out of the box, requiring no modifications. And at a price competitive with “open” enclosure clutch-brakes.

TENV Super-Mod will give you extended cycles, enhanced operating efficiency and longer operating life. TENV Super-Mod Modules are well suited for challenging applications where water, moisture, dirt, dust and other airborne pollutants can shorten the life of traditional clutch-brakes.

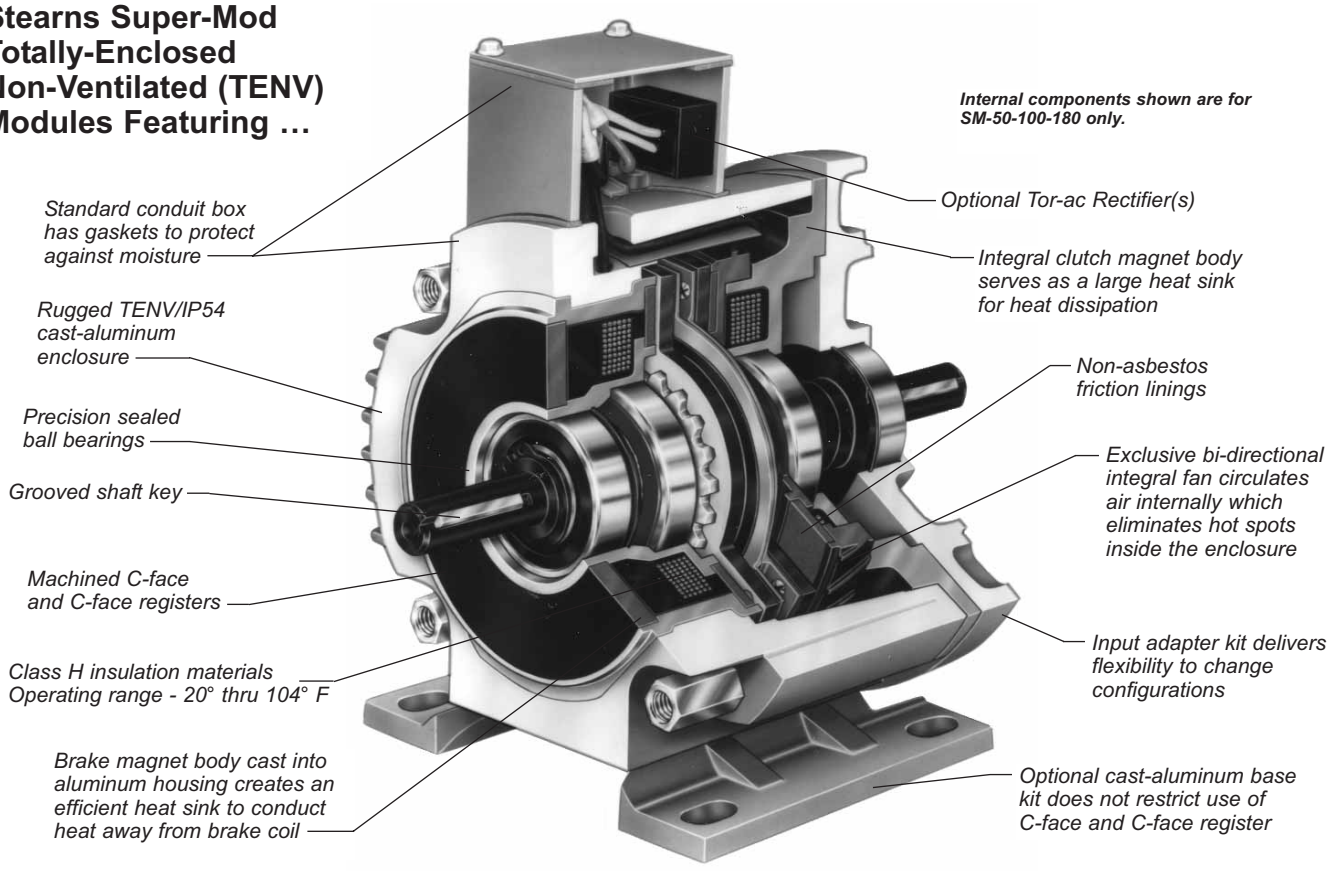
Examine these key value-added features:

- Cast-aluminum housing that meets IP54 requirements, preventing moisture and dirt from affecting operation of the unit
- Integrally cast, clutch-side magnetic body and endbell provides large heat sink that conducts heat away from coil
- Brake-side magnetic body integrated with cast housing creates a heat exchanger that keeps the brake coil cool
- Unique fan design creates bi-directional air movement within the unit. This stabilizes internal temperatures and eliminates hot spots. The fan is cast into the drive hub and is equally efficient at moving air axially through the housing during motor rotation in either direction
- Depending on the model, between 28 and 60 percent fewer parts than competitive units for enhanced reliability and service life
- Armature assembly features an automatic gap adjustment that maintains a consistent de-energized armature-to-friction-face air gap
- Completely gasketed conduit box resists moisture and spray
- Washdown (IP55) availability in select models

For even better performance, include an optional Tor-ac™ rectifier for 115 or 230 Vac input. Tor-ac rectifiers connect directly to the AC power source for switching on the AC-side. This eliminates contact arcing, improving the life of associated switching components while providing you with mechanical response times comparable to DC-side switching.

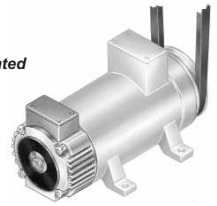
The Stearns TENV Super-Mod Module comes in a wide range of popular sizes with nominal static torque ratings from 16 and 145 lb-ft. Each unit is designed as an exact drop-in replacement, so you can upgrade today or at your next regularly scheduled maintenance shutdown.

Stearns Super-Mod Totally-Enclosed Non-Ventilated (TENV) Modules Featuring …

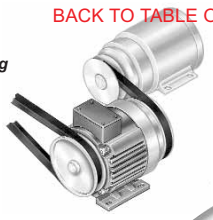


Super-Mod® Clutch-Brake Modules

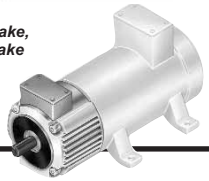
How To Select The Proper Unit For Your Application



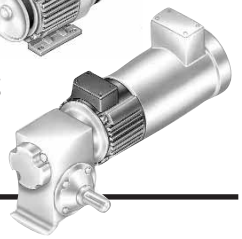
C-face mounted motor brake module (20MB)



Foot/base mounting of clutch-brake or clutch module (2030B or 3040B)



C-face mounted brake, clutch or clutch-brake module (20, 1020 or 1040)



C-face mounted brake, clutch, or clutch-brake module. Mounted between motor and gearbox (20, 1020, or 1040)

1st Select the appropriate configuration based on the relationship with the motor, gearbox and drive components.

2nd Determine if the application requires clutching only, braking only or a clutch-brake combination.

Clutch Only

Provides a start and/or continuous motion until the control logic disengages (removes the power or voltage from the unit's coil).

NOTE: The load will coast since no braking action is provided.

Brake Only

Provides a stop and hold, typically of a motor shaft, until the control logic disengages (removes the power or voltage from the unit's coil).

Clutch-Brake

Provides a start-stop motion used for cycling, intermediate or random motion and controls a load or machine element. Both the clutch and brake coils are electrically engaged (power on), however, the control logic should not signal both coils to be engaged at the same time.

3rd Select the proper size/torque rating based on horsepower and RPM (speed at the clutch or brake) using the Super-Mod Selection Chart to the right. Based on 2.75 service factor.

For other service factors and speeds, use the formulas shown to the far right.

CAUTION: RPM refers to shaft speed at clutch or brake.

Note: Frame size and shaft diameter may affect selection and should be considered. See manufacturer's dimensional and sizing information.

Super-Mod Selection Chart

HP \ RPM	200	400	600	800	1000	1200	1500	1800	2100	2400
1/8										
1/4										
1/3										
1/2					SM-50					
3/4										
1					SM-100/180					
1 1/2										
2										
3						SM-210				
5										
7 1/2							SM-250			
10										

$$T_d = \frac{5252 \times P}{N} \times SF$$

Where:

T_d = Average dynamic torque, lb-ft

P = Horsepower, HP

N = Shaft speed differential at clutch and/or brake components, RPM

SF = Service factor

5252 = Constant

4th Ensure that the unit can properly dissipate the heat generated by the application. Thermal capacity can be calculated as follows:

$$E = 1.7 \times WR^2 \times \left(\frac{N}{100}\right)^2 \times F$$

Where:

E = Energy (heat) which needs to be dissipated in foot pounds per minute (ft-lb/min) for the application requirement.

WR^2 = Total reflected inertia at clutch-brake shaft location. This should include clutch-brake inertia.

Inertia (lb-ft²)	SM 50, 100, 180	SM 210, 250
Clutch/Brake	0.063	0.144
Clutch Only	0.04	0.08
Brake Only	0.035	0.08

N = Speed differential in revolutions per minute at the clutch-brake shaft.

F = Number of cycles per minute (cycle rate)

The thermal capacity requirements calculated should be compared to the thermal capacity ratings. Exceeding this rating could cause overheating and possible failure. SM 50-100-180 can accommodate 5,000 ft-lb/min; SM-210 7,000 ft-lb/min; and SM-250 5,600 ft-lb/min.

5th Options Select any other options you may require.

Tor-ac Kit

Single-channel, solid-state, quick-response rectifier circuit can be mounted in any SM unit which allows you to switch on the AC-side with mechanical response times comparable to traditional DC-side switching.

Adapter Kit

An input adapter kit can be stocked which gives you immediate flexibility to modify to double shafted configurations. See page 115 for ordering and dimensional information.

Base Kit

A base kit can be added to clutch only (1040) or clutch-brake (1020) units. See page 16 for ordering and dimensional information.

6th Special Applications

Low Speed

Application of clutches and brakes at speeds of 300 RPM or less may not permit sufficient burnishing or run-in to occur, the result being reduced and erratic torque output. For these applications, we suggest using a unit which has a static torque rating of at least two times the calculated torque requirement.

High Cycle Rates

Applications where high cycle rates are required could result in heat being generated which is in excess of the unit's capability to dissipate. The thermal capacity requirement equation should be used to size the clutch and/or brake for this type of application. High cycle rates may also require special high-speed controls.

Washdown

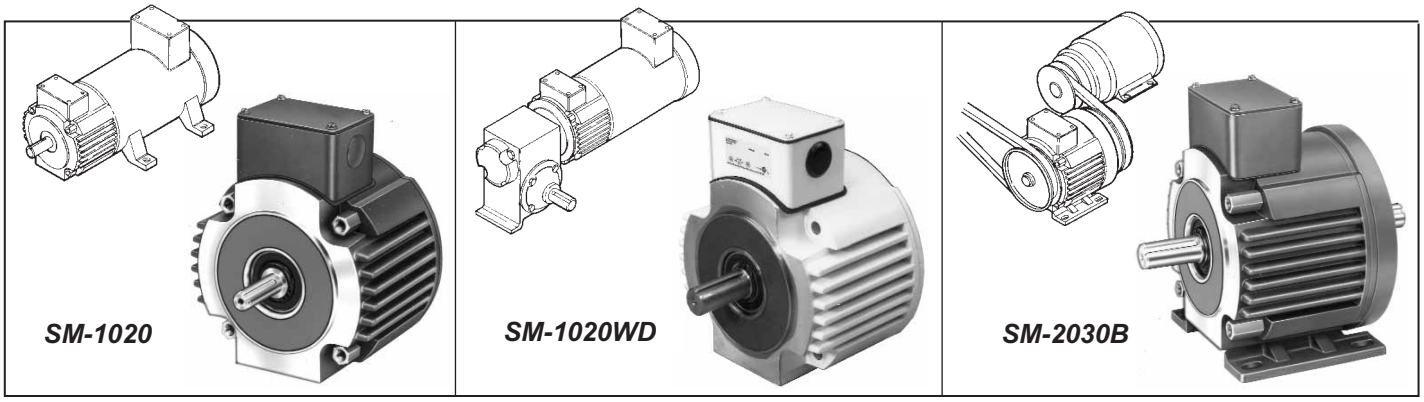
For applications requiring regular washdown, such as food processing or other wet, high-humidity environments use the Super-Mod TENV Washdown Clutch-Brake Modules.

- Models in most popular sizes with nominal static torque ratings of 16 and 35 lb-ft.
- Fully neoprene gasketed with BISSC approved white epoxy paint.

Soft Starts And/Or Stops

While the Stearns Gap feature is desirable in most applications, there are some situations where it should be disabled, such as very soft starts and/or stops achieved with low voltage energizing of the coil. For applications where the voltage will be varied to below 75% of the coil rating, request that the Stearns Gap feature be disabled.

Super-Mod® Clutch-Brake Modules:
SM-1020, SM-1020WD (Washdown) and SM-2030B



- 56C through 215TC NEMA Frame Sizes
- 16 through 145 lb-ft Static Torque; 2400 Maximum RPM
- TENV – Totally Enclosed (Non-Ventilated) IP-54 Enclosure Protection, (IP-55 for Washdown Units)
- Listed by Underwriters Laboratories, Inc., File E-71115 and CSA Certified, File LR-6254
- Power-On Clutch and Brake* Engagement
- Maximum Overhung load capacity is 85 lbs

*See Series 56,700 and 87,700 for power-off "fail safe" C-face coupler units

Performance Data, Ordering Information and List Prices (Discount Symbol X-8)

Static Torque lb-ft	Dynamic Torque lb-ft	NEMA Frame	Hub bore and shaft diameter	Model	Part Number①	Thermal Capacity (ft-lb/min) ②	Wt. (lbs)	Maximum Electrical Power (watts)	List Price③
16	10	56C	5/8 hub bore 5/8 shaft	SM-50-1020	2-35-0561-01-A*L	5000	20	19	$1250.00
16	10	56C		SM-50-1020B	2-35-0561-01-B*L	5000	22	19	1306.00
16	10	56C		SM-50-1020WD	2-35-0562-01-A*L	5000	20	19	1526.00
16	10	56C		SM-50-2030	2-35-0561-01-C*L	5000	24	19	1426.00
16	10	56C		SM-50-2030B	2-35-0561-01-D*L	5000	24	19	1482.00
35	20	56C		SM-100-1020	2-35-0561-02-A*L	5000	20	29	1586.00
35	20	56C		SM-100-1020B	2-35-0561-02-B*L	5000	22	29	1642.00
35	20	56C		SM-100-1020WD	2-35-0562-02-A*L	5000	20	29	1834.00
35	20	56C		SM-100-2030	2-35-0561-02-C*L	5000	24	29	1876.00
35	20	56C		SM-100-2030B	2-35-0561-02-D*L	5000	24	29	1934.00
35	20	140TC	7/8 hub bore 7/8 shaft	SM-180-1020	2-35-1401-02-A*O	5000	20	29	1586.00
35	20	140TC		SM-180-1020B	2-35-1401-02-B*O	5000	22	29	1666.00
35	20	140TC		SM-180-1020WD	2-35-1402-02-AJO	5000	20	29	1934.00
35	20	140TC		SM-180-2030	2-35-1401-02-C*O	5000	24	29	1876.00
35	20	140TC		SM-180-2030B	2-35-1401-02-D*O	5000	24	29	1956.00
75	44	180TC	1-1/8 hub bore 1-1/8 shaft	SM-210-1020	2-35-1801-03-A*R	7000	31	16	2824.00
75	44	180TC		SM-210-1020B	2-35-1801-03-B*R	7000	31	16	2944.00
75	44	180TC		SM-210-2030	2-35-1801-03-C*R	7000	37	16	3362.00
75	44	180TC		SM-210-2030B	2-35-1801-03-D*R	7000	37	16	3484.00
145	86	210TC	1-3/8 hub bore 1-3/8 shaft	SM-250-1020	2-35-2101-04-A*U	5600	37	38	3072.00
145	86	210TC		SM-250-1020B	2-35-2101-04-B*U	5600	37	38	3192.00
145	86	210TC		SM-250-2030	2-35-2101-04-C*U	5600	37	38	3764.00
145	86	210TC		SM-250-2030B	2-35-2101-04-D*U	5600	37	38	3886.00

②Thermal capacity rating is based on ambient temperature of 70°F at 1750 RPM.
③List prices subject to change without notice.

①Example of a complete part number:
2-35-0561-01-AJL
- 5/8 hub
- 90-100 Vdc
- Basic unit
- 0=Standard Unit
- 2= Without Gap Adjust

Specials available upon request.
Consult factory for list price adder.

Options - Features Table

Series	Character	Description
SM-1020	A	Basic Unit - Direct Couple
SM-1020B	B	Basic Unit Plus Base
SM-2030	C	Basic Unit Plus Clutch Input Adapter
SM-2030B	D	Basic Unit Plus Base & Clutch Input Adapter
SM-1020WD		IP-55 Washdown (available in NEMA frame sizes 56C-145TC)

Voltage Table

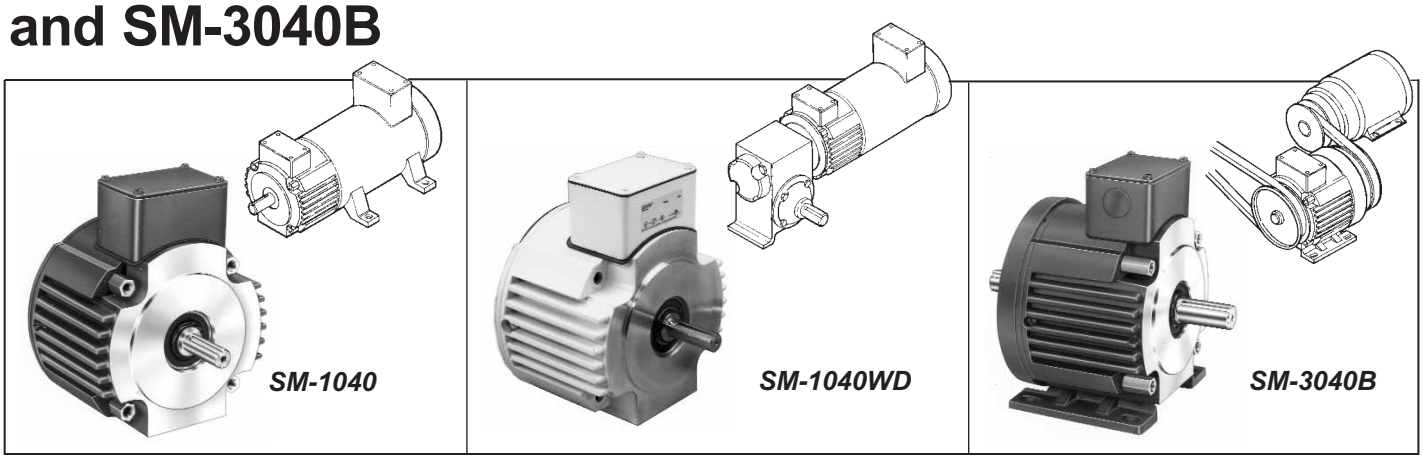
Character	Voltage	List Adder
C E J	12 Vdc 24-28 Vdc 90-100 Vdc	*none*
N	115 Vac	$184.00
P	230 Vac	220.00

Hub Size Table for SM-1020's

Character	Bore	Keyway
L	5/8	3/16 x 3/32
O	7/8	3/16 x 3/32
R	1 1/8	1/4 x 1/8
U	1 3/8	5/16 x 5/32

BACK TO TABLE OF CONTENTS

Super-Mod® Clutch Only Modules:
SM-1040, SM-1040WD (Washdown) and SM-3040B



- 56C through 215TC NEMA Frame Sizes
- 16 through 145 lb-ft Static Torque; 2400 Maximum RPM
- TENV – Totally Enclosed (Non-Ventilated) IP-54 Enclosure Protection, (IP-55 for Washdown Units)
- Listed by Underwriters Laboratories, Inc., File E-71115 and CSA Certified, File LR-6254
- Maximum overhung load capacity is 85 lbs

Performance Data, Ordering Information and List Prices (Discount Symbol X-8)

Static Torque lb-ft	Dynamic Torque lb-ft	NEMA Frame	Hub bore and shaft diameter	Model	Part Number①	Thermal Capacity (ft-lb/min) ②	Wt. (lbs)	Maximum Electrical Power (watts)	List Price③
16	10	56C	5/8 hub bore 5/8 shaft	SM-50-1040	2-36-0561-01-A*L	5000	20	19	$1046.00
16	10	56C		SM-50-1040B	2-36-0561-01-B*L	5000	22	19	1102.00
16	10	56C		SM-50-1040WD	2-36-0562-01-A*L	5000	20	19	1276.00
16	10	56C		SM-50-3040	2-36-0561-01-C*L	5000	20	19	1222.00
16	10	56C		SM-50-3040B	2-36-0561-01-D*L	5000	24	19	1278.00
35	20	56C		SM-100-1040	2-36-0561-02-A*L	5000	20	29	1338.00
35	20	56C		SM-100-1040B	2-36-0561-02-B*L	5000	22	29	1394.00
35	20	56C		SM-100-1040WD	2-36-0562-02-A*L	5000	22	29	1632.00
35	20	56C		SM-100-3040	2-36-0561-02-C*L	5000	22	29	1626.00
35	20	56C		SM-100-3040B	2-36-0561-02-D*L	5000	24	29	1684.00
35	20	140TC	7/8 hub bore 7/8 shaft	SM-180-1040	2-36-1401-02-A*O	5000	20	29	1338.00
35	20	140TC		SM-180-1040B	2-36-1401-02-B*O	5000	22	29	1418.00
35	20	140TC		SM-180-1040WD	2-36-1402-02-A*O	5000	20	29	1632.00
35	20	140TC		SM-180-3040	2-36-1401-02-C*O	5000	22	29	1626.00
35	20	140TC		SM-180-3040B	2-36-1401-02-D*O	5000	24	29	1706.00
75	44	180TC	1-1/8 hub bore 1-1/8 shaft	SM-210-1040	2-36-1801-03-A*R	7000	31	16	2374.00
75	44	180TC		SM-210-1040B	2-36-1801-03-B*R	7000	31	16	2496.00
75	44	180TC		SM-210-3040	2-36-1801-03-C*R	7000	31	16	2916.00
75	44	180TC		SM-210-3040B	2-36-1801-03-D*R	7000	31	16	3036.00
145	86	210TC	1-3/8 hub bore 1-3/8 shaft	SM-250-1040	2-36-2101-04-A*U	5600	31	38	2600.00
145	86	210TC		SM-250-1040B	2-36-2101-04-B*U	5600	31	38	2720.00
145	86	210TC		SM-250-3040	2-36-2101-04-C*U	5600	31	38	3228.00
145	86	210TC		SM-250-3040B	2-36-2101-04-D*U	5600	31	38	3348.00

②Thermal capacity rating is based on ambient temperature of 70°F at 1750 RPM.
③ List prices subject to change without notice.

①Example of a complete part number:
2-36-0561-01-AJL
- 5/8 hub
- 90-100 Vdc
- Basic unit
- 0=Standard Unit
- 2= Without Gap Adjust

Specials available upon request.
Consult factory for list price adder.

Options - Features Table

Series	Character	Description
SM-1040	A	Basic Unit - Direct Couple
SM-1040B	B	Basic Unit Plus Base
SM-3040	C	Basic Unit Plus Clutch Input Adapter
SM-3040B	D	Basic Unit Plus Base & Clutch Input Adapter
SM-1040WD		IP-55 Washdown (available in NEMA frame sizes 56C-145TC)

Voltage Table

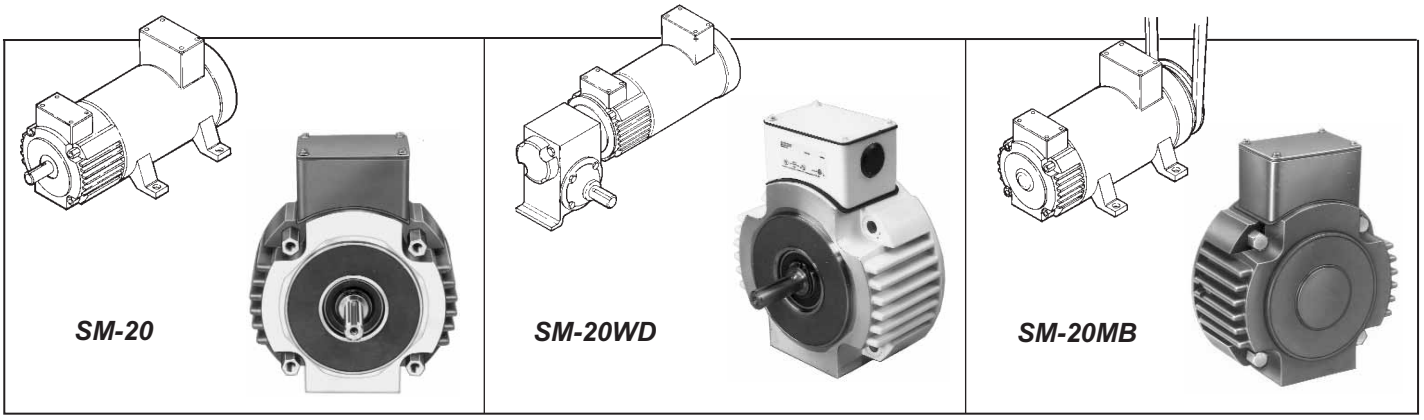
Character	Voltage	List Adder
C E J	12 Vdc 24-28 Vdc 90-100 Vdc	*none*
N	115 Vac	$ 92.00
P	230 Vac	110.00

Hub Size Table for SM-1040's

Character	Bore	Keyway
L	5/8	3/16 x 3/32
O	7/8	3/16 x 3/32
R	1 1/8	1/4 x 1/8
U	1 3/8	5/16 x 5/32

Super-Mod® Brake Only Modules:
SM-20, SM-20WD (Washdown) and SM-20MB

BACK TO TABLE OF CONTENTS



- 56C through 215TC NEMA Frame Sizes
- 16 through 145 lb-ft Static Torque; 2400 Maximum RPM
- TENV – Totally Enclosed (Non-Ventilated) IP-54 Enclosure Protection, (IP-55 for Washdown Units)
- Listed by Underwriters Laboratories, Inc., File E-71115 and CSA Certified, File LR-6254
- Power-On Brake* Engagement
- Maximum overhung load capacity is 85 lbs.

*See Series 56,700 and 87,700 for power-off "fail safe" C-face coupler units

Performance Data, Ordering Information and List Prices (Discount Symbol X-8)

Static Torque lb-ft	Dynamic Torque lb-ft	NEMA Frame	Hub bore and shaft diameter	Model	Part Number①	Thermal Capacity (ft-lb/min) ②	Wt. (lbs)	Maximum Electrical Power (watts)	List Price③
16	10	56C	5/8 hub bore 5/8 shaft	SM-50-20	2-37-0561-01-A*L	5000	11	19	$ 720.00
16	10	56C		SM-50-20WD	2-37-0562-01-A*L	5000	11	19	878.00
16	10	56C		SM-50-20MB	2-37-0561-01-X*L	5000	10	19	660.00
35	20	56C		SM-100-20	2-37-0561-02-A*L	5000	11	29	916.00
35	20	56C		SM-100-20WD	2-37-0562-02-A*L	5000	11	29	1118.00
35	20	56C		SM-100-20MB	2-37-0561-02-X*L	5000	10	29	892.00
35	20	140TC	7/8 hub bore 7/8 shaft	SM-180-20	2-37-1401-02-A*O	5000	12	29	916.00
35	20	140TC		SM-180-20WD	2-37-1402-02-A*O	5000	12	29	1118.00
35	20	140TC		SM-180-20MB	2-37-1401-02-X*O	5000	11	29	892.00
75	44	180TC	1-1/8 hub bore 1-1/8 shaft	SM-210-20	2-37-1801-03-A*R	7000	15	16	1784.00
75	44	180TC		SM-210-20MB	2-37-1801-03-X*R	7000	15	16	1714.00
145	86	210TC	1-3/8 hub bore 1-3/8 shaft	SM-250-20	2-37-2101-04-A*U	5600	18	38	1986.00
145	86	210TC		SM-250-20MB	2-37-2101-04-X*U	5600	18	38	1906.00

②Thermal capacity rating is based on ambient temperature of 70°F at 1750 RPM.
③ List prices subject to change without notice.

①Example of a complete part number:
2-37-0561-01-AJL
- 5/8 hub
- 90-100 Vdc
- Basic unit
- 0=Standard Unit
- 2= Without Gap Adjust

Specials available upon request.
Consult factory for list price adder.

Options - Features Table

Series	Character	Description
SM-20	A	Basic Unit - Coupler
SM-20MB	X	No Shaft (end mount motor brake)
SM-20WB		IP-55 Washdown (available in NEMA frame sizes 56C-145TC)

Voltage Table

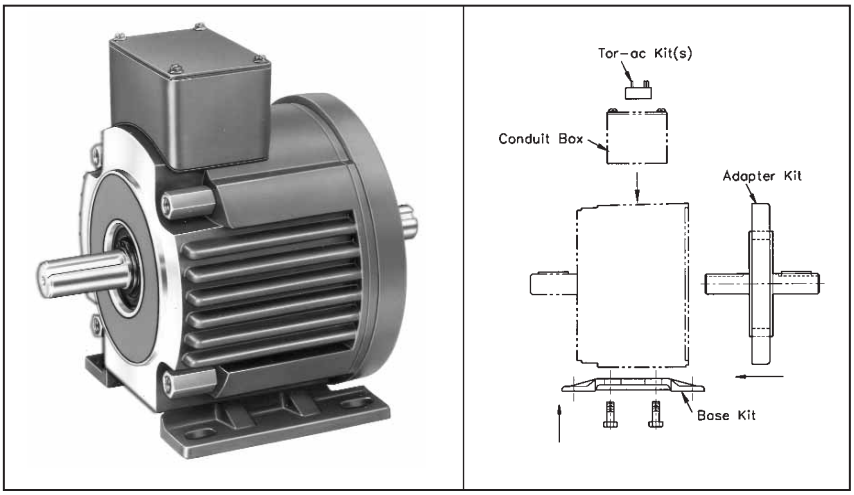
Character	Voltage	List Adder
C E J	12 Vdc 24-28 Vdc 90-100 Vdc	*none*
N	115 Vac	$ 92.00
P	230 Vac	110.00

Hub Size Table for SM-20's

Character	Bore	Keyway
L	5/8	3/16 x 3/32
O	7/8	3/16 x 3/32
R	1 1/8	1/4 x 1/8
U	1 3/8	5/16 x 5/32

Super-Mod® Conversion Kits

BACK TO TABLE OF CONTENTS



Mechanical Flexibility through Conversion Kits

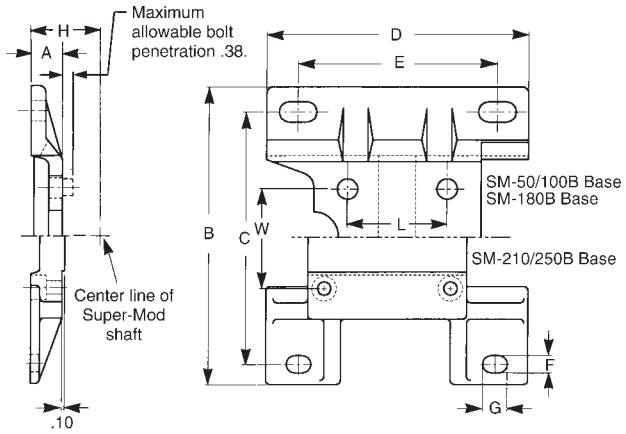
Super-Mod units are stocked in a wide range of configurations and voltages. Additionally, to keep your inventory down and provide quick shipments, Super-Mod provides the answer with inexpensive, easy to use, stock conversion kits. Stock either the base kit, adapter kit, Tor-ac kit or all of them and you can quickly modify your standard clutch (1040), or clutch-brake (1020) into almost any configuration (2030TB, 3040B for example).

Super-Mod is an innovative product. When combined with your equipment, it provides added value through increased reliability and reduced inventory.

Base Kit Dimensional Data (In Inches)

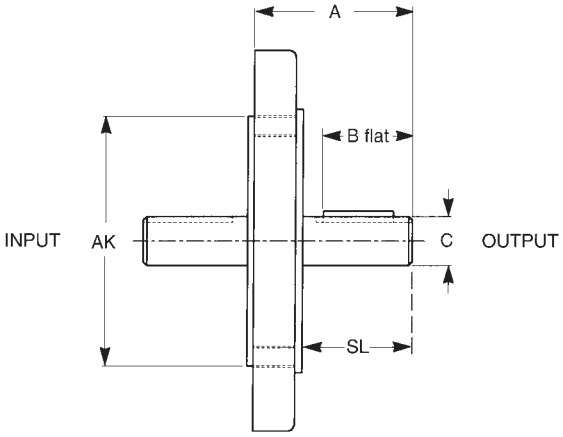
Base Kits Cannot Be Used On Brake Only (20 and 20MB)

Series	A	B	C	D	E	F	G	H	L	W	Bolt Size
SM-50/100B	.54	6.00	5.00	5.25	4.00	.41	.78	3.50	2.02 1.98	1.914 1.910	3/8" - 16x3/4" hex head
SM-180B	1.54	6.00	5.00	5.25	4.00	.41	.78	4.50	2.02 1.98	1.914 1.910	3/8" - 16x3/4" hex head
SM-210/250B	.80	9.00	7.75	8.00	6.00	.54	.78	5.26	3.13 3.12	3.865 3.855	3/8" - 16x1" socket head



Input Adapter Kit (For use with Super-Mod only) Dimensional Data (In Inches)

Series	AK	A	B	C	Keyway	SL
SM-50/100A	4.50	2.78	1.41	.625/.624	3/16 x 3/32	1.785-2.014
SM-180A	4.50	2.84	1.41	.875/.874	3/16 x 3/16	1.792-2.022
SM-210A	8.50	3.33	1.78	1.125/1.124	1/4 x 1/4	2.439-2.489
SM-250A	8.50	3.87	2.41	1.375/1.374	5/16 x 5/16	2.929-2.979



Ordering Information and List Prices

Catalog Number	Part Number	Option	List Price Adder	Discount Symbol
Base Kits *(Base Kits Cannot Be Used On Brake Only - 20 and 20MB)*				
SM-50/100B	5-78-1101-01	SM-50 and SM-100 Series	$ 56.00	X-8
SM-180B	5-78-1101-02	SM-180 Series	79.00	X-8
SM-210B	5-78-0001-30	SM-210 and SM-250 Series	120.00	X-8
Input Adapter Kits				
SM-50/100A	5-78-6100-31	SM-50 and SM-100 Series	174.00	X-8
SM-180A	5-78-6100-32	SM-180 Series	290.00	X-8
SM-210A	5-78-0000-23	SM-210 Series	548.00	X-8
SM-256A	5-78-0000-24	SM-250 Series	692.00	X-8

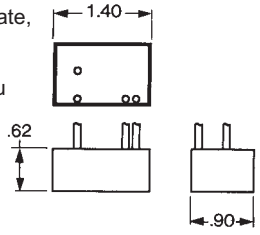
Rectifiers Performance/List Price Data

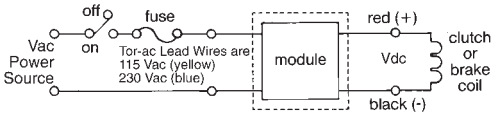
	Catalog Number	Part Number	AC Input Voltage	Nominal DC Output			List Price ③	Discount Symbol
				Volts	Max. Amps②	Max. Watts		
SM-Tor-ac①	SBC-100-1	4-1-20194-00K	115 50-60 Hz	100	.4	40	$92.00	X-8
SM-Tor-ac①	SBC-200-1	4-1-20290-00K	230 50-60 Hz	100	.4	80	110.00	X-8

①Use with 90-100 Vdc "J" coils only.
②Based on ambient temperature of 149°F.
③List prices subject to change without notice.

SM Tor-ac™ Kit

Single channel, solid-state, quick response rectifier circuit can be mounted in any SM unit. Lets you switch on the AC-side, with mechanical response times equal to traditional DC-side switching.

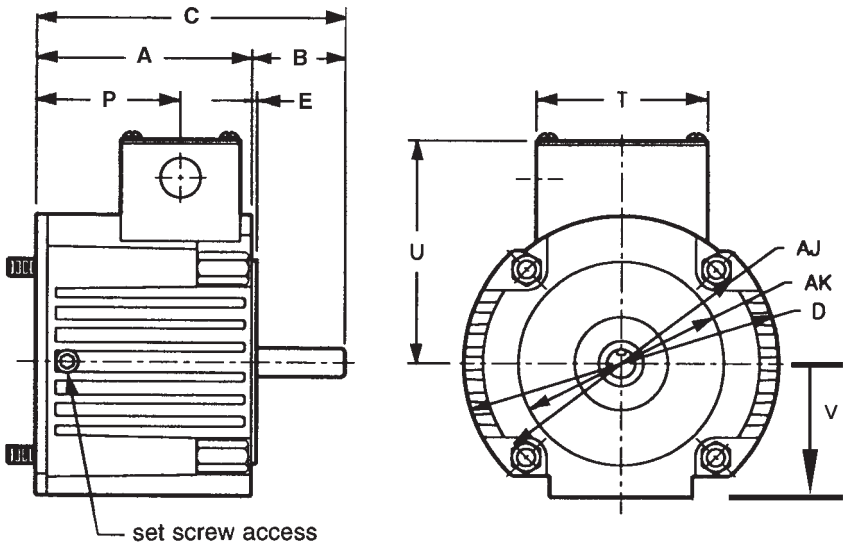




Super-Mod® Dimensional Data

BACK TO TABLE OF CONTENTS

SM-1020, SM-1040, SM-20 and SM-20MB

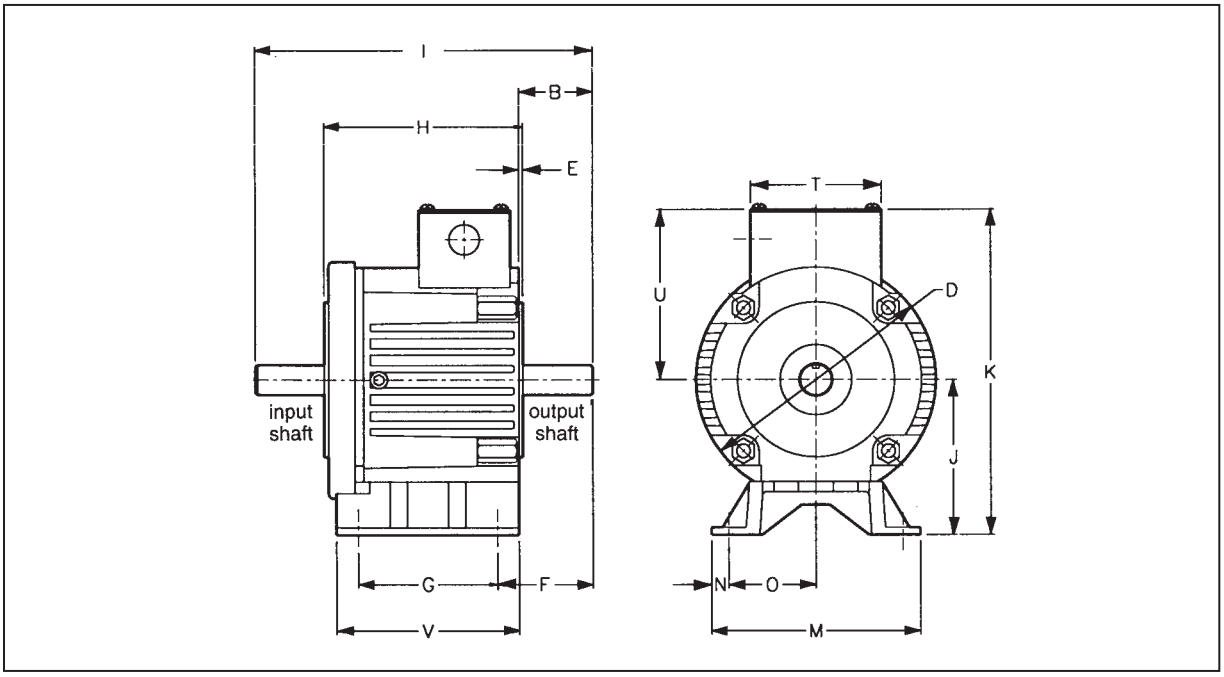


NEMA C-Face Frame Size	Configuration	Basic Module Style	Basic Model Number	AJ	AK	Hub Bore and Shaft Ø	Keyway	A	B	C	D	E	P	T	U	V
SM-50 SM-100 56C 5/8 hub bore 5/8 shaft	C-Face Clutch/Brake	1020	2-35-056X-0X-A*L	5.875	4.5	5/8	3/16 x 3/32	4.71	2.06	6.77	6.9	.16	3.15	2.8	4.9	3.0
	C-Face Clutch Only	1040	2-36-056X-0X-A*L													
	C-Face Brake Only	20	2-37-056X-0X-A*L					3.14		5.2			2.92			
	C-Face Brake Only without Shaft	20MB	2-37-056X-0X-X*L						-	-		-				
SM-180 145TC 7/8 hub bore 7/8 shaft	C-Face Clutch/Brake	1020	2-35-140X-02-A*O	5.875	4.5	7/8	3/16 x 3/32	4.71	2.12	6.83	6.9	.16	3.15	3.8	4.9	3.0
	C-Face Clutch Only	1040	2-36-140X-02-A*O													
	C-Face Brake Only	20	2-37-140X-02-A*O					3.14		5.25			1.58			
	C-Face Brake Only without Shaft	20MB	2-37-140X-02-X*O						-	-		-				
SM-210 182TC 184TC 1-1/8 hub bore 1-1/8 shaft	C-Face Clutch/Brake	1020	2-35-1801-03-A*R	7.25	8.5	1-1/8	1/4 x 1/8	6.11	2.59	8.7	9	.25	2.83	4	7.4	4.63
	C-Face Clutch Only	1040	2-36-1801-03-A*R													
	C-Face Brake Only	20	2-37-1801-03-A*R					4.61		7.2			2.17			
	C-Face Brake Only without Shaft	20MB	2-37-1801-03-X*R						-	-		-				
SM-250 213TC 215TC 1-3/8 hub bore 1-3/8 shaft	C-Face Clutch/Brake	1020	2-35-2101-04-A*U	7.25	8.5	1-3/8	5/16 x 5/32	6.11	3.03	9.14	9	.25	2.83	4	7.4	4.63
	C-Face Clutch Only	1040	2-36-2101-04-A*U													
	C-Face Brake Only	20	2-37-2101-04-A*U					4.61		7.64			2.17			
	C-Face Brake Only without Shaft	20MB	2-37-2101-04-X*U						-	-		-				

Super-Mod® Dimensional Data

BACK TO TABLE OF CONTENTS

SM-2030B and SM-3040B



NEMA C-Face Frame Size	Configuration	Basic Module Style	Basic Model Number	Shaft ø	Keyway	B	D	E	F	G	H	I	J	K	M	N	O	T	U	V
SM50 SM100 56C 5/8 shaft	Base Mount Clutch/Brake-Double Shaft	2030B	2-35-056X-0X-D*L	5/8	3/16 x 3/32	2.06	6.9	.16	2.76	4	5.9	9.55	3.5	8.4	6	0.5	2.5	3.8	4.9	5.25
	Base Mount Clutch Only-Double Shaft	3040B	2-36-056X-0X-D*L	5/8	3/16 x 3/32															
SM-180 143TC 145TC 7/8 shaft	Base Mount Clutch/Brake-Double Shaft	2030B	2-35-140X-0X-D*O	7/8	3/16 x 3/32	2.12	6.9	.16	2.82	4	5.9	9.61	4.5	9.4	6	0.5	2.5	3.8	4.9	5.25
	Base Mount Clutch Only-Double Shaft	3040B	2-36-140X-0X-D*O	7/8	3/16 x 3/32															
SM-210 182TC 184TC 1-1/8 shaft	Base Mount Clutch/Brake-Double Shaft	2030B	2-35-1801-03-D*R	1-1/8	1/4 x 1/8	2.59	9	.25	3.41	6	6.91	12.09	5.25	12.65	9	0.63	3.87	4	7.4	8
	Base Mount Clutch Only-Double Shaft	3040B	2-36-1801-03-D*R	1-1/8	1/4 x 1/8															
SM-250 213TC 215TC 1-3/8 shaft	Base Mount Clutch/Brake-Double Shaft	2030B	2-35-2101-04-D*U	1-3/8	5/16 x 5/32	3.03	9	.25	3.88	6	6.91	12.97	5.25	12.65	9	0.63	3.87	4	7.4	8
	Base Mount Clutch Only-Double Shaft	3040B	2-36-2101-04-D*U	1-3/8	5/16 x 5/32															

Introduction

Information and guidelines provided in the application section are intended for general selection and application of spring set brakes. Unusual operating environments, loading or other undefined factors may affect the proper application of the product. Stearns application services are available to assist in proper selection or to review applications where the specifier may have questions.

A spring set brake is used to stop and hold a rotating shaft. Generally the brake is mounted to an electric motor, but can also be mounted to gear reducers, hoists, machinery or utilize a foot mount kit.

The brake should be located on the high speed shaft of a power transmission system. This permits a brake with the lowest possible torque to be selected for the system.

Spring set disc brakes use friction to stop (dynamic torque) and hold (static torque) a load. Energy of the motor rotor and moving load is converted to thermal energy (heat) in the brake during deceleration. The brakes are power released, spring applied. No electrical current is required to maintain the spring set condition.

The system designer will need to consider the mount surface and match the brake to the load and application. Factors include: brake torque, stopping time, deceleration rate, load weight and speed, location and environment. Brake thermal ratings, electrical requirements and environmental factors are discussed in separate sections.

Electrical Considerations

Solenoid actuated brakes (SAB's) are available with standard motor voltages, frequencies and Class B or H coil insulation. Most models can be furnished with either single or dual voltage coils. Coils in most models are field replaceable.

Inrush and holding amperage information is published for the common coil voltages and factory available for other voltages or frequencies. Amperage information for specific coil sizes is provided for selection of wire size and circuit protection at brake installation. Fixed voltage - 50/60 Hz dual frequency coils are available in many models.

All SAB AC coils are single phase and can be wired to either single or three phase motors without modifications. All solenoid coils have a voltage range of +/- 10% of the rated nameplate voltage at the rated frequency. Instantaneous rated voltage must be supplied to the coil to insure proper solenoid pull in and maximum coil cycle rate. The plunger rapidly seats in the solenoid and the amperage requirements drops to a holding amperage value.

Instantaneous voltage must be supplied to the coil to insure proper solenoid pull-in and maximum coil cycle rate.

Because Stearns Solenoid Actuated Brakes (SAB's) require low current to maintain the brake in the released position, the response time to set the brake *can* be affected by EMF voltages generated by the motor windings. It may be necessary to isolate the brake coil from the motor winding.

The solenoid coil cycle rate limits the engagements per minute of a static or holding duty brake. Brake thermal performance, discussed in another section, limits engagements per minute in dynamic applications.

Class B insulation is standard in most SAB models, class H coil insulation is optional and is recommended for environments above 104°F (40°C), or rapid cycling applications.

Armature actuated brakes (AAB's) are available in standard DC voltages. Available AC rectification is listed in the catalog section. Wattage information is provided in the catalog pages. Unlike solenoid actuated brakes, armature actuated brakes do not have inrush amperage. Coil and armature reaction time and resulting torque response time information is available. Like SAB, mechanical reaction time depends on typical application factors including load, speed and position.

Electrical response time and profiles are unique to the SAB and AAB. Reaction time requirements should be considered when selecting or interchanging brakes.

All Stearns brake coils are rated for continuous duty and can be energized continually without overheating. The coil heating effect is greatest at coil engagement due to engaging, pull in or inrush amperage.

Temperature limits as established by UL controls standards are:

Class A insulation	221°F (105°C)
Class B insulation	266°F (130°C)
Class H insulation	356°F (180°C).

Types of Applications

In order to simplify the selection of a disc brake, loads can be classified into two categories, non-overhauling and overhauling.

Loads are classified as non overhauling, if (1) no components of the connected equipment or external material undergo a change of height, such as would occur in hoisting, elevating or lowering a load, and (2) there is only rotary motion in a horizontal plane. For example, a loaded conveyor operating in a horizontal plane would be typical of a non-overhauling load.

If the same conveyor were transporting material to a lower level, it would be classified as an overhauling load. The external material or load undergoes a change in height, with the weight of the load attempting to force the conveyor to run faster than its design speed or to overhaul.

Non-overhauling loads require braking torque only to stop the load and will remain at rest due to system friction. Overhauling loads, such as a crane hoist, have two torque requirements. The first requirement is the braking torque required to *stop* the load, and the second requirement is the torque required to *hold* the load at rest. The sum of these requirements is considered when selecting a brake for an overhauling load.

Alignment

Requirements per NEMA:

Permissible ECCENTRICITY of mounting rabbet (AK dimension):

42C to 286TC frames inclusive is 0.004" total indicator reading. 324TC to 505TC frames inclusive is 0.007" total indicator reading.

Face Runout:

42C to 286TC frames inclusive is 0.004" total indicator reading.

If a customer furnishes a face on the machine for brake mounting, the same tolerances apply. Floor mounted brakes must be carefully aligned within 0.005" for concentricity and angular alignment. Use of dowels to insure permanent alignment is recommended.

In offset brake mount locations such as fan covers, cowls or jack shafting, proper mount rigidity and bearing support must be provided. Spring set frictional brakes characteristically have a rapid stop during torque application which may affect the mount surface or contribute to shaft deflection.

Printed installation information is published and available on all Stearns spring set brakes.

Determining Brake Torque

Torque ratings

Brake torque ratings are normally expressed as nominal static torque. That is, the torque required to begin rotation of the brake from a static, engaged condition. This value is to be distinguished from dynamic torque, which is the retarding torque required to stop a linear, rotating or overhauling load.

As a general rule, a brake's dynamic torque is approximately 80% of the static torque rating of the brake for stopping time up to one second. Longer stopping time will produce additional brake heat and possible fading (reduction) of dynamic torque. The required dynamic torque must be converted to a static torque value before selecting a brake, using the relationship:

$$T_S = \frac{T_d}{0.8}$$

Where, T_S = Static torque, lb-ft

T_d = Dynamic torque, lb-ft

0.8 = Constant (derating factor)

All Stearns brakes are factory burnished and adjusted to produce no less than rated nominal static torque. Burnishing is the initial wear-in and mating of the rotating friction discs with the stationary metallic friction surfaces of the brake.

Although brakes are factory burnished and adjusted, variations in torque may occur if components are mixed when disassembling and reassembling the brake during installation. Further burnishing may be necessary after installation. Friction material will burnish under normal load conditions. Brakes used as holding only duty require friction material burnishing at or before installation to insure adequate torque.

When friction discs are replaced, the brake must be burnished again in order to produce its rated holding torque.

System Friction

The friction and rolling resistance in a power transmission system is usually neglected when selecting a brake. With the use of anti-friction bearings in the system, friction and rolling resistance is usually low enough to neglect. Friction within the system will assist the brake in stopping the load. If it is desired to consider it, subtract the frictional torque from the braking torque necessary to decelerate and stop the load. Friction and rolling resistance are neglected in the examples presented in this guide.

Non-overhauling Loads

There are two methods for determining brake torque for non-overhauling loads. The first method is to size the brake to the torque of the motor. The second is to select a brake on the basis of the total system or load inertia to be stopped.

Selecting Brake Torque from the Motor Data

Motor full-load torque based or nameplate horsepower and speed can be used to select a brake. This is the most common method of selecting a brake torque rating due to its simplicity.

This method is normally used for simple rotary and linear inertial loads. Brake torque is usually expressed as a percent of the full load torque of the motor. Generally this figure is not less than 100% of the motor's full load torque. Often a larger service factor is considered. Refer to *Selection of Service Factor.*

The required brake torque may be calculated from the formula:

$$T_S = \frac{5{,}252 \times P}{N} \times SF$$

Where, T_S = Static brake torque, lb-ft

P = Motor horsepower, hp

N = Motor full load speed, rpm

SF = Service factor

5,252 = Constant

Match the brake torque to the hp used in the application. When an oversized motor hp has been selected, brake torque based on the motor hp may be excessive for the actual end use.

Nameplate torque represents a nominal static torque. Torque will vary based on combinations of factors including cycle rate, environment, wear, disc burnish and flatness. Spring set brakes provide a rapid stop and hold and are generally not used in repeat positioning applications.

Selection of Service Factor

A service factor is applied to the basic drive torque calculation. The SF compensates for any tolerance variation, data inaccuracy, unplanned transient torque and potential variations of the friction disc.

When using the basic equation: T= (hp x 5252) / rpm with non-overhauling loads, a service factor of 1.2 to 1.4 is typical. Overhauling loads with unknown factors such as reductions may use a service factor of 1.4 to 1.8.

Spring set brakes combined with variable frequency drives use service factors ranging from 1.0 to 2.0 (2.0 for holding duty only) depending on the system design. These holding duty brakes must be wired to a separate dedicated power supply.

Occasionally, a brake with a torque rating less than the motor full load torque or with a service factor less than 1.0 is selected. These holding or soft stop applications must be evaluated by the end user or system designer to insure adequate sizing and thermal capacity.

Typically a brake rated 125% of the motor full load torque, or with a 1.25 service factor, provides a stop in approximately the same time as that required for the motor to accelerate the load to full load speed.

Occasionally a motor is oversized or undersized for the load or application. In these situations, the load inertia and desired stopping time calculations should be used rather than relying on the service factor method alone.

Service factor selection can be based on motor performance curves. Motor rotor and load inertia should be considered in this selection process. Depending on the motor design (NEMA A, B, C and D), rpm and horsepower, the maximum torque is either the starting or breakdown torque. A NEMA design B, 3 phase, squirrel cage design motor at breakdown torque produces a minimum of 250% the full load torque. A service factor of 2.5 would be selected. Typical service factors depending on NEMA motor design are: NEMA design A or B: 1.75 to 3.0, NEMA design C: 1.75 to 3.0 and NEMA design D: not less than 2.75.

A brake with an excessive service factor may result in system component damage, an unreasonably rapid stop or loss of load control. A SF above 2.0 is not recommended without evaluation by the end user or system designer.

Example 1: Select brake torque from motor horsepower and speed.

Given: Motor power (P) - 5 hp

Motor speed (N) - 1,750 rpm

Service factor (SF) - 1.4

$$T = \frac{5{,}252 \times P}{N} \times SF$$

$$= \frac{5{,}252 \times 5}{1{,}750} \times 1.4$$

T = 21 lb-ft

A brake having a standard rating of 25 lb-ft nominal static torque would be selected.

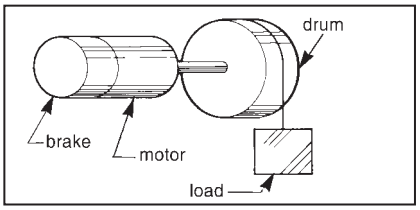
Example 2 illustrates selection of a brake to provide proper static torque to hold a load if dynamic braking were used to stop the load.

Example 2: Select a brake to hold a load in position after some other method, such as dynamic braking of the motor, has stopped all rotation.

Given: Weight of load (W) - 5 lb

Drum radius (R) - 2 ft

Service factor (SF) - 1.4



The static holding torque is determined by the weight of the load applied at the drum radius. A service factor is applied to ensure sufficient holding torque is available in the brake.

$$T_S = F \times R \times SF$$
$$= 5 \times 2 \times 1.4$$
$$T_S = 14 \text{ lb-ft}$$

Sizing the Brake to the Inertial Load

For applications where the load data is known, where high inertial loads exist, or where a stop in a specified time or distance is required, the brake should be selected on the basis of the total inertia to be retarded. The total system inertia, reflected to the brake shaft speed, would be:

$$Wk_T^2 = Wk_B^2 + Wk_M^2 + Wk_L^2$$

Where: Wk_T^2 = Total inertia reflected to the brake, lb-ft^2

Wk_B^2 = Inertia of brake, lb-ft^2

Wk_M^2 = Inertia of motor rotor, lb-ft^2

Wk_L^2 = Equivalent inertia of load reflected to brake shaft, lb-ft^2

Other significant system inertias, including speed reducers, shafting, pulleys and drums, should also be considered in determining the total inertia the brake would stop.

If any component in the system has a rotational speed different than the rotational speed of the brake, or any linear moving loads are present, such as a conveyor load, their equivalent inertia in terms of rotary inertia at the brake rotational speed must be determined. The following formulas are applicable:

Rotary motion:

$$\text{Equivalent } Wk_B^2 = Wk_L^2 \left(\frac{N_L}{N_B}\right)^2$$

Where,

Equivalent Wk_B^2 = Inertia of rotating load reflected to brake shaft, lb-ft^2

Wk_L^2 = Inertia of rotating load, lb-ft^2

N_L = Shaft speed at load, rpm

N_B = Shaft speed at brake, rpm

Horizontal Linear Motion

$$\text{Equivalent } Wk_W^2 = W\left(\frac{V}{2\pi N_B}\right)^2$$

Where,

Equivalent Wk_W^2 = Equivalent inertia of linear moving load reflected to brake shaft, lb-ft^2

W = Weight of linear moving load, lb

V = Linear velocity of load, ft/min

N_B = Shaft speed at brake, rpm

Once the total system inertia is calculated, the required average dynamic braking torque can be calculated using the formula:

$$T_d = \frac{Wk_T^2 \times N_B}{308 \times t}$$

Where, T_d = Average dynamic braking torque, lb-ft

Wk_T^2 = Total inertia reflected to brake, lb-ft^2

N_B = Shaft speed at brake, rpm

t = Desired stopping time, sec

308 = Constant

The calculated dynamic torque is converted to the static torque rating using the relationship:

$$T_s = \frac{T_D}{0.8}$$

Where, T_s = Brake static torque, lb-ft

T_d = System dynamic torque, lb-ft

Examples 3, 4, 5 and 6 illustrate how brake torque is determined for non-overhauling loads where rotary or horizontal linear motion is to be stopped.

Example 3: Select a brake to stop a rotating flywheel in a specified time.

Given, Motor speed (N_M) - 1,750 rpm

Motor inertia (Wk_M^2) - 0.075 lb-ft^2

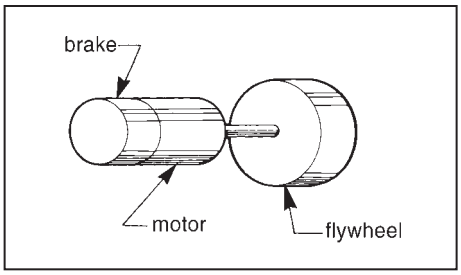
Flywheel inertia (Wk_{FW}^2) - 4 lb-ft^2

Brake inertia (Wk_B^2) - 0.042 lb-ft^2

Required stopping time (t) - 1 sec

First determine the total inertia to be stopped,

$$Wk_T^2 = Wk_M^2 + Wk_{FW}^2 + Wk_B^2$$
$$= 0.075 + 4 + 0.042$$
$$Wk_T^2 = 4.117 \text{ lb-ft}^2$$



The dynamic braking torque required to stop the total inertia in 1 second is,

$$T_d = \frac{Wk_T^2 \times N_{BM}}{308 \times t}$$
$$= \frac{4.117 \times 1{,}750}{308 \times 1}$$
$$T_d = 23.4 \text{ lb-ft}$$

Converting T_d to static torque

$$T_S = \frac{T_d}{0.8}$$
$$= \frac{23.4}{0.8}$$
$$T_S = 29.3 \text{ lb-ft}$$

A brake having a standard static torque rating of 35 lb-ft would be selected. Since a brake with more torque than necessary to stop the flywheel in 1 second is selected, the stopping time would be,

$$t = \frac{Wk_T^2 \times N_{BM}}{308 \times T_d}$$
$$= \frac{Wk_T^2 \times N_{BM}}{308 \times (0.8\ T_S)}$$
$$\frac{4.117 \times 1{,}750}{308 \times (0.8 \times 35)}$$
$$t = 0.84 \text{ sec}$$

See section on *Stopping Time* and *Thermal Information.*

Example 4: Select a brake to stop a rotating flywheel, driven through a gear reducer, in a specified time.

Given: Motor speed (N_M) - 1,800 rpm

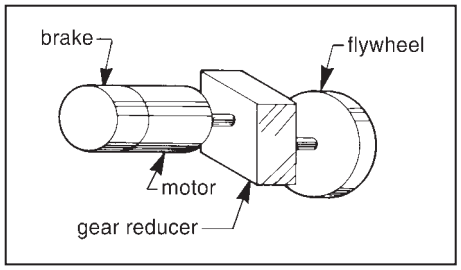
Motor inertia (Wk_M^2) - 0.075 lb-ft^2

Gear reduction (GR) - 20:1

Gear reducer inertia at high speed shaft (Wk_{GR}^2) - 0.025 lb-ft^2

Flywheel inertia (Wk_{FW}^2) - 20 lb-ft^2

Required stopping time (t) - 0.25 sec



First, determine rotating speed of flywheel (N_{FW})

$$N_{FW} = \frac{N_{BM}}{GR}$$

$$= \frac{1,800}{20}$$

$$N_{FW} = 90 \text{ rpm}$$

Next, the inertia of the flywheel must be reflected back to the motor brake shaft.

$$Wk_b^2 = Wk_{FW}^2 \left(\frac{N_{FW}}{N_M}\right)^2$$

$$= 20\left(\frac{90}{1,800}\right)^2$$

$$Wk_b^2 = 0.05 \text{ lb-ft}^2$$

Determining the total Wk^2,

$$Wk_T^2 = Wk_M^2 + Wk_{GR}^2 + Wk_b^2$$

$$= 0.075 + 0.025 + 0.05$$

$$Wk_T^2 = 0.15 \text{ lb-ft}^2$$

The required dynamic torque to stop the flywheel in 0.25 seconds can now be determined.

$$T_d = \frac{Wk_T^2 \times N_{BM}}{308 \times t}$$

$$T_d = \frac{0.15 \times 1,800}{308 \times 0.25}$$

$$T_d = 3.5 \text{ lb-ft}$$

Converting dynamic torque to static torque,

$$T_s = \frac{T_d}{0.8}$$

$$= \frac{3.5}{0.8}$$

$$T_s = 4.4 \text{ lb-ft}$$

A brake having a standard static torque rating of 6 lb-ft would be selected. Since a brake with more torque than necessary to stop the flywheel in 0.25 seconds is selected, the stopping time would be,

$$t = \frac{Wk_T^2 \times N_M}{308 \times T_d}$$

$$= \frac{Wk_T^2 \times N_M}{308 \times (0.8 \times T_s)}$$

$$= \frac{0.15 \times 1,800}{308 \times (0.8 \times 6)}$$

$$t = 0.18 \text{ sec}$$

See section on *Stopping Time* and *Thermal Information*.

Example 5: Select a brake to stop a load on a horizontal belt conveyor in a specified time.

Given:

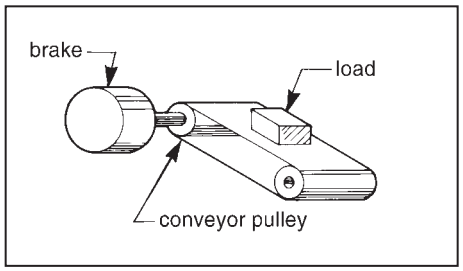
Conveyor pulley speed (N_p) - 32 rpm

Weight of load (W) - 30 lb

Conveyor pulley and belt inertia (Wk_p^2) - 4.0 lb-ft^2

Conveyor pulley diameter (d_p) - 1 ft

Required stopping time (t) - 0.25 sec



First, convert the rotational pulley speed to linear belt speed (V_B).

$$V_B = \pi d_p N_p$$

$$= \pi \times 1 \times 32$$

$$V_B = 100.5 \text{ ft/min}$$

Next, determine inertia of load.

$$Wk_W^2 = W\left(\frac{V_B}{2\pi \times N_p}\right)^2$$

$$= 30\left(\frac{100.5}{2\pi \times 32}\right)^2$$

$$Wk_W^2 = 7.5 \text{ ft-lb}^2$$

Then, determine total inertial load

$$Wk_T^2 = Wk_W^2 + Wk_p^2$$

$$= 7.5 + 4.0$$

$$Wk_T^2 = 11.5 \text{ lb-ft}^2$$

The required dynamic torque to stop the conveyor load in 0.25 seconds can now be determined.

$$T_d = \frac{Wk_T^2 \times N_p}{308 \times t}$$

$$T_d = \frac{11.5 \times 32}{308 \times 0.25}$$

$$T_d = 4.8 \text{ lb-ft}$$

Converting dynamic torque to static torque,

$$T_S = \frac{T_d}{0.8}$$

$$= \frac{4.8}{0.8}$$

$$T_S = 6 \text{ lb-ft}$$

A brake having a standard static torque rating of 6 lb-ft would be selected. See *Thermal Information.*

Example 6: Select a brake to stop a trolley crane and its load in a specified time. Brake mounted on wheel axle.

Given:

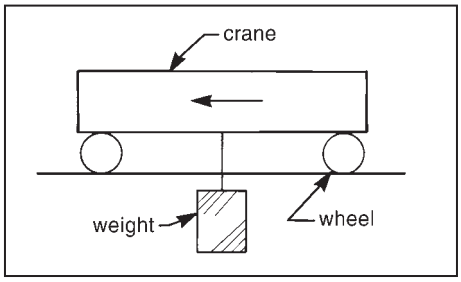
Weight of crane (W_C) - 2,000 lb

Weight of load (W_L) - 100 lb

Trolley velocity (v) - 3 ft/sec or 180 ft/min

Radius of trolley wheel (r) - 0.75 ft

Required stopping time (t) - 2 sec



The dynamic braking torque required to stop the trolley crane and load can be determined by one of two methods. The first method is to determine the equivalent inertia of the linearly moving crane and load, then calculate the dynamic braking torque. The second method is to determine the dynamic braking torque directly.

Using the first method, the total weight to be stopped is determined first.

$W_T = W_L + W_C$

$= 100 + 2{,}000$

$W_T = 2{,}100$ lb

Next, the rotational speed of the axle (N_B) is calculated.

$$N_B = \frac{V}{2\pi r}$$

$$= \frac{180}{2 \times \pi \times 0.75}$$

$N_B = 38.2$ rpm

Then, the equivalent inertia of the linearly moving crane and load is determined.

$$Wk_T^2 = W_T\left(\frac{V}{2\pi N_B}\right)^2$$

$$= 2{,}100\left(\frac{180}{2\pi\ 38.2}\right)^2$$

$Wk_T^2 = 1{,}181$ lb-ft^2

Finally, the dynamic braking torque required to stop the total inertia in 2 seconds is,

$$T_d = \frac{Wk_T^2 \times N_B}{308 \times t}$$

$$= \frac{1{,}181 \times 38.2}{308 \times 2}$$

$T_d = 73$ lb-ft

Using the second method, the dynamic braking torque required to stop the crane and load in 2 seconds can be calculated directly using the formula,

$$T_d = \frac{W_T v}{gt} \times r$$

Where, T_d = Average dynamic braking torque, lb-ft

W_t = Total weight of linear moving load, lb

v = Linear velocity of load, ft/sec

g = Gravitational acceleration constant, 32.2 ft/sec^2

t = Desired stopping time, sec

r = Length of the moment arm (wheel radius), ft

or, for this example,

$$T_d = \frac{2{,}100 \times 3}{32.2 \times 2} \times .75$$

$T_d = 73$ lb-ft

For both methods above, the required dynamic braking torque is converted to static torque,

$$T_s = \frac{T_d}{0.8}$$

$$= \frac{73}{0.8}$$

$T_s = 91$ lb-ft

A smaller brake could be mounted on the high speed shaft in place of the higher torque on the low speed shaft.

A brake having a standard static torque rating of 105 lb-ft is selected. Since a brake with more torque than necessary to stop the load in 2 seconds is selected, the stopping time would be,

$$T = \frac{W_T v}{gT_d} \times r$$

$$= \frac{W_T v}{g \times (0.8 \times T_s)} \times r$$

$$= \frac{2{,}100 \times 3}{32.2 \times (0.8 \times 105)} \times 0.75$$

$t = 1.8$ sec

See section on *Stopping Time* and cycle rates, *Thermal Selection.* Stops should be under 2 seconds. Longer stops require application test.

Overhauling Loads

Applications with a descending load, such as power lowered crane, hoist or elevator loads, require a brake with sufficient torque to both *stop* the load, and *hold* it at rest. Overhauling loads having been brought to rest still invite motion of the load due to the effect of gravity. Therefore, brake torque must be larger than the overhauling torque in order to stop and hold the load. If brake torque is equal to or less than the overhauling torque, there is no net torque available for stopping a descending load.

First, the total system inertia reflected to the brake shaft speed must be calculated.

Second, the average dynamic torque required to decelerate the descending load in the required time is calculated with the formula:

$$T_d = \frac{Wk_T^2 \times N_B}{308 \times t}$$

Where, T_d = Average dynamic braking torque, lb-ft

Wk_T^2 = Total inertia reflected to brake, lb-ft^2

N_B = Shaft speed at brake, rpm. Consider motor slip when descending.

t = Desired stopping time, sec

Third, the overhauling torque reflected to the brake shaft is determined by the formula:

$$T_o = W \times R \times \frac{N_L}{N_B}$$

Where, T_o = Overhauling dynamic torque of load reflected to brake shaft, lb-ft

W = Weight of overhauling load, lb

R = Radius of hoist or elevator drum, ft

N_L = Rotating speed of drum, rpm

N_B = Rotating speed at brake, rpm

Or alternately, the dynamic torque to overcome the overhauling load can be calculated with the formula:

$$T_o = \frac{0.158 \times W \times V}{N_B}$$

Where, T_o = Overhauling dynamic torque of load reflected to brake shaft, lb-ft

W = Weight of overhauling load, lb

V = Linear velocity of descending load, ft/min

N_B = Shaft speed at brake, rpm

0.158 = Constant

Next, the total dynamic torque required to stop and hold the overhauling load is the sum of the two calculated dynamic torques:

$$T_t = T_d + T_o$$

Finally, the dynamic torque must be converted to static brake torque to select a brake:

$$T_S = \frac{T_d}{0.8}$$

Where, T_S = Brake static torque, lb-ft

T_t = System dynamic torque, lb-ft

If the total inertia of the system and overhauling load cannot be accurately determined, a brake rated at 180% the motor full load torque should be selected. Refer to *Selection of Service Factor.* The motor starting torque may permit a heavier than rated load to be lifted; the brake must stop the load when descending.

Examples 7, 8 and 9 illustrate how brake torque would be determined for overhauling loads. In these examples brakes are selected using the system data rather than sizing them to the motor. Refer to the section on *Thermal Calculations* to determine cycle rate.

Consider motor slip in calculation. An 1800 rpm motor with 10% slip would operate at 1,620 rpm when the load is ascending and 1,980 rpm when descending. Motor rpm, armature inertia and load position will affect stop time. Brakes on overhauling loads should be wired through a dedicated relay.

Example 7: Select a brake to stop an overhauling load in a specified time.

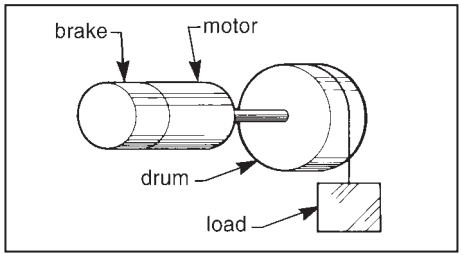
Given: Cable speed (V) - 667 ft/min
Weight of load (W) - 100 lb
Drum diameter (D) - 0.25 ft
Drum inertia (Wk_D^2) - 5 lb-ft^2
Required stopping time (t) -1 sec

First, determine brakemotor shaft speed (N_B).

$$NB = \frac{V}{\pi D}$$

$$= \frac{667}{\pi \times 0.25}$$

$$NB = 849 \text{ rpm}$$



Then, determine the equivalent inertia of the overhauling load.

$$Wk_I^2 = W\left(\frac{V}{2\pi N_B}\right)^2$$

$$= 100\left(\frac{667}{2\pi \times 849}\right)^2$$

$$Wk_I^2 = 1.56 \text{ lb-ft}^2$$

Therefore, the total inertia at the brake is,

$$Wk_T^2 = Wk_D^2 + Wk_I^2$$

$$= 5 + 1.56$$

$$Wk_T^2 = 6.56 \text{ lb-ft}^2$$

Now, the dynamic torque required to decelerate the load and drum in the required time is calculated.

$$T_d = Wk_T^2 \times N_B$$

$$= \frac{6.56 \times 850}{308 \times 1}$$

$$T_d = 18.1 \text{ lb-ft}$$

Next, calculate the dynamic torque required to overcome the overhauling load.

$$T_O = W \times R$$

$$= 100 \times \frac{0.25}{2}$$

$$T_O = 12.5 \text{ lb-ft}$$

The total dynamic torque to stop and hold the overhauling load is the sum of the two calculated dynamic torques.

$$T_t = T_d + T_O$$

$$= 18.1 + 12.5$$

$$T_t = 30.6 \text{ lb-ft}$$

Dynamic torque is then converted to static torque.

$$T_s = \frac{T_t}{0.8}$$

$$= \frac{30.6}{0.8}$$

$$T_s = 38.3 \text{ lb-ft}$$

A brake having a standard torque rating of 50 lb-ft is selected based on expected stop time. Since a brake with more torque than necessary to stop the load in 1 second is selected, the stopping time would be,

$$t = \frac{WK_T^2 \times N}{308 \times T_d}$$

where, $T_s = \frac{T_t}{0.8}$

$$= \frac{T_d + T_O}{0.8}$$

or, $T_d = 0.8T_S - T_O$

$$= (0.8)\ (50) - 12.5$$

$$T_d = 27.5 \text{ lb-ft}$$

therefore, $t = \frac{6.56 \times 850}{308 \times 27.5}$

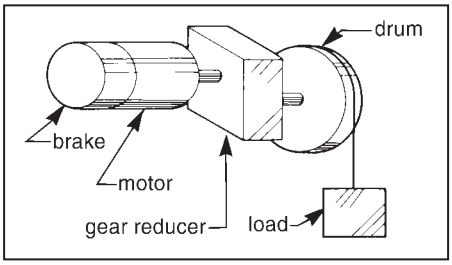
$$t = 0.7 \text{ sec}$$

Wire the brake through a dedicated relay on overhauling loads where stop time or distance is critical. See section on *Stopping time*.

Example 8: Select a brake to stop an overhauling load driven through gear reducer in a specified time.

Given: Motor speed (N_M) - 1,150 rpm
Motor inertia (WK_M^2) - 0.65 lb-ft^2
Gear reduction (GR) - 300:1
Drum diameter (D) - 1.58 ft
Weight of load (W) - 4,940 lb
Drum inertia (WK_D^2) - 600 lb-ft^2
Required stopping time (t) - 0.5 sec

First, calculate all inertial loads reflected to the brakemotor shaft.



The rotational speed of the drum is,

$$N_D = \frac{N_M}{GR}$$

$$= \frac{1,150}{300}$$

$$N_D = 3.83 \text{ rpm}$$

From this, the cable speed can be determined.

$$V = N_D \times \pi D$$

$$= 3.83 \times \pi \times 1.58$$

$$V = 19.0 \text{ ft/min}$$

The equivalent inertia of the load reflected to the brakemotor shaft is,

$$Wk_I^2 = W\left(\frac{V}{2\pi N_{BM}}\right)^2$$

$$= 4,940\left(\frac{19.0}{2\pi\ 1,150}\right)^2$$

$$Wk_I^2 = 0.034 \text{ lb-ft}^2$$

The equivalent inertia of the drum at the brakemotor shaft speed is,

$$Wk_d^2 = Wk_D^2\left(\frac{N_D}{N_{BM}}\right)^2$$

$$= 600\left(\frac{3.83}{1,150}\right)^2$$

Finally, the total inertia the brake will retard is,

$$Wk_T^2 = Wk_M^2 + Wk_T^2 + Wk_d^2$$

$$Wk_T^d = .0067 \text{ lb-ft}^2$$

$$Wk_T^2 = 0.691 \text{ lb-ft}^2$$

The dynamic torque required to decelerate the total inertia is,

$$T_d = \frac{Wk_T^2 \times N_{BM}}{308 \times t}$$

$$= \frac{0.691 \times 1,150}{308 \times 0.5}$$

$$T_d = 5.16 \text{ lb-ft}^2$$

Now, calculate the dynamic torque to overcome the overhauling load.

$$T_O = W \times R = W \times ½D$$

$$= 4,940 \times \frac{1.58}{2}$$

$$T_O = 3,903 \text{ lb-ft}$$

Which reflected to the brakemotor shaft becomes,

$$T_m = \frac{T_O}{GR}$$

$$= \frac{3,903}{300}$$

$$T_m = 13.0 \text{ lb-ft}$$

Then, the total dynamic torque to stop and hold the overhauling load is the sum of the two calculated dynamic torques.

$$T_t = T_d + T_m$$

$$= 5.16 + 13.0$$

$$T_t = 18.16 \text{ lb-ft}$$

Dynamic torque is then converted to static torque.

$$T_S = \frac{T_t}{0.8}$$

$$= \frac{18.16}{0.8}$$

$$T_S = 22.7 \text{ lb-ft}$$

A brake having a standard torque rating of 25 lb-ft is selected.

Example 9: Select a brake to stop and hold a load on an inclined plane (skip hoist).

Given: Motor data

Power (P) - 7½ hp

Speed (N_M) - 1,165 rpm

Rotor inertia (WK_M^2) - 1.4 lb-ft²

Gear reducer data:

Reduction (G_R) - 110:1

Inertia at input shaft (Wk_R^2) - 0.2 lb-ft²

Drum data

Diameter (D_D) - 1.5 ft

Inertia (Wk_D^2) - 75 lb-ft²

Pulley data

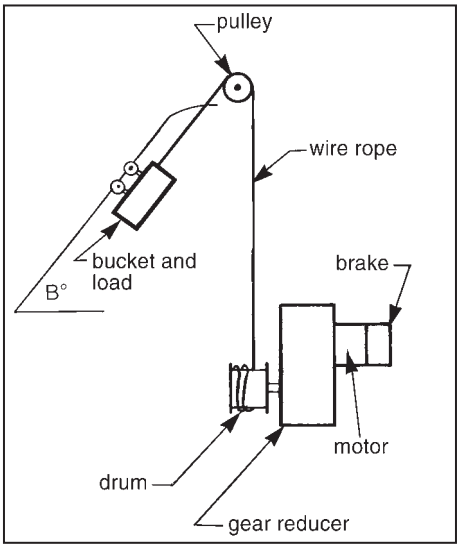
Diameter (D_P) - 1.5 ft

Inertia (Wk_P^2) - 20 lb-ft²

Bucket weight (W_B) - 700 lb

Maximum weight of load (W_L) - 4,000 lb

Slope of track (B) -52.7°



Required stopping time (t) -1 sec

The bucket is full when ascending the track and is empty when descending. When selecting a brake the most severe condition would be a fully loaded bucket backed down the hoist track. In normal operation the descending bucket would be empty. In this example, the brake is selected for the most severe condition.

The total torque to stop and hold the bucket and load when descending is the sum of (a) the torque to decelerate the total inertia and (b) the torque required to hold the loaded bucket.

First, calculate all inertial loads reflected to the brakemotor shaft. The rotational speed of the drum is:

$$N_D = \frac{N_M}{GR}$$

$$= \frac{1,165}{110}$$

$$N_D = 10.6 \text{ rpm}$$

From this the cable speed can be determined

$$V = N_D \times \pi D_D$$

$$= 10.6 \times \pi \times 1.5$$

$$V = 50 \text{ ft/min}$$

The equivalent inertia of the loaded bucket reflected to the brakemotor shaft is,

$$Wk_I^2 = W\left(\frac{V}{2\pi N_M}\right)^2$$

$$= 4,700\left(\frac{50}{2\pi \times 1,165}\right)^2$$

$$Wk_I^2 = 0.219 \text{ lb-ft}^2$$

Next, the inertia of the pulley and drum are reflected to the brake motor shaft speed so the total inertia at the brake can be determined.
Since the diameters of the pulley and drum are the same, 1.5 ft, their rotational speeds would be the same, 10.6 rpm.

The inertia of the pulley reflected to the brakemotor shaft is,

$$Wk_P^2 = Wk_P^2\left(\frac{N_D}{N_M}\right)^2 = Wk_P^2\left(\frac{1}{GR}\right)^2$$

$$= 20 \times \left(\frac{1}{110}\right)^2$$

$$Wk_P^2 = 0.0017 \text{ lb-ft}^2$$

The inertia of the drum reflected to the brakemotor shaft is,

$$Wk_d^2 = Wk_D^2\left(\frac{N_D}{N_M}\right)^2 = Wk_D^2\left(\frac{1}{GR}\right)^2$$

$$= 75 \times \left(\frac{1}{110}\right)^2$$

$$Wk_d^2 = 0.0062 \text{ lb-ft}^2$$

The total inertia to be stopped is,

$$Wk_T^2 = Wk_I^2 + Wk_P^2 + Wk_d^2 + Wk_R^2 + Wk_M^2$$

$$= 0.219 + 0.0017 + 0.0062 + 0.2 + 1.4$$

$$Wk_T^2 = 1.827 \text{ lb-ft}$$

Then, the dynamic torque required to bring the descending bucket and load to rest is,

$$T_d = \frac{Wk_T^2 \times N_M}{308 \times T_d}$$

$$T_d = \frac{1.827 \times 1,165}{308 \times 1}$$

The additional dynamic torque required to hold the overhauling load would be determined by the unbalanced component of the force acting along the plane of the hoist track, $W_T$sinB, and the length of the moment arm which is the drum radius (R_D). $W_T$sinB is the force necessary to retard downward motion of the loaded hoist bucket.

$$T_O = W_T\text{sinB} \times R_D$$
$$= W_T\text{sinB} \times \tfrac{1}{2}D_D$$
$$= 4{,}700 \times \sin 52.7^o \times \tfrac{1}{2}(1.5)$$
$$= 4{,}700 \times 0.7955 \times 0.75$$
$$T_O = 2{,}804 \text{ lb-ft}$$

Which reflected to the brakemotor shaft becomes,

$$T_m = \frac{T_O}{GR}$$
$$= \frac{2{,}804}{110}$$
$$T_m = 25.5 \text{ lb-ft}$$

Then, the total dynamic torque to stop and hold the descending bucket and load is the sum of the two calculated dynamic torques.

$$T_t = T_d + T_m$$
$$= 6.9 + 25.5$$
$$T_t = 32.4 \text{ lb-ft}$$

Converting to static torque,

$$T_S = \frac{T_t}{0.8}$$
$$= \frac{32.4}{0.8}$$
$$T_S = 40.5 \text{ lb-ft}$$

A brake having a standard torque rating of 50 lb-ft is selected. Since a brake with more torque than necessary to stop the load in 1 second is selected, the stopping time would be,

$$t = \frac{W_T^2 \times N_M}{308 \times T_d}$$

Where, $T_S = \frac{T_t}{0.8}$

$$= \frac{T_d + T_m}{0.8}$$

or, $T_d = 0.8T_S - T_m$

$$= (0.8)(50) - 25.5$$
$$T_d = 14.5 \text{ lb-ft}$$

therefore,

$$t = \frac{1.827 \times 1{,}165}{308 \times 14.5}$$
$$t = 0.48 \text{ sec}$$

See section on *Stopping time.*

Stopping Time and Deceleration Rate

In the formulas used to determine dynamic torque, stopping time or "t" in seconds is a desired or assumed value selected on the requirements of the application. For optimum brake performance, a stopping or braking time of 1 second or less is desirable. Stop times between 2 and 3 seconds require test. *A brake of insufficient torque rating will lengthen the stopping time. This may result in overheating of the brake to a point where torque falls appreciably. The friction material could carbonize, glaze, or fail.*

After determining the braking torque required by a system, it may be necessary to recalculate the stopping time based on the actual brake size selected to insure that stopping time falls within the 0 to 2 second range. Any formula, where the stopping time is a variable, may be rewritten to solve for the new stopping time. For instance, the dynamic torque equation may be transposed as follows:

$$T_d = \frac{Wk_f^2 \times N_B}{308 \times t}$$

or, $$t = \frac{Wk_f^2 \times N_B}{308 \times (0.8 \times T_S)}$$

Where, t = Stopping time, sec

Wk_f^2 = Total inertia reflected to brake, lb-ft^2

N_B = Shaft speed at brake, rpm

T_S = Nominal static torque rating of brake, lb-ft

T_d = Dynamic braking torque ($0.8 \times T_S$), lb-ft

0.8 = Constant (derating factor)

308 = Constant

Brakes are rated in static torque. This value is converted to dynamic torque, as done in the above equation, when stopping time is calculated. That is,

$$T_d = 0.8 \times T_S$$

Where, T_d = Dynamic braking torque, lb-ft

T_S = Nominal static torque rating of brake, lb-ft

The approximate number of revolutions the brake shaft makes when stopping is:

$$\text{Revolutions to stop} = \frac{t \times N_B}{120}$$

Where, t = Stopping time, sec

N_B = Shaft speed at brake, rpm

120 = Constant

The average rate of deceleration when braking a linearly moving load to rest can be calculated using the stopping time determined by the above formula and the initial linear velocity of the load.

$$a = -\frac{V_i}{t}$$

Where, a = Deceleration, ft/sec^2

V_i = Initial linear velocity of load, ft/sec

t = Stopping time, sec

RPM Considerations

The maximum allowable rotational speed of the brake should not be exceeded in braking. Maximum brake rpm as listed in the catalog is intended to limit stopping time to 2 seconds or less and insure friction disc stability. Brakes are not dynamically balanced because of the low brake inertia.

Determining Required Thermal Capacity

Thermal Ratings

When a brake stops a load, it converts mechanical energy to thermal energy or heat. The heat is absorbed by components of the brake. This heat is then dissipated by the brake. The ability of a given brake to absorb and dissipate heat without exceeding temperature limitations is known as thermal capacity.

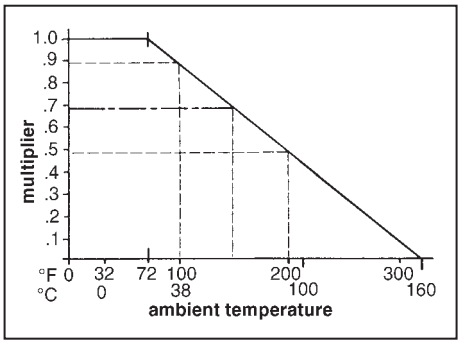
There are two categories of thermal capacity for a brake. The first is the *maximum* energy the brake can absorb in one stop, generally referred to as a "crash" or "emergency" stop. The second is the heat dissipation capability of the brake when it is cycled frequently. *To achieve optimum brake performance, the thermal rating should not be exceeded. They are specified for a predetermined maximum temperature rise of the brake friction material.*

The ability of a brake to absorb and dissipate heat is determined by many factors, including the design of the brake, the ambient temperature, brake enclosure, position of the brake, the surface that the brake is mounted to, and the altitude.

The rating for a given brake is the maximum allowable. Longer brake life results when the brake has more thermal capacity than a power transmission requires. Much shorter life or brake failure will result when the thermal capacity rating is exceeded. Ratings are determined at an ambient temperature of 72°F *(22°C)*, with the brake in a horizontal position, with a stopping time of 1 second or less, and with no external heat source such as a motor.

Ambient temperature will limit the thermal capacity of a brake. Temperatures above 72°F *(22°C)* require derating of the thermal capacity rating. For example, at 150°F, thermal capacity is reduced approximately 30% (see *Derating Thermal Capacity Chart*).

CHART: Derating Thermal Capacity



A temperature range of 20°F *(-7°C)* to 104°F *(40°C)* is acceptable in most brake applications. Above 104°F also consider Class H coil insulation.

Thermal capacity ratings are determined with enclosures on the brake. Other customer furnished covers or cowls may affect a brake's thermal capacity. The effect on thermal capacity should be evaluated. In some cases, thermal capacity may be increased by use of air or liquid cooling. However, provisions must be made to prevent contaminating the brake internally.

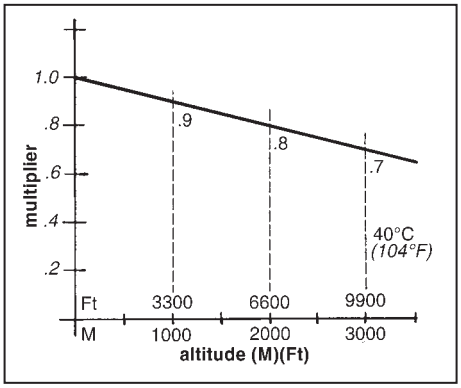
Brakes with brass stationary discs are derated 25%.

The mounting position of a brake will also affect thermal capacity. The specified ratings are for brakes mounted in a horizontal position with the solenoid plunger above the solenoid. For brakes mounted in a vertical position, or 15° or more from horizontal, the thermal capacity decreases due to friction disc drag. Brakes are modified for vertical operation to minimize the drag. 2- and 3- disc brakes are derated 25%, 4-disc brakes are derated 33%. 4- and 5-disc brakes are not recommended for vertical use.

Thermal capacity ratings are established without external sources of heat increasing the brake temperature. The surface that a brake is mounted to, such as an electric motor or gear reducer, will limit the heat dissipation capability or thermal capacity of a brake. These sources of heat should be evaluated when determining the thermal requirements of the system for which the brake is selected.

High altitudes may also affect a brake's thermal capacity. Stearns brakes will operate to 10,000 ft above sea level at 72°F *(22°C)* ambient temperature. At 104°F *(40°C)* ambient temperature, altitude and temperature adjustments occur. Refer to *NEMA MG1-1993 Section 14 for additional information.*

CHART: Altitude & Thermal Capacity



Maximum Energy Absorption

The thermal capacity of a brake is limited by the maximum energy it can absorb in one stop. This factor is important when stopping extremely high inertial loads at infrequent intervals. Such use of a brake requires extensive cooling time before it can be operated again.

The energy a brake is required to absorb in one stop by a given power transmission system is determined by the formulas below. *The calculated energy of the system should not exceed the maximum kinetic energy rating of the brake. System energy exceeding the brake's maximum rating may result in overheating of the brake to a point where torque falls appreciably. The friction material of the brake could glaze, carbonize or fail.*

In the case of linear loads, the energy that the brake must absorb is kinetic energy. It is determined by the formula:

$$KE_I = \frac{W_V^2}{2g}$$

KE_I = Kinetic energy of linear moving load, lb-ft

W = Weight of load, lb

v = Linear velocity of load, ft/sec

g = Gravitational acceleration constant, 32.2 ft/sec^2

In the case of rotational loads, the energy that the brake must absorb is also kinetic energy. It is determined by the formula:

$$KE_r = \frac{Wk_T^2 \times N_B^2}{5875}$$

Where, KE_r = Kinetic energy of linear load, lb-ft

Wk_T^2 = Inertia of the rotating load reflected to brake shaft, lb-ft^2

N_B = Shaft speed at brake, rpm

5875 = Constant

In the case of overhauling loads, both the kinetic energy of the linear and rotating loads and the potential energy transformed into kinetic energy by the change in height or position must be considered when determining the total energy that the brake must absorb. The potential energy transformed to kinetic energy is determined by the formula:

$$PE = W_S$$

Where, PE = Change in potential energy, ft-lb

W = Weight of overhauling load, lb

s = Distance load travels, ft

Thus, the total energy to be absorbed by a brake stoping an overhauling load is:

$$E_T = KE_I + KE_r + PE$$

Example 10 illustrates how energy absorption for Example 8 would be determined for one stop.

Example 10: Determine the total energy absorbed by a brake in one stop.

In Example 8, the calculation for total energy to be absorbed would be as follows.

First, calculate the kinetic energy of the linear load. The load weight was 4,940 lb and the velocity is 19 ft/min or 0.317 ft/sec. The kinetic energy is:

$$KE_I = \frac{W_V^2}{2g}$$

$$= \frac{4{,}940 \times 0.317^2}{2 \times 32.2}$$

KE_I = 7.71 ft-lb

Next, calculate the kinetic energy for the rotational load. The motor inertia is 0.65 lb-ft^2 and the drum inertia reflected to the brake shaft speed is 0.0067 lb-ft^2. The total rotational inertia at the brakemotor shaft is,

$$Wk_t^2 = Wk_M^2 + Wk_d^2$$
$$= 0.65 + 0.0067$$
$$Wk_t^2 = 0.6567 \text{ lb-ft}^2$$

And the kinetic energy of the rotating components is,

$$KE_r = \frac{Wk_t^2 \times N_B^2}{5{,}875}$$
$$= \frac{0.6567 \times 1{,}150^2}{5{,}875}$$
$$KE_I = 147.8 \text{ ft-lb}$$

Now, calculate the potential energy converted to kinetic energy due to the change in position of the load while descending. A descending load is the most severe case since potential energy is transformed to kinetic energy that the brake must absorb. A 25 lb-ft brake was selected in Example 8. The 25 lb-ft static torque rating is converted to dymanic torque,

$$T_t = T_S \times 0.8$$
$$= 25 \times 0.8$$
$$T_t = 20 \text{ lb-ft}$$

Of this torque, 13.0 lb-ft is required to overcome the overhauling load as determined in Example 8. The dynamic torque available to decelerate the load is,

$$T_d = T_t - T_m$$
$$= 20 - 13$$
$$T_d = 7 \text{ lb-ft}$$

The stopping time resulting from this dynamic torque is,

$$t = \frac{Wk_t^2 \times N_M}{308 \times T_d}$$
$$= \frac{0.691 \times 1{,}150}{308 \times 7}$$
$$t = 0.369 \text{ sec}$$

Where, $Wk_t^2 = 0.690$ lb-ft^2 is the total inertia the brake is to retard as determined in Example 8. With the load traveling at 19.0 ft/min or 0.317 ft/sec, the distance it will travel is,

$$s = \tfrac{1}{2} vt$$
$$= \tfrac{1}{2} \times 0.317 \times 0.369$$
$$s = 0.059 \text{ lb-ft}$$

Wire the brake through a dedicated relay on overhauling loads where stop time or distance is critical. The potential energy transformed to kinetic energy in this distance would be,

$$PE = W_S$$
$$= 4{,}940 \times 0.059$$
$$PE = 291 \text{ ft-lb}$$

Thus, the total energy to be absorbed by the brake would be,

$$E_T = KE_I + KE_r + PE$$
$$= 7.71 + 147.8 + 291$$
$$E_T = 447 \text{ lb-ft}$$

The 25 lb-ft brake selected in Example 8 should be capable of absorbing 447 ft-lb of energy. The brake's maximum kinetic energy absorption rating should exceed this value.

Motor slip and test loads (150% of load) should be considered both in sizing and thermal calculations.

Brakes overheated in testing will require inspection before using in the standard application.

Heat dissipation in cyclic applications

In general, a brake will repetitively stop a load at the duty cycle that a standard electric motor can repetitively start the load. A brake's thermal capacity is based upon the heat it can absorb and dissipate while cycling. The thermal capacity ratings for brakes are listed in the specification tables for specific brake models.

The energy that a brake is required to absorb and dissipate by a given power transmission system is determined from the total inertia of the load and system, the rotating or linear speed of the load, and the number of times the load is to be stopped in a given time period. The rate of energy dissipation is expressed in horsepower seconds per minute (hp-sec/min). Other common units for energy rates, such as foot pounds per second (ft-lb/sec), can be converted to hp-sec/min using the conversion factors given in the *Technical Data* section.

Refer to the Thermal Capacity Chart for use above 104°F *(40°C)* ambient temperature.

For applications demanding optimum brake performance, such as high inertial loads and frequent stops, the rate of energy dissipation required by the system is determined using the following formulas. *The calculated rate of energy dissipation should not exceed the thermal capacity of the brake. Thermal dissipation requirements exceeding the brake's rating may result in overheating of the brake to a point where torque falls appreciably. The friction material of the brake could glaze, carbonize or fail.*

For rotating or linear loads, the rate at which a brake is required to absorb and dissipate heat when frequently cycled is determined by the relationship:

$$TC = \frac{Wk_t^2 \times N_B^2 \times n}{3.2 \times 10^6}$$

Where, TC = Thermal capacity required for rotating or linear loads hp-sec/min

Wk_t^2 = Total system inertia reflected to brake, lb-ft^2

N_B = Shaft speed at brake, rpm

n = Number of stops per minute, not less than 1

3.2×10^6 = Constant

The rotating speed enters the formula as a squared function. Therefore, thermal requirements are of particular significance in systems where the brake will be operated at high speeds.

$$TC = \frac{E_T \times n}{550}$$

Where, TC = Thermal capacity required for overhauling loads hp-sec/min

E_T = Total energy brake absorbs, ft-lb

n = Number of stops per minute, not less than 1

550 = Constant

For overhauling loads, the rate at which a brake is required to absorb and dissipate heat when frequently cycled is determined by the relationship:

Example 11 illustrates how the required thermal capacity would be determined for Example 4.

Example 11: Determine the thermal capacity required to stop a rotating load frequently.

Referring back to Example 4, the flywheel will be stopped 20 times per minute. The required thermal capacity of the 6 lb-ft brake selected in this example is determined as follows.

The total inertial load the brake is to retard is 0.15 lb-ft^2. The shaft speed of the brake motor is 1,800 rpm. Therefore, the required thermal capacity is,

$$TC = \frac{Wk_t^2 \times N_M^2 \times n}{3.2 \times 10^6}$$
$$= \frac{0.15 \times 1{,}800^2 \times 20}{3.2 \times 10^6}$$
$$TC = 3.0 \text{ hp-sec/min}$$

The 6 lb-ft brake selected in Example 4 should have a thermal capacity rating equal to or greater than 3.0 hp-sec/min.

A brake with greater thermal capacity will result in greater wear life.

If productivity is to be improved in Example 4 by increasing the cycle rate, the maximum number of stops per minute is determined by the rated thermal capacity of the brake. If the 6 lb-ft brake selected in Example 4 has rated thermal capacity of 9 hp-sec/min, the maximum permissible stops per minute would be determined by transposing the above formula to,

$$n_{max} = \frac{TC_{rated} \times (3.2 \times 10^6)}{Wk_f^2 \times N_M^2}$$

$$= \frac{9 \times (3.2 \times 10^6)}{0.15 \times 1{,}800^2}$$

$$n_{max} = 59 \text{ stops/min}$$

So, the brake could be operated up to 36 times per minute without exceeding its ability to absorb and dissipate the heat generated by the frequent stops and meet the maximum solenoid cycle rating. *Cycle rate cannot exceed the solenoid cycle rate appearing in the catalog.*

Electrical Considerations

Please see page 118.

Environmental Considerations

Brakes with standard open enclosures when mounted on NEMA C-face motors are drip-proof, except where a manual release lever has a clearance opening in the housing. The standard enclosure is commonly used on open, drip-proof and enclosed motors operating indoors or in protected outdoor environments.

NEMA 4, IP 54 enclosures are available on most brake models and are commonly used for outdoor installations, or where there are moist, abrasive or dusty environments. Standard and severe duty NEMA 4 enclosures are available in some brake series.

Brakes of various styles and materials for above or below deck on ships and dockside installation are available. The materials are usually specified by the ship designers or Navy specification MIL-B-16392C. Brakes are also available to meet MIL-E-17807B for shipboard weapon and cargo elevators. Refer to *Marine, Maritime and Navy Catalog* pages.

Brakes Listed by Underwriters Laboratories, Inc. and certified by Canadian Standards Association are available for use in hazardous locations, including Class I, Groups C and D; and Class II, Groups E, F and G. *Motor-mounted*, hazardous-location electric disc brakes are listed only when mounted to a Listed hazardous-location motor of the same Class and Group at the motor manufacturer's facility, and where the combination has been accepted by UL or CSA. This procedure completes the hazardous duty assembly of the brake. However, foot-mounted hazardous-location disc brakes that are Listed are also available for coupling to a motor, and may be installed by anyone.

Hazardous-location brakes are *not* gasketed unless indicated in the brake description. The enclosure prevents flame propagation to the outside atmosphere through controlled clearances. Protection from weather and washdowns must be provided. If the brake is used in a high humidity or low temperature environment, internal electric heaters should be used.

Standard ambient temperature range for brake operation is from 20°F *(-7°C)* to 104°F *(40°C)*. Refer to *Thermal Ratings* section for brake operation at higher ambient temperatures. Heaters may be available for brake operation at low ambient temperatures and high humidity environments. Ductile iron construction and heaters are recommended for prolonged cold climate use.

Conclusion

The spring-set, electrically released disc brake is an important accessory to electric motors used in cycling and holding operations. It is available in a wide variety of enclosures. In most applications, a brake requires no additional wiring, controls or auxiliary electrical equipment. It is simple to maintain since the replaceable items, the friction discs, can be easily changed.

Many spring-set motor brakes are equipped with features such as simple wear adjustment to provide optimum friction disc life, visual wear indicator, torque adjustment and manual release. Featured on some types of brakes is automatic adjustment to compensate for friction disc wear. This feature eliminates the need for periodic adjustment and is advantageous in remote or inaccessible locations. Not all of the brakes on the market provide all of these features, but there are many Stearns motor brakes offering these features.

Care should be exercised in properly selecting a brake giving due consideration to torque as well as environment and thermal requirements.

On applications where all the pertinent information is not available, selection must be based on previous experience of the designer and user, as well as the brake manufacturer, and should be confirmed by tests under actual operating conditions. If the brake is selected with reasonable allowances made for extremes in operating conditions, it will perform its task with little attention or maintenance.

Formulas

BACK TO TABLE OF CONTENTS

The following formulas cover the basic calculations used in brake application engineering.

Required	Given	Formula
Full load motor torque (T_{flmt}), lb-ft	Horsepower (P), hp Shaft speed (N), rpm 5252 = Constant	$T_{flmt} = \frac{5252 \times P}{N}$
Average dynamic braking torque (T_d), lb-ft	Total inertia reflected to brake (Wk^2), lb-ft^2 Shaft speed at brake (N), rpm Desired stopping time (t), seconds 308 = Constant	$T_d = \frac{Wk^2 \times N}{308 \times t}$
Static torque (T), lb-ft	Force (F), lb Pulley or drum radius, (R), ft	T = F x R
Overhauling dynamic torque reflected to brake shaft (T_o), lb-ft	Weight of overhauling load (W), lb Linear velocity of descending load (V), ft/min Shaft speed at brake (N), rpm 0.158 = Constant	$T_o = \frac{0.158 \times W \times V}{N}$
Static torque of brake (T_s), lb-ft (General Guideline)	Dynamic braking torque required (T_d), lb-ft 0.8 = Constant (derating factor)	$T_s = \frac{T_d}{0.8}$
Inertia of rotating load reflected to brake shaft ($W k_b^2$), lb-ft^2	Inertia of rotating load ($W k_L^2$), lb-ft^2 Shaft speed at load (N_L), rpm Shaft speed at brake (N_B), rpm	Equivalent $W k_b^2 = W k_L^2 \left(\frac{N_L}{N_B}\right)^2$
Equivalent inertia of linear moving load reflected to brake shaft ($W k_w^2$), lb-ft^2	Weight of linear moving load (W), lb Linear velocity of load (V), ft/min Shaft speed at brake (N_B), rpm 2π = Constant	Equivalent $W k_w^2 = W \left(\frac{V}{2\pi N_B}\right)^2$
Kinetic energy of rotating load, (KE_r), ft-lb	Inertia of rotating load reflected to brake shaft ($W k_b^2$), lb-ft^2 Shaft speed at brake (N_B), rpm 5875 = Constant	$KE_r = \frac{W k_b^2 \times N_B^2}{5875}$
Kinetic energy of linear moving load (KE_I), ft-lb	Weight of load (W), lb Linear velocity of load (v), ft/sec g = Gravitational acceleration constant, 32.2 ft/sec^2	$KE_I = \frac{W v^2}{2g}$
Change in potential energy (PE), ft-lb	Weight of overhauling load (W), lb Distance load travels (s), ft	PE = Ws
Total energy absorbed by brake (E_T), ft-lb	Total linear kinetic energy, (KE_L), ft-lb Total rotary kinetic energy (KE_R), ft-lb Potential energy converted to kinetic energy (PE), ft-lb	$E_T = KE_L + KE_R + PE$
Thermal capacity required for rotational or linear moving loads (TC), hp-sec/min	Total system inertia reflected to brake shaft (Wk_T^2), lb-ft^2 Shaft speed at brake (N_B), rpm Number of stops per minute (n), not less than one 3.2 x 10^6 = Constant	$TC = \frac{W k_T^2 \times N_B^2 \times n}{3.2 \times 10^6}$
Thermal capacity required for overhauling loads (TC), hp-sec/min	Total energy brake absorbs (E_T), ft-lb Number of stops per minute (n), not less than one 550 = Constant	$TC = \frac{E_T \times n}{550}$
Linear velocity, ft/min	N = rpm Diameter (D), ft	$V = N\pi D$

BACK TO TABLE OF CONTENTS

Worldwide Sales and Service

District Sales Offices

CINCINNATI DISTRICT
Bill Pappas
3143 N. Farmcrest Drive
Cincinnati, OH 45213
Telephone: (513) 631-0639
Fax: (513) 631-1195
bill.pappas@rexnord.com

FLORIDA DISTRICT
Taylor Industrial Sales
6401 Harney Road - Suite E
Tampa, FL 33610
Telephone: (813) 663-9111
Fax: (813) 663-9104
bill@tiscotampa.com

INTERMOUNTAIN DISTRICT
(Please contact factory)
5150 S. International Drive
Cudahy, WI 53110
Telephone: (414) 277-4329
Fax: (414) 277-4364
raymond.mazurek@rexnord.com

LOS ANGELES DISTRICT
Foxco Equipment Sales, Inc.
7071 Warner Avenue - Suite F751
P.O. Box 2148
Huntington Beach, CA 92647-2148
Telephone: (714) 596-3600
Fax: (800) 428-9857
foxcoinfo@foxcoequipment.com

MICHIGAN DISTRICT
Ganco Industrial, Inc.
2960 S. Wilson Court NW - Suite B
Grand Rapids, MI 49544
Telephone: (616) 249-8430
Fax: (616) 249-8628
gnorris@gancoindustrial.com

MID-ATLANTIC DISTRICT
N.O. Holder & Associates, Inc.
4109 East North Street, Suite 400 (29615)
P.O. Box 25603
Greenville, SC 29616
Telephone: (864) 244-8854
Fax: (864) 244-2355
jay@noholder.com

N.O. Holder & Associates, Inc.
105 Autumn Court
Rocky Mount, NC 27803
Telephone: (252) 266-3552
Fax: (252) 451-9100
keith@noholder.com

NEW ENGLAND DISTRICT
Please Contact Factory
5150 S. International Drive
Cudahy, WI 53110
Telephone: (414) 277-4329
Fax: (414) 277-4364
raymond.mazurek@rexnord.com

NEW YORK DISTRICT
Please Contact Factory
5150 S. International Drive
Cudahy, WI 53110
Telephone: (414) 277-4329
Fax: (414) 277-4364
raymond.mazurek@rexnord.com

PHILADELPHIA DISTRICT
Brisbane Industrial Drives Company, Inc.
1432 State Route 903
Jim Thorpe, PA 18229
Telephone: (570) 325-3684
Fax: (570) 325-3870
dchrisb@brisbaneindustrial.com

ST. LOUIS DISTRICT
Scott Peterson
345 Laduemont Drive
St. Louis, MO 63141
Telephone: (314) 453-1600
Fax: (314) 453-1601
scott.peterson@rexnord.com

SOUTHEAST DISTRICT
Power & Motion Industrial
3440 Blue Springs Road-Suite 103
Kennesaw, GA 30144
Telephone: (770) 529-0418
Fax: (770) 529-0768
ed@powerandmotion.com

Power & Motion Industrial
4205 Hillsboro Road, Suite 218 (UPS only)
P.O. Box 159042
Nashville, TN 37215
Telephone: (615) 269-4050
Fax: (615) 296-0423
thomtecind@aol.com

TEXAS DISTRICT
Conveying & Power Transmission Solutions
1199 E. Main Street
P.O. Box 146
Itasca, TX 76055
Telephone: (800) 383-5918
Fax: (254) 687-2205
sales@c-pts.com

Conveying & Power Transmission Solutions
1033 N. Hwy. 77
Schulenberg, TX 78956
Telephone: (979) 561-6907
Fax: (979) 743-3208
shollas@c-pts.com

WISCONSIN DISTRICT
Randy Sprink
5150 S. International Drive
Cudahy, WI 53110-6111
Telephone: (414) 277-4368
Fax: (414) 277-4364
randall.sprink@rexnord.com

International

AUSTRALIA:
Rexnord Australia Pty. Ltd.
25 Henry Street
P.O. Box 620
Picton, New South Wales 2571
Australia
Telephone: 61-2-4677-3811
Fax: 61-2-4677-3812

BRAZIL:
Rexnord Correntes Ltda.
Rua Alferes Magalhaes, 92 - Cj. 96
02034-006 - Sau Paulo - SP
Brazil
Telephone: 55-11-6221-2283
Fax: 55-11-6221-6745

EUROPE:
Rexnord Belgium NV/SA
Dellingstraat 55
B-2800 Mechelen
Belgium
Telephone: 32-15-443811
Fax: 32-15-443860

LATIN AMERICA (Miami):
Rexnord International Inc.
7200 NW 19th Street
Suite 202
Miami, FL 33126, USA
Telephone: 305/592-4367
Fax: 305/592-5384

SINGAPORE:
Rexnord International Inc.
36 Purvis Street
Talib Center #02-01
Singapore 188613
Telephone: 65-6338-5622
Fax: 65-6338-5422

Canada

ALBERTA:
9783-45 Avenue
Edmonton, Alberta
T6E 5V8
Telephone: 708/463-9444
Fax: 780/450-4973

BRITISH COLUMBIA:
201-2497 Clearbrook Road
Abbotsford, British Columbia
V2T 2Y3
Telephone: 604/852-9545
Fax: 604/852-9693

ONTARIO:
81 Maybrook Drive
Scarborough, Ontario
M1V 3Z2
Telephone: 416/297-6868
Fax: 416/297-6873

QUEBEC:
6039 Thimens Boul.
Ville St-Laurent, Quebec
H4S 1V8
Telephone: 514/337-2446
Fax: 514/337-2615

Stearns Brand - Time Tested and Trusted for Over 90 Years

Since 1916, Stearns has been totally focused on the needs of our customers, setting the standard for brake and clutch quality, on-time delivery performance and a commitment to innovative service.



R. H. Stearns - Founder

1916 Founded by R. H. Stearns

1928 Invented the DC Clutch and Brake

1935 Originated the AC Motor Brake

1953 Introduced the first UL approved Brake for Hazardous Locations

1973 Introduced the first effective self-adjust mechanism for industrial spring-set brakes

1986 Introduced SINPAC Centrifugal Switches

1995 Introduced Stearns Patented Splined Hub for longer friction disc life & maximum heat dissipation

2007 Introduced MSHA approved brake for the mining industry

As the largest supplier of spring-set, electrically released brakes in North America, Stearns commitment to quality, service, innovation and reliability continue to be the driving force behind our business.

As an ISO 9001-2000 Certified company, internal Six Sigma, Lean Manufacturing and Demand Flow programs continue to support our goal of quality products.

To assure consistant quality and reliability we have incorporated a fully integrated operation within our 100,000 square foot facility, including:

~ Research & Development Lab

~ CNC / DNC Machine Shop

~ Complete Assembly Capability

~ Specialty Mechanical Manufacturing

~ Electronics Manufacturing



Committed to 100% RoHS Compliance

We are committed to providing environmentally responsible products. Specifically, we have a program in place to eliminate banned materials covered in the RoHS Directive for all our products.



To date, our fully compliant product lines include:

~ All AAB Series Products

~ All SAB Series Products

~ All SINPAC Solid-State Switches

~ All Super-Mod Electrically Applied Clutch/Brake Modules

Numerous other products can be supplied RoHS compliant upon specific request.



Stearns has earned the reputation as the industry's leader in delivery, quality and customer service by working directly with our customers.

With a factory trained sales force, knowledgeable customer service, world-wide distribution and complete EDI capabilities, Stearns can respond to your needs.

Stearns commitment to total customer service reaches out to your facility as well. Our field service technicians will work with your maintenance staff and plant engineers.

Stearns is fully insured and our Field Service support capabilities include:

~ Application Assistance

~ Application Engineering Support

~ Upgrade Reconfigurations

~ Troubleshooting

~ Travel for on-site technical services

~ Field training programs for your maintenance staff and sales force, on all of Stearns products.



Because ***Reliability*** is ***Critical***... **Stearns**®

Notes:

Trombetta
MOTION TECHNOLOGIES
Strokes of Genius.

Instruction Sheet for S500-A300



Trombetta's electronic controls are special modules designed to enhance solenoid performance by increasing force capability and reducing operating temperature. Trombetta's electronic controls for solenoids regulate the magnitude of electrical drive applied to the coil during the pull in and / or hold operation of the solenoid to optimize the performance of the solenoid.

Nominal Module Input Voltage 120VAC 60HZ

Nominal Pull Output Voltage:	108 VDC to solenoid
Power Requirements:	Operating source voltage is 95-135 VAC. Current requirements as high as 20 Amps, (depending on coil selection)
Trigger Input:	90-130 VAC or 12-24 VDC. Module can be triggered from the source voltage (Aux in tied to main power in), or mobile can be triggered from a second source. Note: Aux in circuitry is isolated from power circuitry.
Response Time:	10 ms using separate trigger source, 40 ms when Aux in is hard wired to power source.
Coil Drive Capabilities:	The module can power a 2400 Watt coil maximum. This value will depreciate as the cycle time is reduced.
Cycle Repetition Rate:	Repetition rate is dependent on coil selection. The module can cycle a 1500 watt coil at 2 second periods, 1 second on, followed by 1 second off time. At 2000 watts 4 second per period is the maximum repetition. In other words 1 on/off cycle every 4 second period
Termination:	Beau connectors, 6-32 panhead.
Indication:	Led will display 3 modes: *Bright- pull mode *Dim- hold mode *Flashing- low power cut off since last trigger request.
Features:	Variable PWM dependent on line voltage, straight line correction 100-140 VAC=13-8.3%. Variable pull time dependent on line voltage, straight line correction 100-140 VAC=500-300ms.
Environment:	-40C to 70C, 0-100% humidity, non-condensing.
Low Voltage Cut Off:	90 Volts

Application Information:

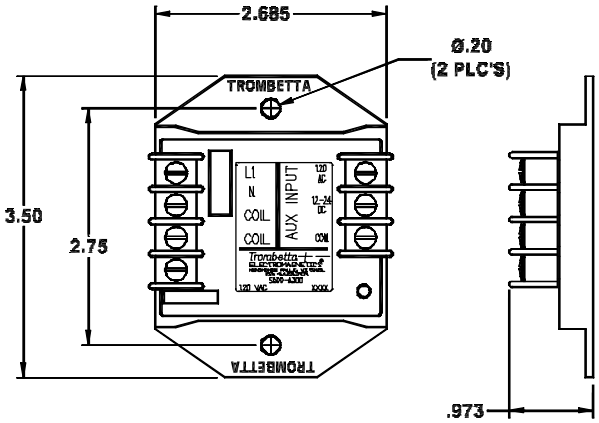
With the S500-A300 module has been designed to work properly with a (1) section coil. The module operates in the following manner. When a remote control signal is applied to the Aux input of the module it applies full voltage to the solenoid coil. After the actuation time (approximately .5 seconds) the module reduces the output voltage to the solenoid to 13% to 16% of the input voltage for continuous duty. This reduced voltage level is applied to the coil until the control signal is removed.

This Trombetta module gives you the option of using AC or DC voltage for the Aux trigger signal. The A300 module will adjust it's duty cycle depending on the line voltage. This module also offers an LED display. The LED will display if the module is in the pull or hold mode and will indicate lower power cut off since the last trigger request.

Figure 1 shows a typical wiring diagram when controlled by a low current, 120VAC signal to the Aux input. Figure 2 shows a typical wiring diagram controlled by a low current, 12 to 24 VDC signal to the Aux input. Figure 3 is controlled by the same signal which provides power to the module.

Instruction Sheet for S500-A300

Dimensions:
(Inches)



Wiring Diagrams:

Figure 1

FIGURE #1 120 VAC AUX CONTROL

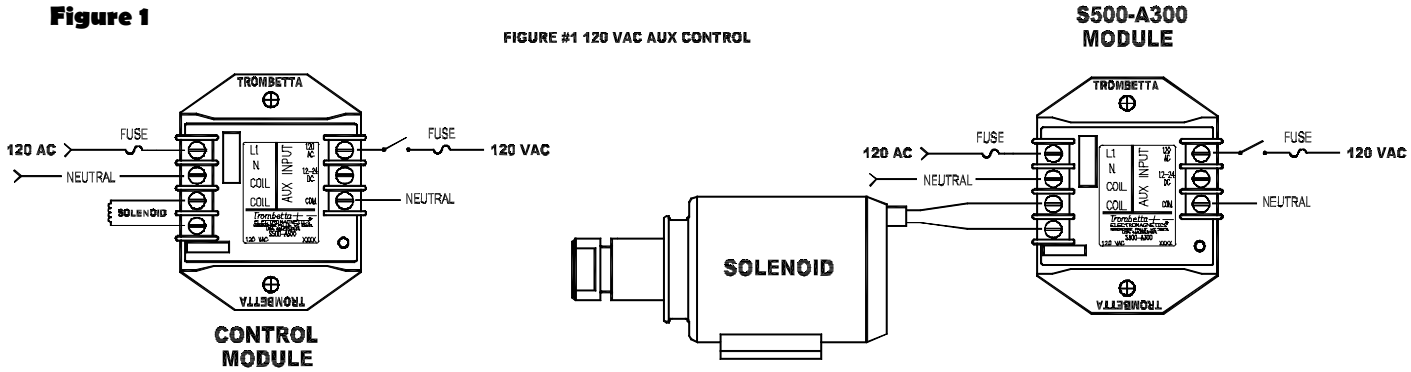


Figure 2

FIGURE #2 12-24 VDC AUX CONTROL

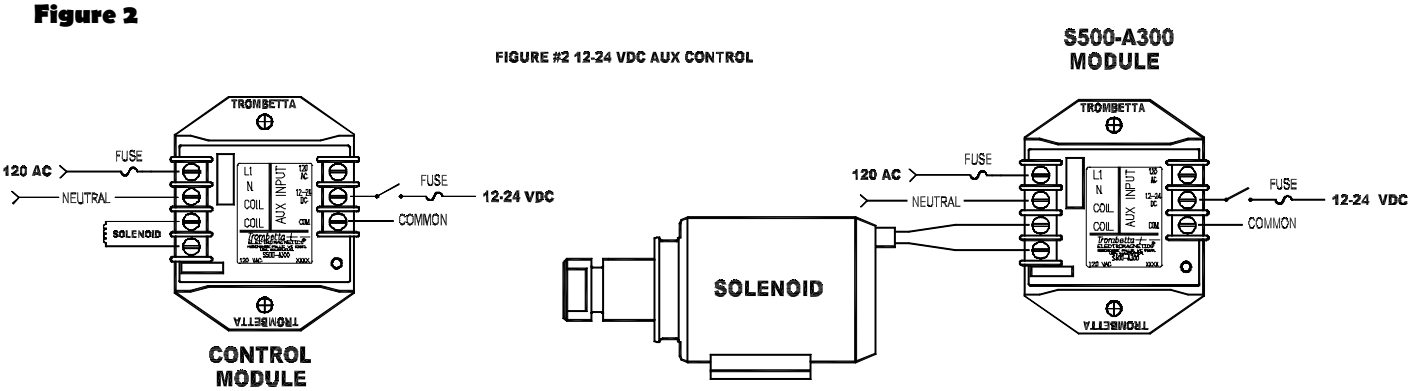


Figure 3

FIGURE #3 120 VAC LINE CONTROL

