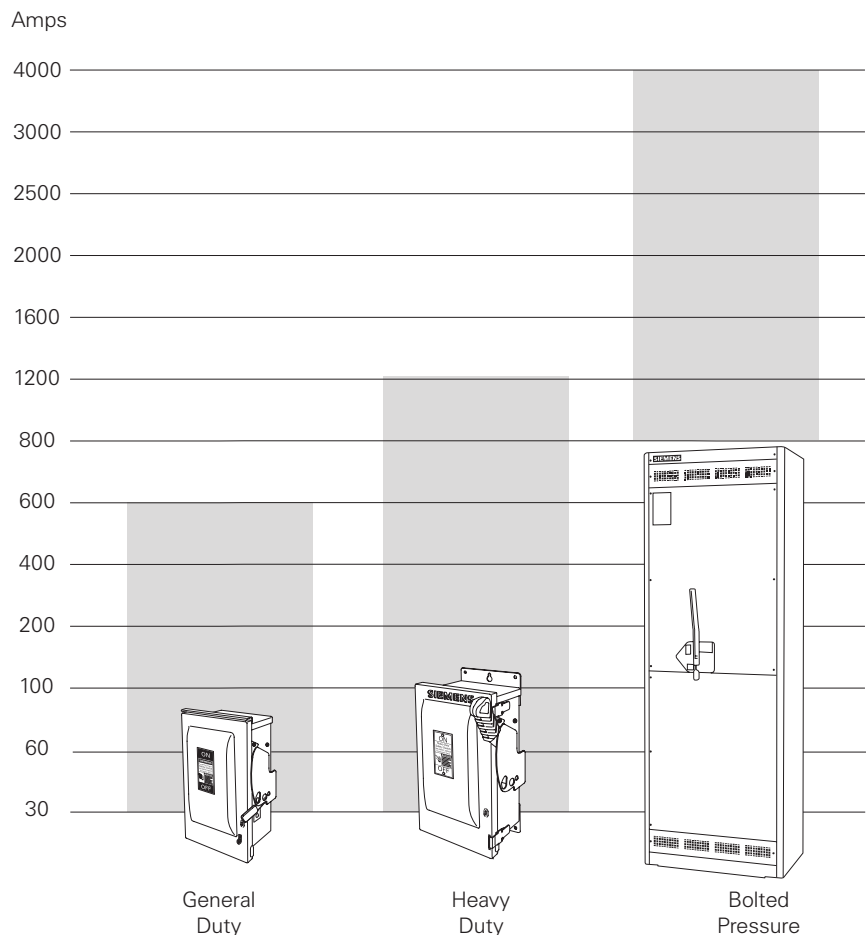


Safety Switch Ratings

Ampere Rating

Siemens safety switches are available in two types: general duty and heavy duty, both of which are listed by Underwriters Laboratories (UL). Every safety switch has a specific ampere rating, which is the maximum continuous current it can carry without causing deterioration or exceeding temperature rise limits. General duty switches are available with ampere ratings of 30, 60, 100, 200, 400, and 600 amperes. Heavy duty switches are rated for 30, 60, 100, 200, 400, 600, 800, and 1200 amperes. (Though not discussed in this course, bolted pressure switches are also available, with ampere ratings of 800, 1200, 1600, 2000, 2500, 3000, and 4000 amperes.)



Short Circuit Withstandability

Safety switches must be capable of withstanding the largest potential short circuit current that can occur in the selected application. General duty switches have a maximum short circuit withstandability of 100,000 amperes, while the equivalent rating of heavy duty switches is 200,000 amperes.

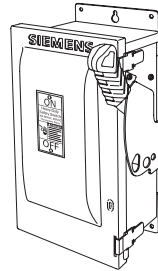
Voltage Rating

Safety switches are also rated according to the maximum voltage they can handle. The voltage rating of the switch must be at least equal to the circuit voltage. In other words, it can be higher than the circuit voltage, but never lower. For example, a safety switch rated for 600 volts can be used on a 480 volt circuit, but a switch rated for 240 volts must not be used on a 480 volt circuit. The following chart reflects available voltage ratings.



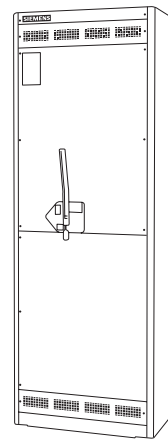
General Duty

240 VAC
250 VDC



Heavy Duty

240 VAC
600 VAC
600 VDC



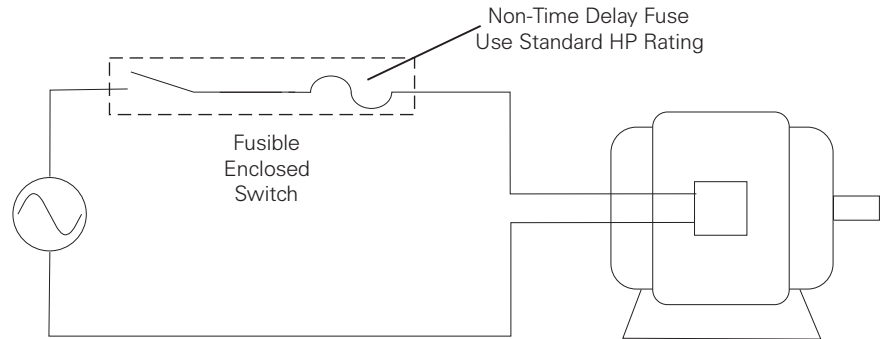
Bolted Pressure

240 VAC
480 VAC
600 VAC*

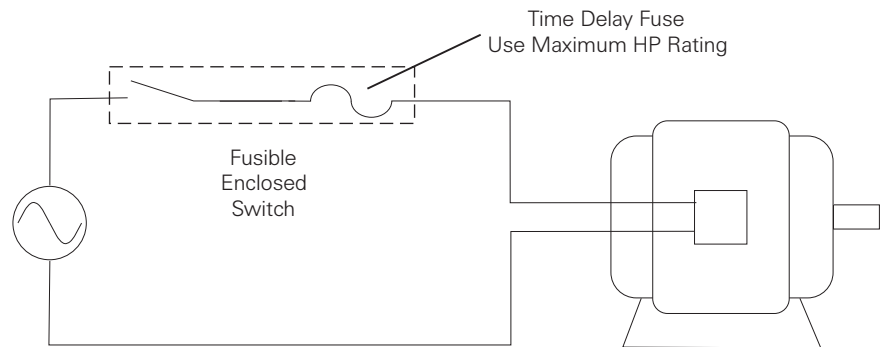
*600 VAC Bolted Pressure Switch is not UL Listed

Dual Horsepower Ratings

All Siemens safety switches have two horsepower ratings for motor applications. This is referred to as "dual horsepower rated." For example, a switch might have a standard rating of 10 HP, and a maximum rating of 30 HP. The standard rating, 10 HP, applies when non-time delay fuses are used.



The maximum rating of 30 HP applies when time delay fuses are used.



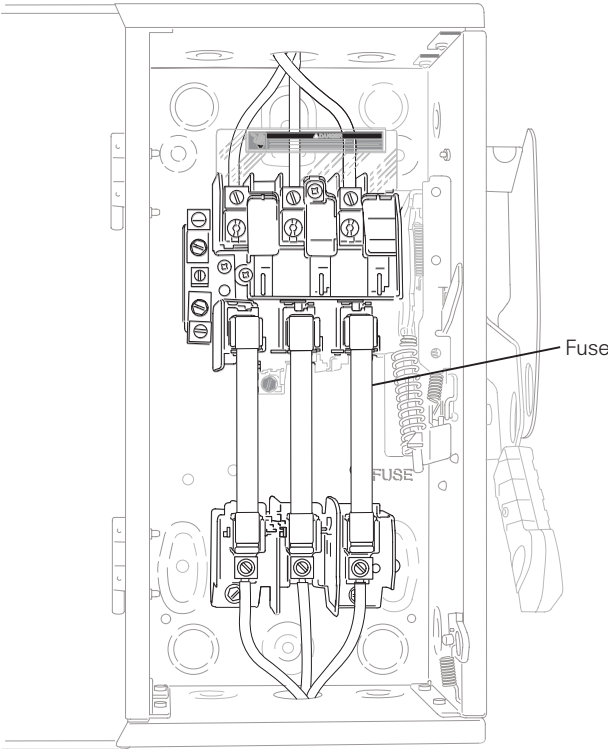
The following chart reflects the range of horsepower ratings for Siemens safety switches.

Safety Switch Type	Voltage	Horsepower Range
General Duty	240 VAC	1½ - 200
	250 VDC	5-50
Heavy Duty	240 VAC	1½ - 250
	600 VAC	3-500
	250 VDC	5-50
	600 VDC	15-50

Switch Circuit Types And Terminology

Pole

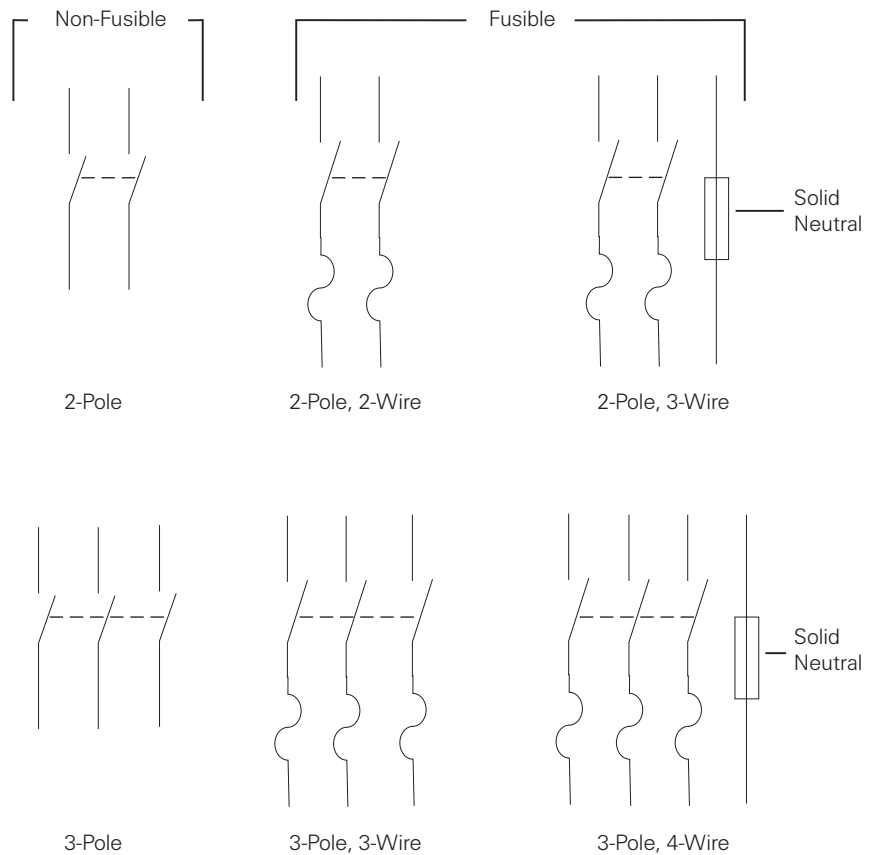
The term pole refers to the number of wires that a switch will disconnect at one time. The following drawing, for example, shows a 3-pole safety switch. The three circuits are mechanically connected so that all three poles connect and disconnect the line and load simultaneously when the switch is operated. In this case, each pole is fused for overcurrent protection.



3-Pole, 3-Fuse

Circuit Configurations

Following are circuit configuration diagrams for 2- and 3-pole safety switches. Safety switches may be fusible, non-fusible, or fusible with a solid neutral.



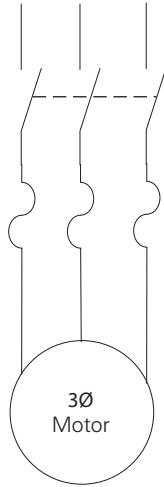
The following circuit configurations are available in Siemens safety switches:

- 2-Pole
- 3-Pole
- 6-Pole (not shown)
- 2-Pole, 2-Wire
- 3-Pole, 3-Wire
- 4-Pole, 4-Wire (not shown)
- 6-Pole, 6-Wire (not shown)
- 2-Pole, 3-Wire
- 3-Pole, 4-Wire

Example

The circuit configuration required depends on the load and on the power supply connected to it. For example, a three-phase motor needs a 3-pole switch to connect it to a three-phase power supply. If overcurrent protection is required, a fusible 3-pole safety switch should be selected, as in the following example.

3Ø AC Power Supply



Switch Throws

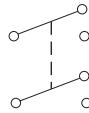
All the example switches shown so far have been single throw. "Throw" is the term used to refer to the number of different positions a switch has, that is, the number of different circuits it can connect a given wire to. Switches may be single throw, double throw, or multiple throw. The simplest is a single pole, single throw:



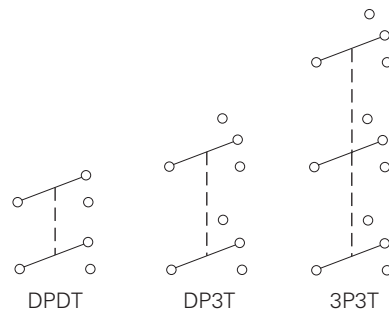
Next in complexity is the single pole, double throw which can connect a single wire to one of two different circuits:



Two- and three-pole single throw switches have already been shown. The double pole, double throw (DPDT) switch can connect each of two different wires to two different circuits:



Many different arrangements are possible. The following illustrates only a few of them:



Catalog Numbers

To help identify each type of safety switch, a catalog number is assigned. The catalog number provides a description of the safety switch. There are eight parts to the catalog number of Siemens VBII Safety Switches. The following figure illustrates a typical catalog number.

Catalog Number	Part 1	Part 2	Part 3	Part 4	Part 5	Part 6	Part 7	Part 8
HF364NRCU=	H	F	3	6	4	N	R	CU

Part 1

Part 1 indicates the switch type. There are three types available: General Duty 10k AIC Max. (Plug Fused & 60A Max Non-Fused); General Duty; and Heavy Duty.

Designator	Switch Type
L	General Duty 10k AIC Max
G	General Duty
H	Heavy Duty
DT	Heavy Duty Double Throw
DTG	General Duty Double Throw

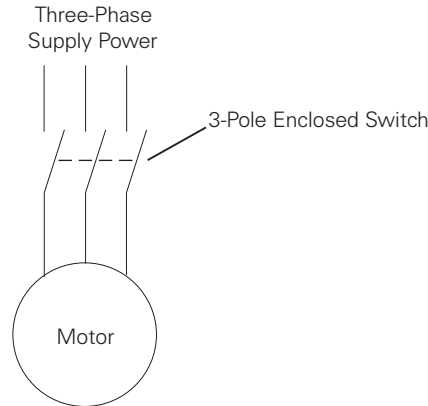
From the above table, one can see that the example switch, type H, is a heavy duty switch.

Part 2

Part 2 indicates whether the switch is fused or non-fused. "F" designates a fused switch; while "NF" designates non-fused types. The example switch is fused.

Part 3

Part 3 of the catalog number indicates the number of poles. Siemens VBII safety switches can be provided with 1, 2, or 3 poles. (A neutral, if required, is not included in the number of poles.) The following shows a 3-pole safety switch used with a 3-phase AC motor. The example catalog number calls for a 3-pole safety switch.



Part 4

Part 4 of the catalog number indicates the voltage rating. The example catalog number indicates a safety switch with a maximum voltage rating of 600 volts.

Designator	Voltage
1	120V or 120/240V
2	240V
6	600V

Part 5

Part 5 of the catalog number refers to the switch's current rating. The example indicates a safety switch with a 200 ampere rating.

Designator	Amperes
1	30A
2	60A
3	100A
4	200A
5	400A
6	600A
7	800A
8	1200A

Part 6

Part 6 of the catalog number indicates whether or not a neutral is included with the switch. If no neutral is needed, part 6 of the catalog number is simply omitted. If a neutral is needed, an “N” is added to the catalog number, as in the example.

Part 7

Part 7 of the catalog number indicates the type of enclosure. The example catalog number indicates a safety switch in a NEMA Type 3R outdoor enclosure.

Designator	Enclosure Type
Omit	Type 1, Indoor
R	Type 3R, Outdoor
S	Type 4/4X, Stainless Steel
X	Type 4/4X, Non-Metallic
J	Type 12, Industrial

Part 8

Part 8 of the catalog number is for special applications. The following table lists the possible applications. For example, “CU” indicates factory-installed copper wire grips, as in the representative catalog number given above.

Designator	Special Applications With:
CH	Crouse-Hinds Receptacle
CJ	Factory J Fuse Spacings
CR	Class R Clips Installed
CU	Copper Wire Grips Installed
G	Factory-Installed Ground Bar
PN	Pyle-National Receptacle
W	Viewing Window

Review 4

1. The _____ rating is the maximum continuous current a safety switch can carry.
2. The maximum short circuit current withstandability of heavy duty switches is _____ amperes.
3. The maximum horsepower available in a 240 VAC general duty safety switch is _____ HP.
4. A _____ describes the number of isolated circuits that can pass through the safety switch at one time.
5. The number "3" in part five of the heavy duty catalog number indicates _____ .
 - a. 3-pole
 - b. 3R enclosure
 - c. 100 amperes
 - d. 600 VAC
6. _____ refers to the number of different positions of a given switch.

General Duty Safety Switches

General duty switches are intended for use primarily on power supplies rated at 240 VAC or less, where the available fault current is less than 100,000 amperes (with Class R or T fuses, or 10,000 A max with Class H fuses). They can be supplied in a Type 1 (indoor) or Type 3R (outdoor) enclosure.

Plug Fuse Type Safety Switch

The general duty plug fuse type switch is available for 120 or 240 volt systems. It is suitable for one- or two-pole applications, and is rated at 30 amperes. A separately supplied, 30-ampere Type S plug fuse is required. This switch is available for use on two-wire or three-wire motor applications up to three horsepower. A non-fusible model comes in a two-pole configuration. It is rated at 60 amperes, and can be used with motors up to 10 HP. There are also pullout models available in fused and non-fused versions.

General Duty Switches

The fusible general-duty safety switch is available in two and three poles, both with solid neutral, or with four poles. The non-fusible model is available with a two- or three-pole configuration. Fusible switches accept Class H fuses as standard. A field-installable rejection kit is available which rejects all but Class R fuses. All general duty switches have both cover and handle padlocking capabilities.

Ratings

Ampere ratings: 30, 60, 100, 200, 400, or 600 amperes

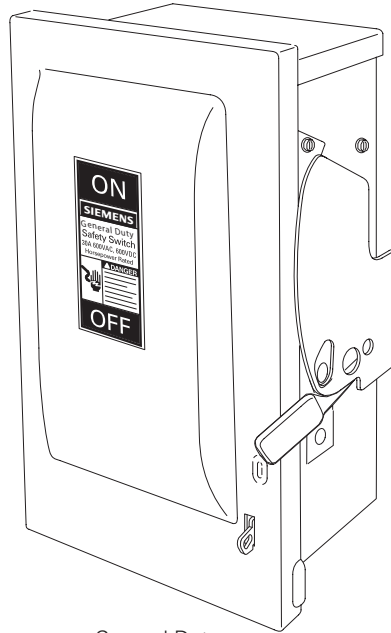
Fuses: 1 - 600 ampere Class H, K, or R
70 - 600 ampere Class T cartridge fuse

Voltage ratings: 240 VAC, 250 VDC

Max short-circuit current withstandability: 100,000 amperes (with current limiting fuses)

Type 1 Enclosure

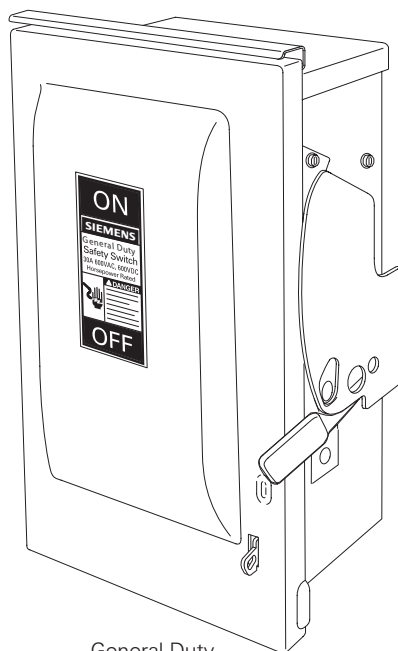
General duty switches are available in the NEMA Type 1 enclosure, which is intended for indoor use. An interlock prevents the cover from being opened when the switch is in the "On" position. A cover interlock also prevents turning the switch "On" with the door open. (There is a front operable release for this feature.) This enclosure is intended primarily to provide protection against contact with the safety switch, and is used in locations where unusual service conditions do not exist.



General Duty
Safety Switch
Type 1 Enclosure

Type 3R Enclosure

General duty 2- and 3-pole safety switches are also supplied in a Type 3R enclosure, which is intended for outdoor use, and provides a degree of protection against falling rain and sleet. It is also able to withstand the formation of ice on the enclosure without damage, but is not intended to provide protection against conditions such as dust, internal condensation, or internal icing.

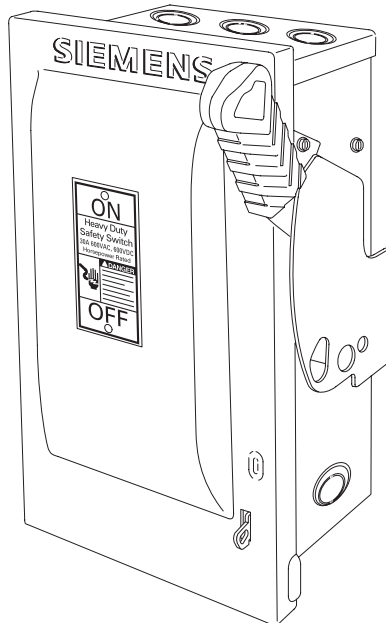


General Duty
Safety Switch
Type 3R Enclosure

Heavy Duty Safety Switches

Type 1 Enclosure

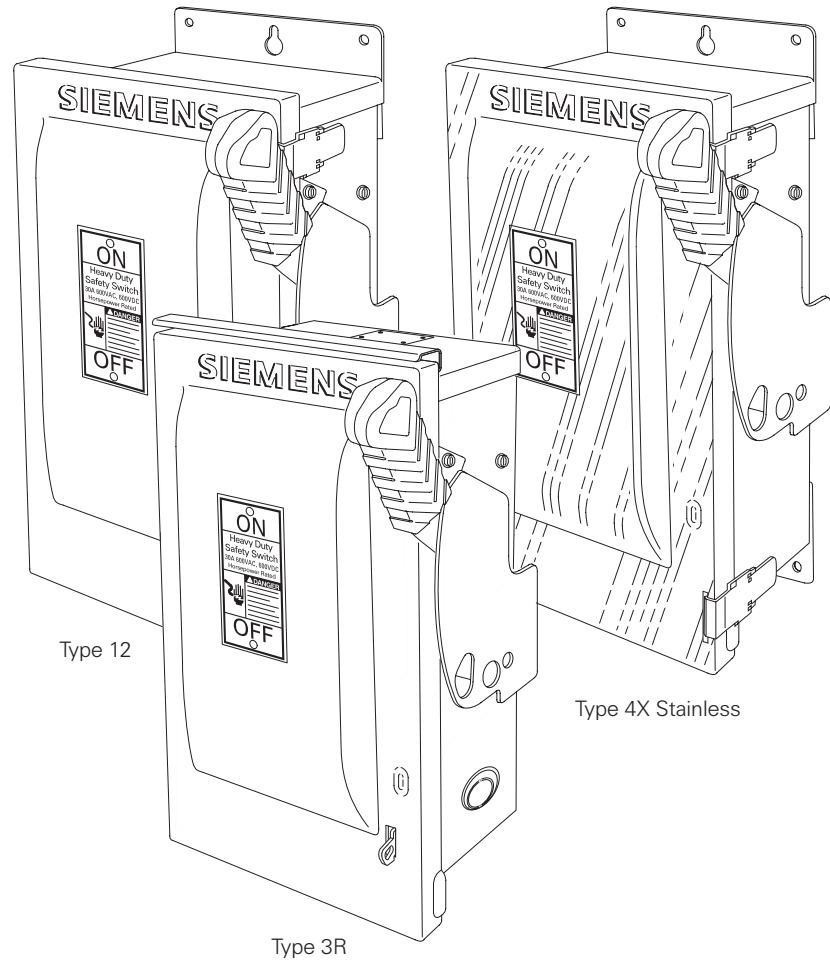
Heavy duty safety switches can be used on power supplies up to 600 Volts, AC or DC. They can be used in applications where the available fault current is 200,000 amperes or less. A cover interlock prevents inadvertent opening of the cover while the switch is in the "On" position, and a mechanism interlock prevents inadvertent turning on of the switch while the cover is open. Heavy duty safety switches also have cover and handle padlocking capabilities.



Type 1 Enclosure

Enclosures for Heavy Duty Safety Switches

Heavy duty safety switches can also be supplied with Type 3R, 4 / 4X, and 12 enclosures.



Ratings

Current ratings: 30, 60, 100, 200, 400, 600, 800, & 1200 amperes

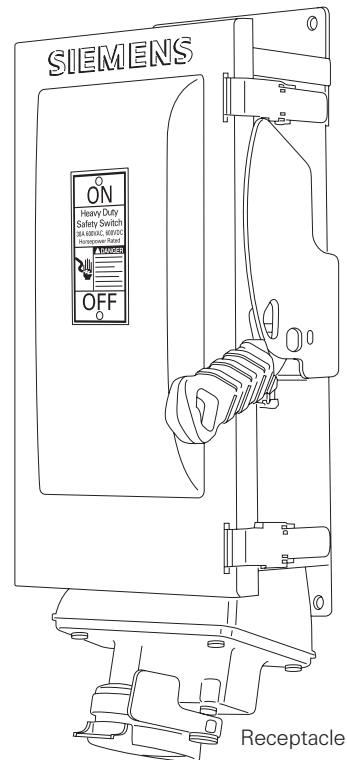
Fuses: 1 - 600 ampere Class H, J, K, and R cartridge fuses
1 - 1200 ampere Class T cartridge fuses
601-1200 ampere Class L bolt-in fuses
(Fusible 800 and 1200 A switches have Class L fuse provisions as standard)

Voltage ratings: 240 / 480 / 600 VAC; 250 / 600 VDC

Max short-circuit current withstandability: 200,000 amperes

Interlock Receptacle

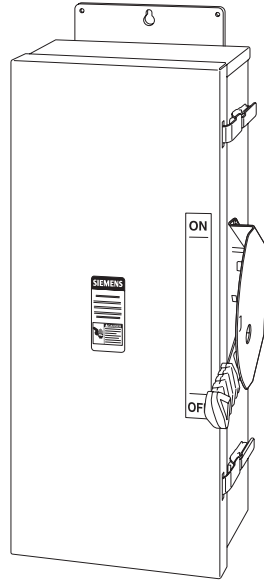
The interlock receptacle safety switch provides cord connection for heavy-duty portable equipment such as refrigerated trucks, welders, and other portable electric tools. It is fitted with a Crouse-Hinds Arktite® or similar receptacle. This receptacle is interlocked to prevent insertion or removal of the plug if the switch is in the "On" position. The Crouse-Hinds receptacle switch requires a Crouse-Hinds 4-wire, 3-pole, style 2, grounded APJ plug. The interlock receptacle safety switches are rated for 30, 60, and 100 amperes. The enclosure meets the requirements for Type 4, 4X, or 12/3R enclosures.



Arktite® is a registered trademark of the Crouse-Hinds Company.

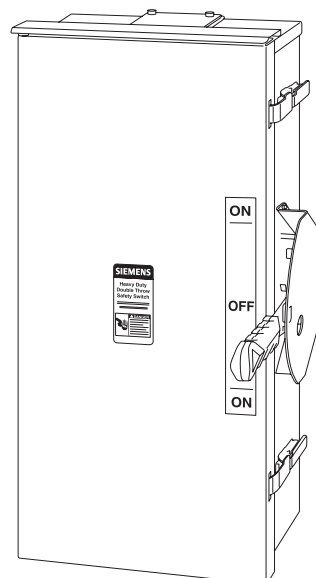
Four- and Six-Pole Safety Switches

Four- and six-pole heavy-duty safety switches are available in current ratings of 30 - 200 amperes, in Type 1 / 3R / 12 or Type 4 / 4X enclosures, fusible or non-fusible. These switches are commonly used as a disconnecting means for two-speed, two-winding motors. A 4-pole switch is also used in 3-phase, 4-wire circuits when a switching neutral is required.



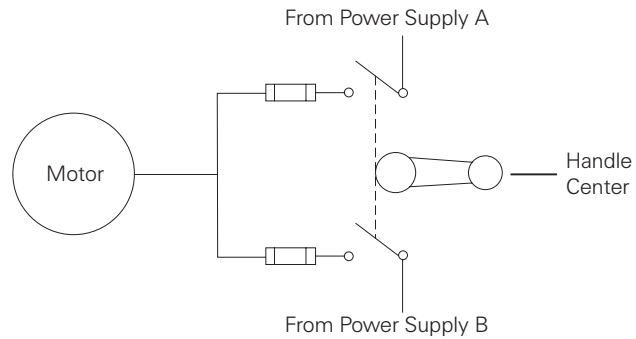
Double Throw Switches

Double throw switches are used to transfer loads from one power source to another. For example, a critical piece of equipment often needs a back-up power supply in case the main power supply fails or needs maintenance. Double throw switches are also used to connect a single power source to either of two loads. 30-600A double-throw fusible switches are available in Types 1 and 3R enclosures, while non-fusible models are available in Types 1 and 3R for 30 to 1200A, and in 4 / 4X and 12 for 30 to 200A. Double throw switches are rated for 240 VAC/250 VDC or 600 VAC.

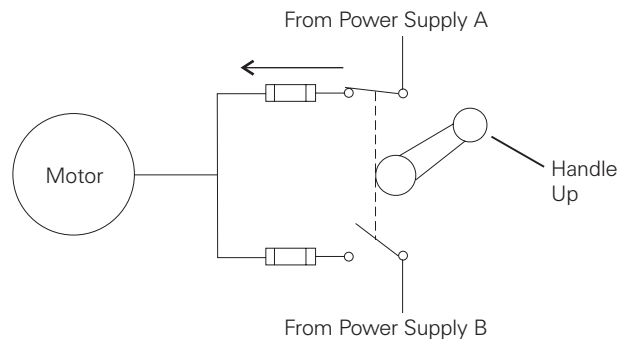


Double Throw Switch Application

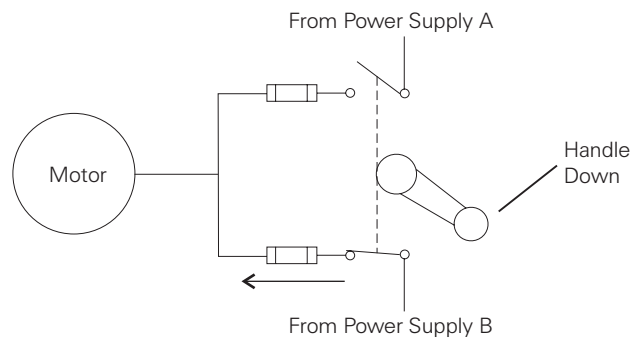
A motor, for example, can be connected through a double throw switch to power supply A or power supply B. When the handle is in the center position the switch is "Off" and no power flows to the motor.



Moving the handle to the up position connects the motor to power supply A.



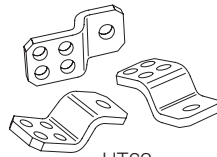
Moving the handle to the down position connects the motor to power supply B.



Safety Switch Accessories

A full range of accessories is available for Siemens VBII Safety Switches. Some of these are shown below.

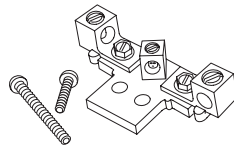
Both General Duty and Heavy Duty Switches are field-convertible to accept Class J or Class T fuses.



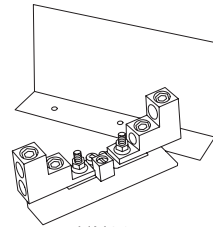
HT63

Class T Fuse Adapter Kit

Standard Neutral Kits can be field installed in both General and Heavy Duty Safety Switches, and UL listed 200% Neutrals are available on 100-600A Heavy Duty Switches.



HN612



HN264

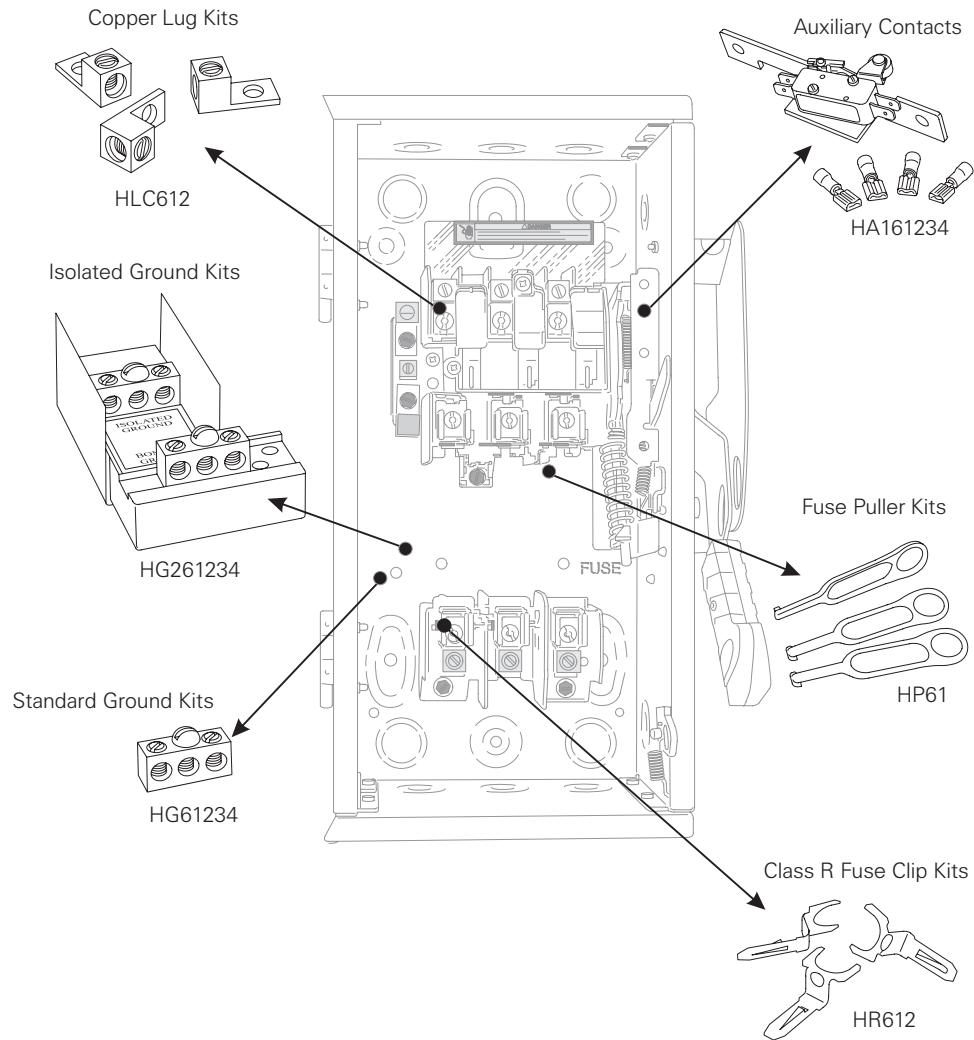
The Multiple Padlock Accessory is a tamper-proof device to provide for multiple padlocking to meet OSHA or plant requirements.



SL0420

Multiple Padlock Accessory

The following illustrates some of the other accessories available for General and Heavy Duty Safety Switches.

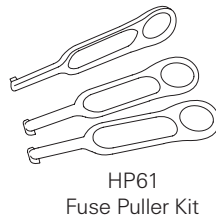


Heavy Duty Switches are UL approved to accept field installed Copper Lug Kits. Equipment Ground Kits are available for all General Duty and Heavy Duty Switches. They come standard in Type 4 / 4X and Type 12 Switches, and are field installable in Type 1 and Type 3R. Isolated Ground Kits are also available for 30-600A Heavy Duty Switches. Some circuits with a high degree of computer or other electronic loading require an isolated ground to prevent interference from the building ground and neutral lines.

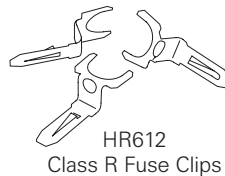
Auxiliary Contacts are available only for Heavy Duty Switches. They come with 1 normally open and 1 normally closed or 2 normally open and 2 normally closed contacts. A PLC Auxiliary Switch for 30-200A switches is also available. It has very low contact resistance, which is compatible with the low voltages and currents typically found in PLC circuits.



Fuse Puller Kits are field installable in 30-100A Heavy Duty Switches.



Class R Fuse Clips are used to prevent the installation of noncurrent-limiting Class H or Class K fuses. All General and 30-600A Heavy Duty Switches are field convertible to accept Class R Fuse Clip Kits.

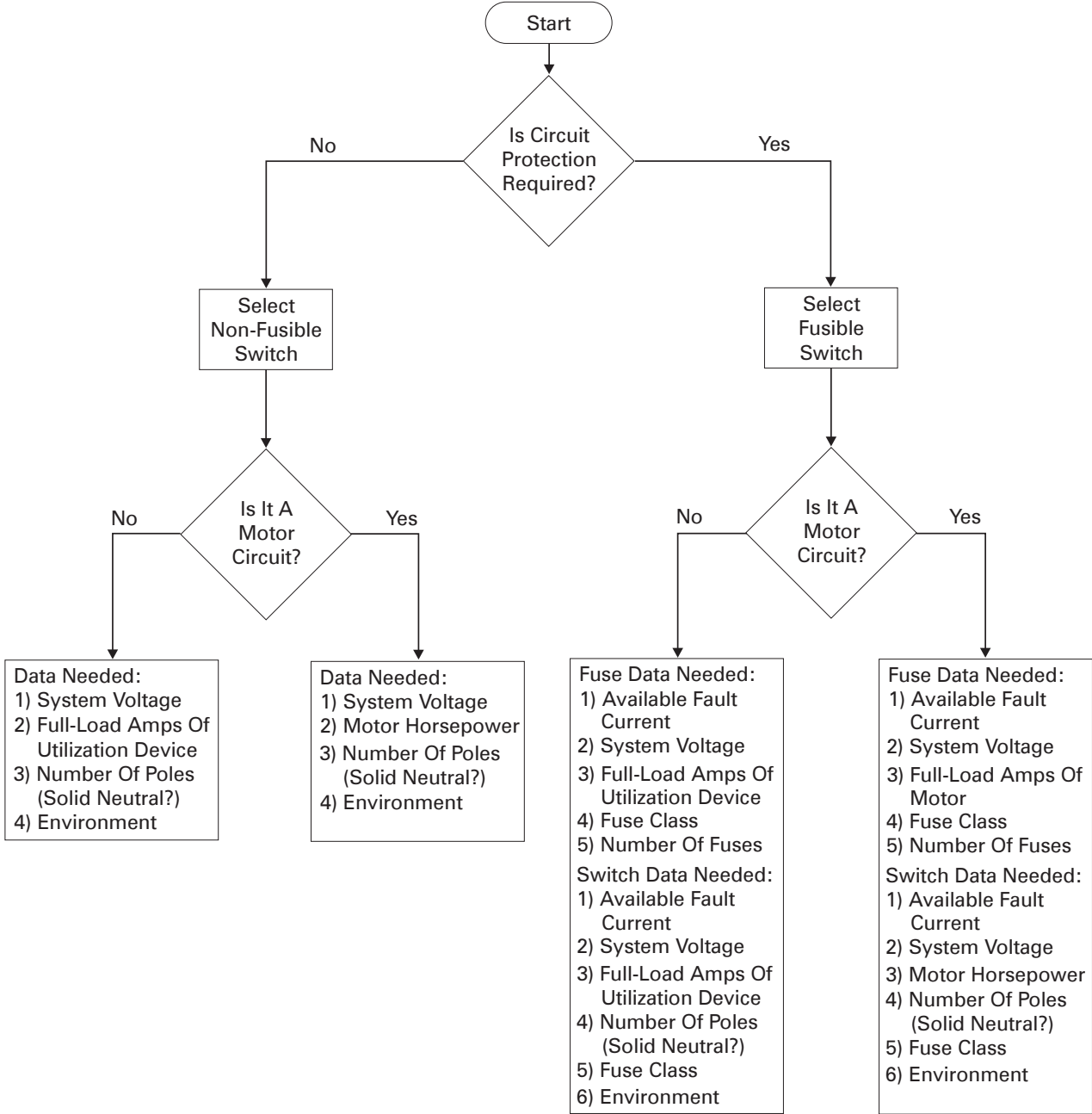


Review 5

1. The maximum short circuit current withstandability of general duty switches is _____ amperes.
2. The maximum short circuit current withstandability of heavy duty switches is _____ amperes.
3. The maximum current rating of a VBII heavy duty switch that is not a bolted pressure switch is _____ amperes.
4. The _____ _____ safety switch provides cord connection for heavy duty portable equipment.
5. _____ _____ switches are intended to transfer loads from one power source to another.

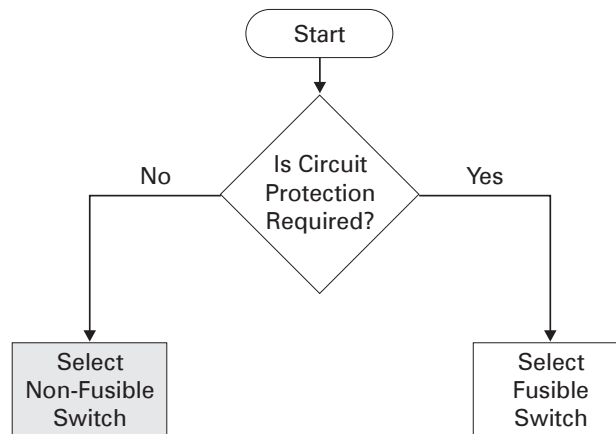
Selecting Safety Switches

While selecting a safety switch is not difficult, flow charts can help to make it even easier. The following flow chart can be used to make key decisions in the selection of a safety switch.



Selecting a Non-Fusible Switch

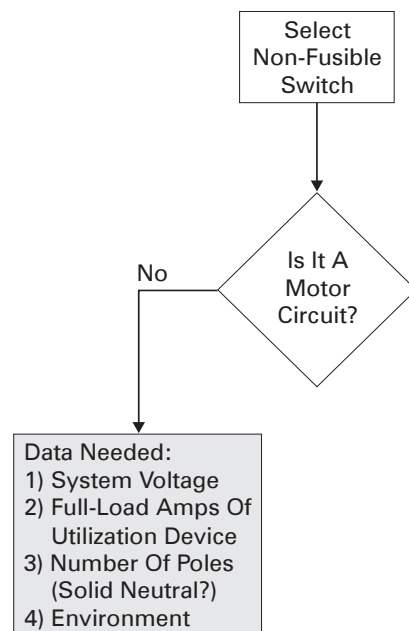
The first question is: Is circuit protection required? If circuit protection is not required a non-fusible switch would be selected.



Non-Fusible Switch not Used on a Motor Circuit

If a non-fusible switch is selected, the next question is: Is it a motor circuit? If the switch is not used on a motor circuit the following information must be known:

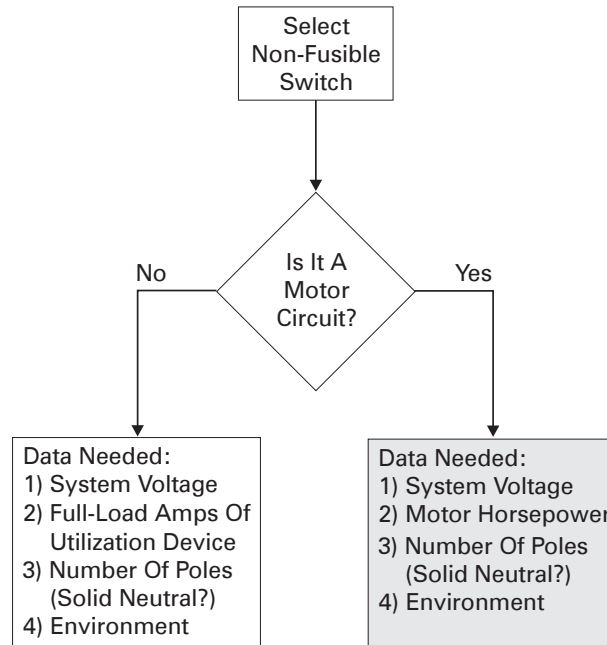
- 1) System voltage: 120 VAC, 240 VAC, 480 VAC, 600 VAC, 250 VDC, 600 VDC
- 2) Full-load amperes of the device to be used on the switch
- 3) The number of poles required, and if a neutral is needed
- 4) The environment (enclosure type)



Non-Fusible Switch Used on a Motor Circuit

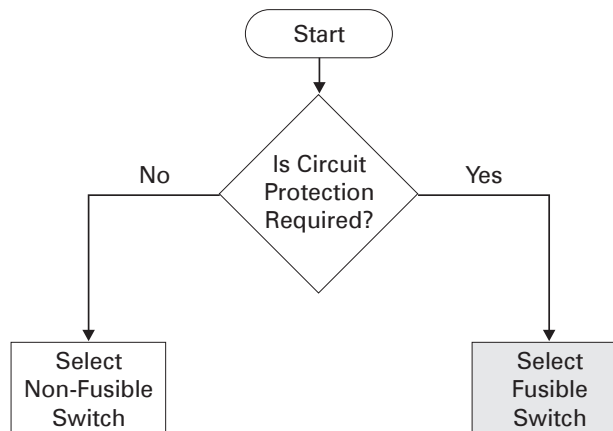
If the switch is used on a motor circuit, the same data is a required, except that motor horsepower replaces full-load current.

- 1) System voltage
- 2) Motor horsepower
- 3) The number of poles required, and if a neutral is needed
- 4) The environment (enclosure type)



Selecting a Fusible Switch

If circuit protection is required, a fusible switch would be selected.



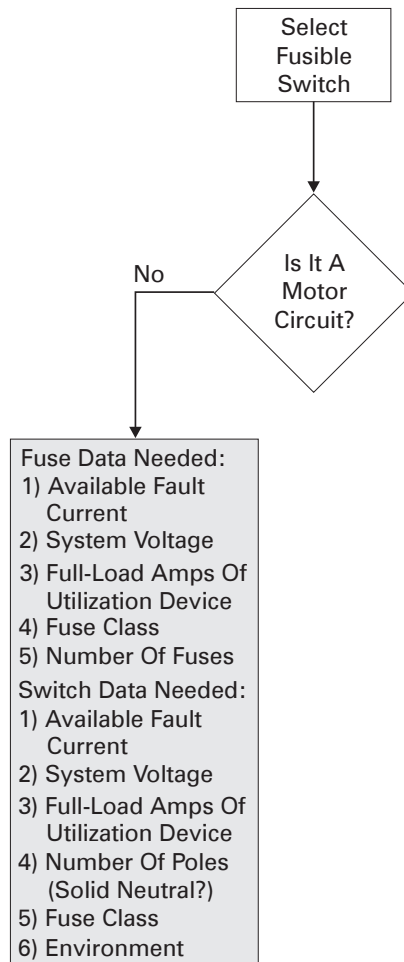
Fusible Switch not Used on a Motor Circuit

If a fusible switch is selected, the next question is: Is it a motor circuit? If not, the following information must be known to select a fuse:

- 1) Available fault current
- 2) System voltage
- 3) Full-load amperes of the device to be used on the switch
- 4) Fuse class
- 5) Number of lines to be fused

The following must be known to select a switch:

- 1) Available fault current
- 2) System voltage
- 3) Full-load amperes of the device to be used on the switch
- 4) Number of poles, and if a neutral is needed
- 5) Fuse class
- 6) Environment (enclosure type)



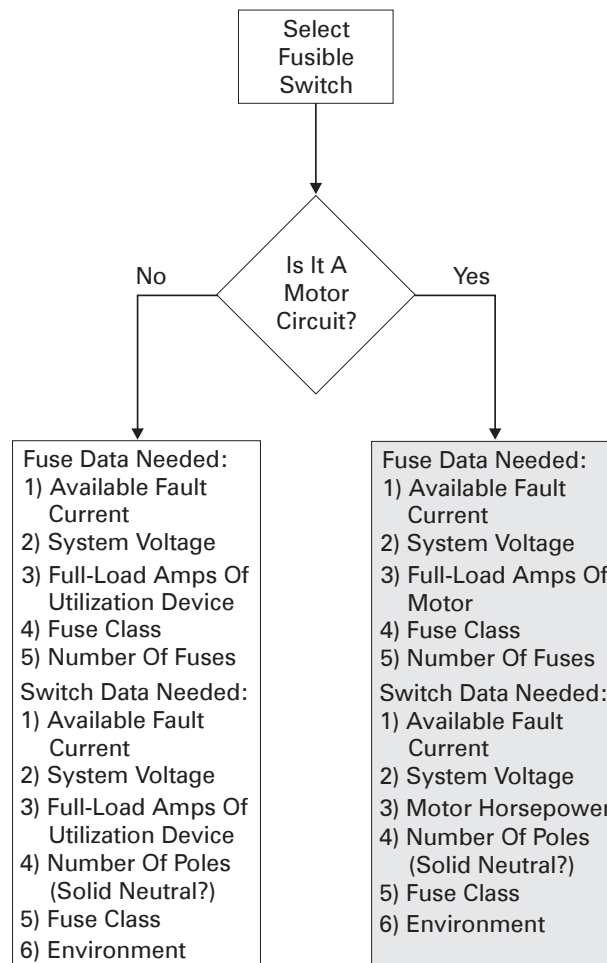
Fusible Switch Used on a Motor Circuit

If the switch is used on a motor circuit, the following information must be known to select a fuse:

- 1) Available fault current
- 2) System voltage
- 3) Full-load amperes required by the motor
- 4) Fuse class
- 5) Number of lines to be fused

The following must be known to select a switch:

- 1) Available fault current
- 2) System voltage
- 3) Motor horsepower
- 4) Number of poles, and if a neutral is needed
- 5) Fuse class
- 6) Environment (enclosure type)



Example of Selecting a Non-Fusible Safety Switch

In the following example, a safety switch needs to be provided for an application that does not require circuit protection. The full-load current of the utilization device is 45 amperes. It is not a motor. The system voltage is 240 VAC, 3-phase, 3-wire (without neutral). The environment is indoors, and there are no unusual conditions such as dust or liquids.

Recall from earlier discussion that in general, all conductors (including the switch) must be capable of carrying 125% of the full-load current. The full-load current of the utilization device is 45 amperes; a switch must be selected that can carry 56 amperes.

$$\begin{array}{r} 45 \text{ amperes} \\ \times 125\% \\ \hline 56 \text{ amperes} \end{array}$$

Knowing that the switch will be used indoors, with no unusual conditions, a Type 1 enclosure can be selected. The other requirements can be met with a general duty switch. Referring to the General Duty Safety Switches section of the Speedfax catalog, the first 240 volt, 3-pole, non-fusible switch that will handle 56 amperes is a 60 amp switch. The catalog number is GNF322.

Since the required fuse is a Class R, and the circuit has a potential fault current of 200,000 amperes, a class R fuse kit (catalog number HR64) is required. This can be found in the accessory section of the Speedfax.

System	Ampere Rating	Indoor - Type 1			Outdoor - Type 3R		
		Catalog Number	List Price \$	Ship Wt. Std. Pkg.	Catalog Number	List Price \$	Ship Wt. Std. Pkg.

240 Volt Non-Fusible

2-Pole or 3-Pole

	30	GNF321			GNF321R		
	60	GNF322			GNF322R		
	100	GNF323			GNF323R		
	200	GNF324			GNF324R		
	400	GNF325			Use 600V Switch - HF365R		
	600	GNF326			Use 600V Switch - HF366R		

Example of Selecting a

In the following example a safety switch needs to be

Fusible Safety Switch

provided for an application that does require circuit protection. This application will have a 480 VAC, three-phase, 75 HP motor, not needing a neutral connection. The customer has specified an RK5 time-delay fuse, for a potential fault current of 200,000 amperes. The switch will be located indoors with no unusual service conditions.

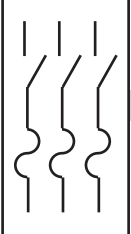
The 480 VAC requirement dictates a heavy duty, 600 volt, fusible switch. Turning to the appropriate Speedfax page, the enclosure type is located, that is, Indoor — Type 1. Next, the 600 Volt Fusible, 3-pole, 3-fuse table is found. From the horsepower ratings, in the 480 VAC, 3-phase, 3-wire section, a switch will be selected from the maximum (Max.) column. The maximum column is chosen because the customer selected time delay fuses. (Had non-time delay fuses been specified, the standard horsepower column would be used.) Reading down the maximum horsepower column, 125 HP, the first rating meeting the 75 HP requirement, is found. Reading to the left the catalog number, HF364, is found under Type 1. (It can also be seen that this safety switch is rated for 200 amperes.)

Since the required fuse is a Class R, and the circuit has a potential fault current of 200,000 amperes, a Class R fuse clip kit (catalog number HR64) is also required. This can be found in the accessory section of the Speedfax.

System	Ampere Rating	Indoor - Type 1			Horsepower Ratings			
		Catalog Number	List Price \$	Ship Wt. Std. Pkg.	480 VAC			
					1 Phase, 2 Wire		3 Phase, 3 Wire	
Std.	Max.	Std.	Max.					

600 Volt Fusible

3-Pole, 3-Fuse

	30	HF361			3	7½	5	15
	60	HF362			5	20	15	30
	100	HF363			10	30	25	60
	200	HF364			25	50	50	125
	400	HF365					100	250
	600	HF366					150	400
	800	HF367					200	500
	1200	HF368					200	500

Selecting a Fuse

Section 430.6 of the *NEC*[®] requires that where the current rating of a motor is used to determine the ampacity of conductors or ampere ratings of switches, branch-circuit overcurrent devices, etc., the values given in Tables 430.247 through 430.250 are required to be used instead of the actual motor nameplate current rating. In order for a customer to properly select a fuse, *NEC*[®] Table 430.250 must be referred to. According to *NEC*[®] Table 430.250, a 75 HP, 460 VAC motor has a full-load current of 96 amperes.

Table 430.250 Full-Load Current, Three-Phase Alternating-Current Motors

The following values of full-load currents are typical for motor running at speeds usual for belted motors and motors with normal torque characteristics.

Motors built for low speeds (1200 rpm or less) or high torques may require more running current, and multispeed motors will have full-load current varying with speed. In these cases, the nameplate current rating shall be used.

The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120, 220 to 240, 440 to 480, and 550 to 600 volts.

Horsepower	Induction-Type Squirrel Cage and Wound Rotor (Amperes)						
	115 Volts	200 Volts	208 Volts	230 Volts	460 Volts	575 Volts	2300 Volts
½	4.4	2.5	2.4	2.2	1.1	0.9	-
¾	6.4	3.7	3.5	3.2	1.6	1.3	-
1	8.4	4.8	4.6	4.2	2.1	1.7	-
1½	12.0	6.9	6.6	6.0	3.0	2.4	-
2	13.6	7.8	7.5	6.8	3.4	2.7	-
3	-	11.0	10.6	9.6	4.8	3.9	-
5	-	15.5	16.7	15.2	7.6	6.1	-
7½	-	25.3	24.2	22	11	9	-
10	-	32.2	30.8	28	14	11	-
15	-	48.3	46.2	42	21	17	-
20	-	62.1	59.4	54	27	22	-
25	-	78.2	74.8	68	34	27	-
30	-	92	88	80	40	32	-
40	-	120	114	104	52	41	-
50	-	150	143	130	65	52	-
60	-	177	169	154	77	62	16
75	-	221	211	192	96	77	20
100	-	285	273	248	124	99	26
125	-	359	343	312	156	125	31
150	-	414	396	360	180	144	37
200	-	552	528	480	240	192	49
250	-	-	-	-	302	242	60
300	-	-	-	-	361	289	72
350	-	-	-	-	414	336	83
400	-	-	-	-	477	382	95
450	-	-	-	-	515	412	103
500	-	-	-	-	590	472	118

Table 430.52 of the *NEC*[®] is provided to help select a fuse that will not trip while starting a motor, and still provide adequate overcurrent protection. According to this table, the *NEC*[®] requires that the ampere rating of an AC motor protected by a time-delay fuse be multiplied by 175%.

Table 430.52 Maximum Rating or Setting of Motor Branch-Circuit Short-Circuit and Ground-Fault Protective Devices

Type of Motor	Percentage of Full-Load Current			
	Nontime Delay Fuse	Dual Element (Time-Delay) Fuse	Instantaneous Trip Breaker	Inverse Time Breaker
Single-phase motors	300	175	800	250
AC polyphase motors other than wound-rotor				
Squirrel cage - other than Design E or Design B energy efficient	300	175	800	250
Design E or Design B energy efficient	300	175	1100	250
Synchronous	300	175	800	250
Wound rotor	150	150	800	150
Direct current (constant voltage)	150	150	250	150

Multiplying the motor rating of 96 amperes times 175% results in a fuse size of 168 amperes. Since this is a non-standard fuse size, the next standard fuse size of 175 amperes would be selected.

<i>96 amperes</i>	<i>Full-Load Motor Current</i>
<i>X 175%</i>	<i>NEC[®] Requirement</i>
<hr/> <i>168 amperes</i>	<i>Fuse Rating</i>

Review 6

1. A _____ safety switch would be selected when circuit protection is not required.
2. A _____ safety switch would be selected when circuit protection is required.
3. When selecting a non-fusible safety switch for utilization device rated at 100 amperes, a switch must be selected that can carry _____ amperes.
4. According to the *NEC*[®], the ampere rating of an AC motor protected by a time-delay fuse should be multiplied by _____ %.

Review Answers

Review 1

1) fusible; 2) 50; 3) a; 4) overload, short circuit; 5) short circuit;
6) overload; 7) peak let-thru; 8) energy; 9) 240; 10) 310.16;
11) 125.

Review 2

1) inverse; 2) half; 3) short; 4) Time-delay; 5) ampere;
6) higher, lower; 7) 200,000.

Review 3

1) 1; 2) 3R; 3) contacts; 4) two.

Review 4

1) ampere; 2) 200,000; 3) 200; 4) pole; 5) c; 6) Throw .

Review 5

1) 100,000; 2) 200,000; 3) 1200; 4) interlock receptacle; 5)
Double throw.

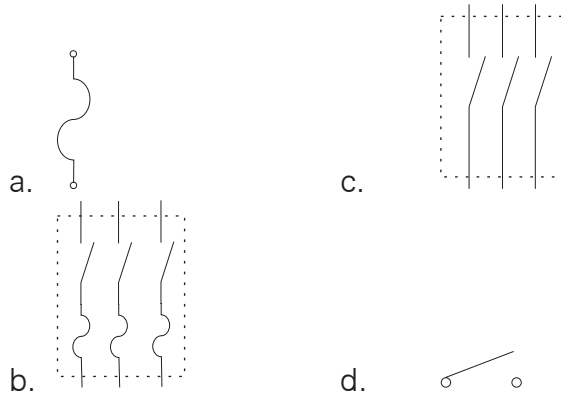
Review 6

1) non-fusible; 2) fusible; 3) 125; 4) 175.

Final Exam

The final exam is intended to be a learning tool. The book may be used during the exam. A tear-out answer sheet is provided. Please fill out the answer sheet neatly and completely. After completing the test, mail the answer sheet in for grading. A grade of 70% or better is passing. Upon successful completion of the test a certificate will be issued.

1. The following symbol represents a non-fusible enclosed switch:



2. A safety switch combined with fuses in a single enclosure is referred to as a _____ safety switch.

- a. non-fusible c. heavy duty
b. fusible d. general duty

3. The *National Electrical Code*[®] defines "in sight" as visible and not more than _____ feet distant.

- a. 10 c. 25
b. 50 d. 100

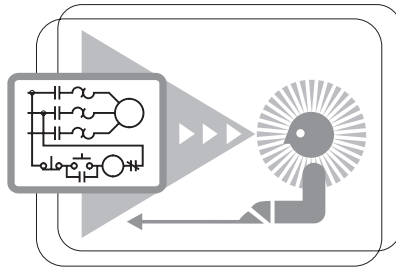
4. With an increase of current, temperature will _____

- a. increase c. decrease
b. remain the same d. increase and decrease

5. Overcurrent protection is covered by *NEC*[®] article _____ .
- a. 110
 - b. 410
 - c. 780
 - d. 240
6. The amount of current a conductor can carry on a continuous basis is known as _____ .
- a. AWG
 - b. peak current
 - c. instantaneous current
 - d. ampacity rating
7. According to the *NEC*[®] a continuous load is a load where the maximum current is expected to continue for _____ hours or more.
- a. 2
 - b. 6
 - c. 3
 - d. 10
8. Fuses have a/an _____ time-current characteristic.
- a. direct
 - b. proportional
 - c. indirect
 - d. inverse
9. Class R fuses have an interrupting rating (AIC) of _____ amperes.
- a. 10,000
 - b. 50,000
 - c. 100,000
 - d. 200,000
10. A UL Type _____ enclosure is intended for indoor use primarily to provide protection against contact with the enclosed equipment in locations where unusual service conditions do not exist.
- a. 1
 - b. 3R
 - c. 4
 - d. 12

17. The _____ safety switch provides cord connection for heavy duty portable equipment.
- a. interlocked receptacle
 - b. double throw
 - c. bolted pressure
 - d. plug fuse
18. Siemens VBII 30 - 200 amp safety switches use a _____ switch action.
- a. Double Break
 - b. Knife-Blade
 - c. Stationary Contact
 - d. Fuse Ejector
19. When selecting a non-fusible switch for use on a non-motor circuit, which of following information is not needed?
- a. system voltage
 - b. full-load amperes
 - c. fuse class
 - d. number of poles
20. _____ safety switches are intended to transfer loads from one power source to another.
- a. Interlock receptacle
 - b. Plug fuse
 - c. Bolted pressure
 - d. Double throw

quickSTEP Online Courses



quickSTEP online courses are available at <http://www.sea.siemens.com/step>.

The quickSTEP training site is divided into three sections: Courses, Downloads, and a Glossary. Online courses include reviews, a final exam, the ability to print a certificate of completion, and the opportunity to register in the Sales & Distributor training database to maintain a record of your accomplishments.

From this site the complete text of all STEP 2000 courses can be downloaded in PDF format. These files contain the most recent changes and updates to the STEP 2000 courses.

A unique feature of the quickSTEP site is our pictorial glossary. The pictorial glossary can be accessed from anywhere within a quickSTEP course. This enables the student to look up an unfamiliar word without leaving the current work area.

