AMPGARD STARTER

High Voltage 72L4 & 72L7 NEMA CLASS E2

Two Speed Pam Motor Starter Without Overload Protection

DESCRIPTION

Application

The Westinghouse Ampgard is a high voltage starter designed for use with AC motors having horsepower ratings as indicated in the Rating Table below. Check table and starter nameplate data against motor nameplate and power system data. This two speed starter is a special design which functions as a set-up switch to provide appropriate motor connections for either of two motor speeds. Overload relays are not provided and contactors are of the mechanically held variety.

Motor running protection is provided by a feeder circuit breaker dedicated to this specific application. System faults are cleared by either the feeder circuit breaker or Type CGLS-78 current limiting fuses, supplied as part of the starter. In the event of a high current system fault, the current limiting fuses will blow and limit fault current to a value the starter is capable of withstanding without damage.

This industrial type control is designed to be installed, operated, and maintained by adequately trained workmen. These instructions do not cover all details, variations, or combinations of the equipment, its storage, delivery, installation, check-out, safe operations, or maintenance. Care must be exercised to comply with local, state, and national regulations, as well as safety practices, for this class of equipment.

Enclosure

The basic starter consists of two NEMA 1 steel floor mounted enclosures, each of which is 40" wide X 30" deep X 90" high. The left unit houses line terminals, isolation switch, current limiting fuses, and the low speed contactor. The right unit contains the two high speed contactors together with terminals for making connections to the high speed and low speed motor windings.

The basic starter unit may be mounted in a weatherproof enclosure for outdoor applications, or in a Westinghouse Electro/Center, or other indoor applications using only the NEMA 1 enclosure.

Installation

Prepare a level mounting per standard floor plan (Figure 2) or per special drawings supplied separately. Installation procedures are specified on 200P026, a copy of which is supplied with this booklet. These recommended procedures will save you time if you follow them. In general, the cable connections can be made by access through the front of the enclosure. Alternately, where there is access space behind the installation, the rear cover of the enclosure can be removed in order to aid wiring. High voltage and low voltage cables should enter the enclosure at the locations specified on the outline drawing.

Type Starter (Contactor)	Voltage	Freq. Cycles	Contactor Continuous Enclosed Rating (Ventilated Enclosure) Amperes	Symmetrical Three Phase Available Short Circuit Capacity @ 6600 Volts MVA	.15 Sec. Starter Current Withstand Rating Amperes	Horsepower Rating *		
						Synchronous Motor		Induction Motor
						Power Factor 100%	80%	
72L4 (LF72H430L)	6200-7200	50-60	360	570	16,000 Sym. 26,000 Asym.	4500	3500	3500
72H7 (LF72H730L)	6200-7200	50-60	650	570	22,000 Sym. 35,000 Asym.	8500	7000	7000

* Typical H.P. Ratings, F.L. Current of Motor Must Not Exceed Contactor Continuous Rating.

Fig. 1 Rating Table

EFFECTIVE DATE - September 1980

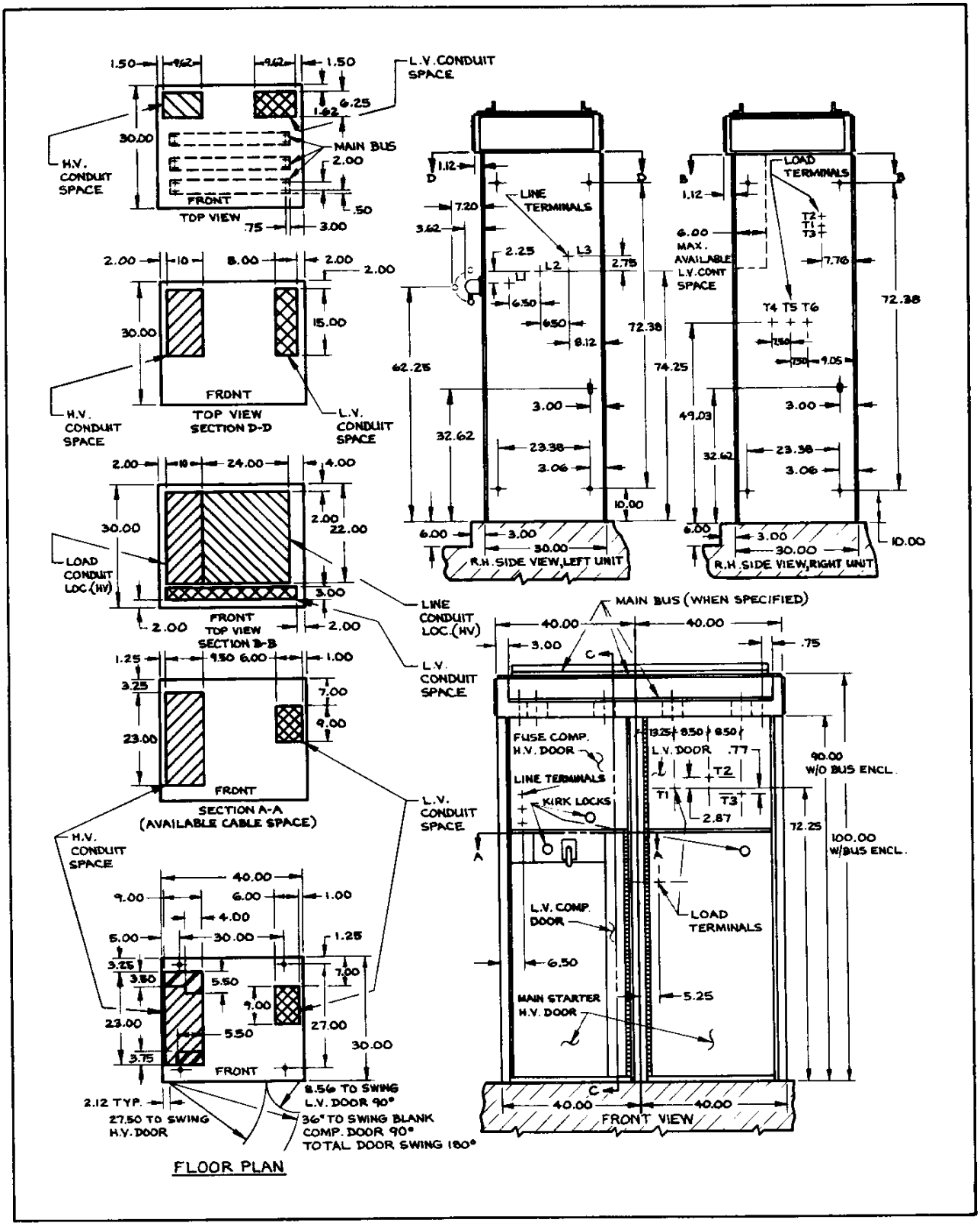


Fig. 2 Typical Mounting & Installation Dimensions of 72L4 & 72L7 Ampgard Starters Dwg. 9873D51

General Description

This two speed Ampgard starter uses Type LF72H430L or LF72H730L contactors, Type LFM7 isolation switch and Type GCLS-78 current limiting fuses. Major components are arranged as shown in Figure 3, where a side view is shown of the incoming line section.

The flow of power through the starter can be traced by referring to Figure 3. The line stab assembly mounted at the rear of the enclosure(1) connects to the starter line terminals by means of cables. The stabs are engaged by movable line fingers(2) of the isolation switch, which is mounted on rails above the contactor. The movable line fingers are connected to the lower fuse castings by means of flexible shunts(3). Power connections to the Type GCLS-78 power fuses(6) are made to the lower end of the fuse through the line finger clusters(4) and fuse line stabs(5). The fuse load stabs(7) engage the fuse load finger clusters(8) in the upper fuse support castings mounted in the upper rear corner of the starter structure. Power flow through the low speed contactor, located on rails below the isolation switch, is from the upper fuse support stabs through interconnecting cables to the top set of contactor line finger clusters(9), through the blow out coils(10), contacts(11), shunts(12), lower finger clusters (13), and then to the lower set of contactor stabs (14). The lower stabs are connected by cables to low speed load terminals located at the top of the right enclosure unit. In a similar manner, cables from the load side of the fuses also connect to the lower set of stabs for the high speed line contactor, mounted on rails at the bottom of the right enclosure unit, and the upper set of stabs on this contactor are connected to the high speed load terminals mounted on the left wall of the right enclosure unit. The lower set of stabs for the upper high speed contactor connect to the three cables going to the low speed terminals and the upper set of stabs for this contactor are connected together with a short section of bus bar.

Safety Interlocks

Before putting the starter into service, it is recommended that the user familiarize himself with the safety interlocks.

Isolation Switch Handle - (See Figure 4). The isolation switch is opened by moving the handle thru a vertical arc from the ON to the OFF position, and from the OFF position, can be rotated 90° counterclockwise to the HORIZONTAL, or door open position.

In both the ON and OFF positions, a portion of the handle housing extends over the enclosure door, and thus prevents the high voltage door from being opened. To open this door, the handle must be moved to the HORIZONTAL position.

With the handle in the OFF position, either a single padlock or up to three padlocks locked in place will prevent the handle from being moved to either the ON or the HORIZONTAL position, thus preventing both unauthorized entry into the high voltage compartment and accidental closing of the isolation switch while maintenance work is being done. From the HORIZONTAL position, the handle cannot be moved to the ON position without first moving to the OFF position.

Door Interlocks- With the isolation switch handle in the HORIZONTAL position, the high voltage compartment door directly below the isolation switch can be opened. As soon as the door opens, a mechanical interlock becomes effective. It is designed to prevent the user from accidentally operating the isolation switch handle and closing the starter on to the line with the enclosure door open.

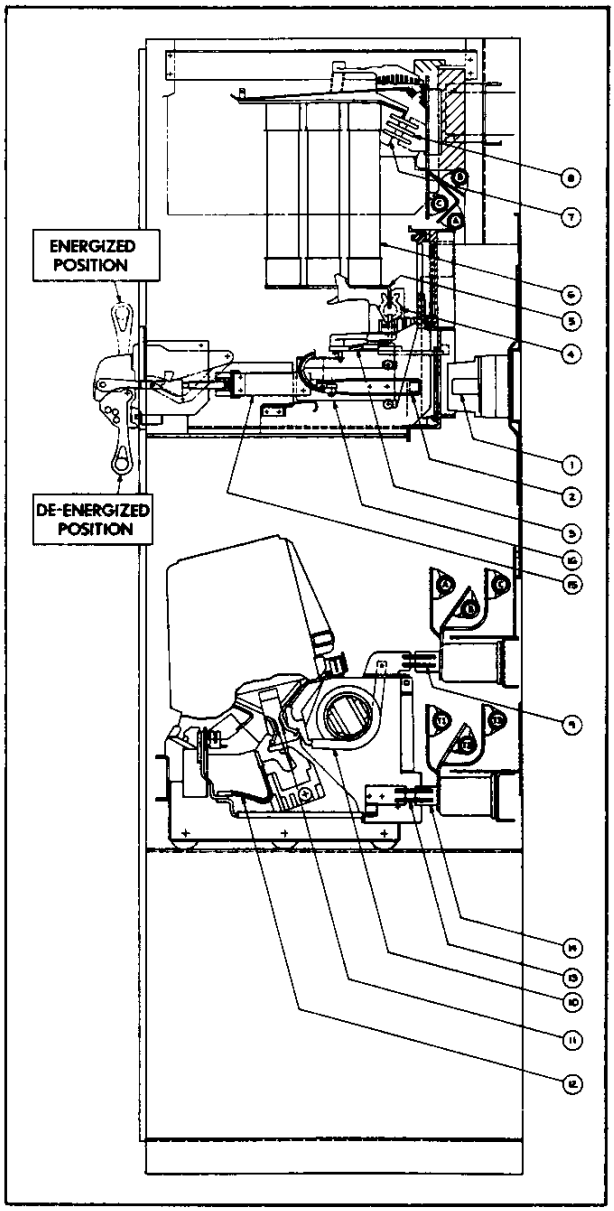


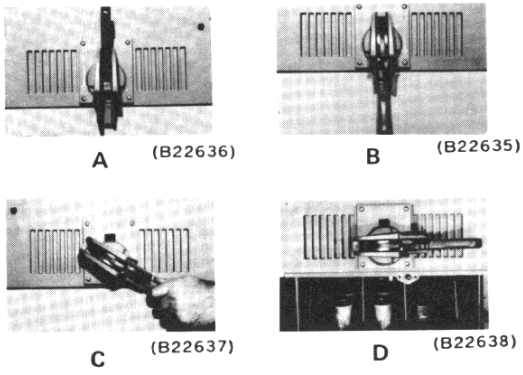
Fig. 3 Section View of Incoming Line Structure In De-Energized Position. Dwg 6432D23

This interlock is a spring loaded plunger located just behind the door. When the door is open, it extends and prevents the handle from being accidentally moved to the OFF position. If the user wishes to observe the operation of the isolation switch during installation or maintenenace, this interlock must be deliberately cheated to move the handle to the OFF position. This is done by depressing the plunger with a screwdriver while moving the handle.

Caution: - This action allows the user to close the switch on to the line stabs. He should be fully aware of the hazards, familiar with the operation of the switch, and take all appropriate safety precautions. The handle must be returned to the HORIZONTAL position to close the high voltage door. Moving the handle from the vertical OFF position to the HORIZONTAL position automatically resets the interlock.

Other doors and bolt-on cover plates which provide access to high voltage devices and connections are NOT interlocked with the isolation switch, but provide protection to personnel through the use of Kirk key interlocks, electrical interlocks which trip the feeder circuit breaker, or warning signs.

Contactor - Isolation Switch Mechanical Interlock - (See Figure 7). The Type LFM 7 isolating switch functions only as a disconnect - it must never close on to or interrupt a power load. To prevent this, a mechanical interlock between all three contactors and the isolation switch has been provided. If any of the contactors are closed, this interlock will lock the handle mechanism of the isolation switch so that it cannot be operated.



The operating handle has three distinct positions. In the ON position (A), the isolation switch is closed, the high voltage door is locked shut, and the starter can be energized.
In the OFF position (B), the isolation switch is open, the high voltage door is locked shut and the starter is de-energized and grounded.
With the handle rotated 90° counterclockwise (C) to the HORIZONTAL position (D), the isolation switch is open, the starter is de-energized, grounded, and the door to the high voltage compartment can be opened.

Fig. 4 Isolation switch operation

When the motor is operating at low speed, neither of the high speed contactors must be allowed to close. For high speed operation, both high speed contactors must be closed, but the low speed contactor must not be allowed to close.

The foregoing interlocking functions are provided by a three way interlock box, mounted on the enclosure wall separating the two starter sections. Adjustable interlock rods link the interlock box with all three contactors and the isolation switch.

When the vertical rod to the isolation switch is moved downward, it causes the horizontal interlock extension rod on the side of the isolation switch to move forward to lock the isolation switch handle. The handle locking mechanism is shown in Figure 6 and its adjustment is described in the Maintenance and Repair Section.

Closing any of the three contactors will actuate the interlock box which will in turn pull the isolation switch interlock rod downward to lock the handle mechanism in whatever position it happens to be. The isolation switch interlocking function is thus accomplished and the isolation switch cannot be operated. The internal operation of the interlock box is such that if either or both of the high speed contactors are closed, the low speed contactor cannot be closed, or if the low speed contactor is closed, neither of the high speed contactors can be closed. This is a positive interlock - it cannot be cheated without disassembly of the interlock.

Isolation Switch Insulating Shutter - As the isolation switch is opened, an insulating shutter slides across the insulating rear barrier to prevent any accidental access to the line bus. This shutter is mechanically driven and thus is positive in action. As the shutter slides across the openings to the line stabs, warning stripes appear. When the isolation switch is fully opened, the line fingers are retracted from the line stabs and connected to the ground bar, grounding the fuses.

The shutter and grounding fingers are visible from the front of the enclosure, and should be checked as a final precaution.

Control Panel and Low Voltage Components

The low voltage components comprised of the interposing relay and recitifer, are mounted on a fixed panel located on the right hand side of the enclosure. The control power transformer may be mounted separately within the starter enclosure or on the left hand contactor frame. The primary is connected to the load side of the main power fuses through current limiting fuses. The secondary supplies power to the 115 volt control circuit through 10 ampere fuses mounted on the right hand contactor frame.

Test-Run Plug - For convenience during maintenance when it may be desirable to energize the contactor or the control circuit only, a control plug with a test position is provided. To use it, simply disconnect the control circuit plug from the socket for the control power transformer secondary and plug it into 60 Hertz, 115

volt single phase extension cord. Special plugs or control circuits may be provided when specified by the user. **CAUTION:** - Disconnect this temporary circuit and restore the plug to the socket for the control circuit power transformer secondary before returning the unit to service.

Power Circuit

For low speed operation, the starter connects motor leads T1-T2-T3 to the incoming line and for high speed operation, motor leads T4-T6-T5 are connected to the incoming line and leads T1-T2-T3 are tied together.

Overload relays are not supplied, and contactors are of the mechanically held variety, to insure the contactors will remain closed under overload conditions and also in the event control circuit power fails.

In normal operation, the motor is started and stopped by means of the feeder circuit breaker. If the motor fails to come up to speed within a predetermined period of time, during the starting period, a timing relay will operate to trip the feeder circuit breaker and deenergize the starter.

Short Circuit and Overload Protection

Electrical protection is provided by Type GCLS-78 current limiting power fuses, supplied as a part of the starter, and overload relays associated with a remote feeder circuit breaker, which is dedicated to this application. The GCLS-78 fuses have a special time/current characteristic, intended for motor service, and this characteristic is coordinated with the characteristic of the feeder breaker overload relays.

Currents greater than full load current, up through locked rotor current, will operate the overload relays and trip the feeder circuit breaker before the fuses blow. Moderate system faults, within the current withstand rating of the starter, will also trip the circuit breaker to clear the fault before the fuses blow. This prevents unnecessary blowing of the fuses.

In the event of a high current system fault, which may exceed the current withstand rating of the starter, the Type GCLS-78 current limiting fuses will blow and limit fault current to a safe value.

The 72L4 starter has a .15 second momentary withstand rating of 16,000 amperes and uses a size 24R current limiting fuse which will clear this fault current in .02 seconds or less. The 72L7 starter has a .15 second momentary withstand rating of 22,000 amperes and uses a size 36R current limiting fuse which will clear this fault current in .02 seconds or less. In the event of higher fault currents, the fuses will limit fault current to a value which will not damage the starters.

Start-Up Precautions:

Before attempting to put a newly installed starter into service, study the wiring diagram and available instruction literature.

General Precautions - Be sure that:

1) The corresponding starter and motor are connected as shown on the Westinghouse drawings and that correct fuses and overload relay settings are used. This is particularly essential in this class of motor starter as the fuse ratings are based on the charcteristics of the particular motor to be controlled and the overload relay characteristics.
2) The starter is connected to a suitable power supply with characteristics agreeing with motor and starter nameplate data.
3) The motor and machine it drives are properly lined up, bolted down, lubricated, free of obstructions, and ready to go.
4) Connections are neat, tight, of proper capacity, and in agreement with the wiring diagram.
5) Equipment has been cleaned of dirt, scraps of wire, tools, and all other foreign material.
6) THE INSULATION LEVEL OF THE STARTER SHOULD BE CHECKED BEFORE THE STARTER IS ENERGIZED. Refer to the maintenance and repair section of this instruction for additional information regarding the checking of insulation level.
7) All possible safety precautions have been taken and the installation checked for conformance with applicable safety codes.

Isolation Switch - Be sure that:

1) The power fuses have been properly installed. See the permanent operating instructions on the inside of the high voltage door.
2) The mechanical interlocks operate freely and are properly adjusted in order to provide the intended protection. See maintenance and repair section of this instruction leaflet for adjustment procedures.

Contactor - Be sure that:

1) The blowout irons are forward and down. If the arc boxes won't go into place, the blowout iron is probably in the wrong position.
2) The arc boxes are in their proper operating position. Push them firmly into place to be sure that the knife blades engage the knife jaws mounted in front of and behind the main contacts.
3) THE FOUR CONTACTOR PHASE BARRIERS ARE INSTALLED (On each contactor)
4) The drawout latch on the lower left hand side of the contactor is engaged.
5) The magnet armature and moving contact system move freely.

Control Circuit - Be sure that:

1) The high voltage and low voltage control fuses are properly installed.
2) The female low voltage control plug from the low voltage control panel has been pushed into the male control socket on the contactor.
3) The test-run plug for the contactor is plugged into the

receptacle for the secondary of the control power transformer.

Close all the high voltage doors, the low voltage doors, and then tighten the door latches. Move the isolation switch handle from the HORIZONTAL to the OFF position. The Ampgard starter is now ready to be energized.

MAINTENANCE AND REPAIR

General

This industrial type control is designed to be installed, operated, and maintained by adequately trained workmen. These instructions do not cover all details, variations, or combinations of the equipment, its storage, delivery, installation, check-out, safe operations, or maintenance. Care must be exercised to comply with local, state, and national regulations, as well as safety practices, for this class of equipment.

Ampgard starters should be operated by authorized personnel **ONLY.** Personnel authorized to operate the isolation switch and those authorized to inspect, adjust, or replace equipment inside the enclosure should have a complete understanding of the operation of the starter, and must have a thorough training in the safety precautions to be followed when working with all high voltage equipment.

A maintenance program should be established as soon as the starter has been installed and put into operation. After the starter has been inspected a number of times at monthly intervals and the conditions noted, the frequency of inspection can be increased or decreased to suit the conditions found, since this will depend upon the severity of the duty.

Before attempting maintenance, consult the specific diagram and the general and specific instruction leaflets. These are listed at the end of this leaflet.

The photos in the installation instruction (200P026) will aid you in understanding this section.

Insulation Level - After installation, and before energizing the starter for the first time, the insulation resistance between poles, and from each pole to ground should be measured and recorded. It is not practical to specify an absolute value for this reading since it is dependent on other connected apparatus and conditions of service. However, any unusually low reading or abrupt reduction in a reading would indicate a possible source of trouble, and the cause should be investigated and corrected.

Fuses - The Type GCLS-78 current limiting fuses should be inspected after each fault-clearing operation, since this is the most severe service to which they will be subjected. Check the fuse resistance, and compare this value with a new fuse. Visual indication of a blown fuse is provided by a colored indicator in the top of the fuse. This indicator pops up and is visible when the fuse is blown.

Blown fuses may be removed and replaced by using the fuse puller mounted on the upright, just inside the high voltage door.

The correct procedure for replacing fuses is described on the instruction sheet (NP 200P027H01) which is permanently fastened inside the high voltage door. This instruction sheet also lists the correct fuse rating and fuse part number for that particular starter. The same type, rating, and part number of power fuses must be used for replacement in all cases.

If for any reason there is doubt about the condition of a fuse, a simple test is to check its electrical continuity and resistance.

Contactor - The Type LF contactor contacts can be easily examined by simply pulling the arc chutes forward to rotate them out of the operating position. To make a more detailed examination, to replace contacts, or to carry out any maintenance work, the contactor can be withdrawn from the enclosure to a drawout position.

To do this:

1) **Lift** the contactor latch on the left hand side of the contactor, and pry the contactor from its stab connections, using a "Jiffy Bar", as outlined in the installation instruction.
2) **Carefully** pull the contactor toward you, to the detent position, which is about ¾ of the way out. It will again be stopped by the contactor latch.
   In this drawout position, all routine maintenance can be carried out. For major overhaul, the contactor can be completely removed from the enclosure by taking two more steps:
3) Remove the low voltage control plug from the R.H. side of the contactor.
4) **Press Down** on the contactor stop latch and roll the contactor out of the enclosure onto the floor using a "Jiffy Bar", as shown in the installation instruction.

TYPE LFM-7 ISOLATION SWITCH

Removal - Any maintenance beyond visual examination should be carried out with the switch removed from the enclosure. This will avoid the possible hazard of closing the switch on to an energized line when the mechanical interlock has been cheated manually.

To remove the isolation switch from the cabinet:

1) De-energize main power feeder, or take precaution noted below.
2) Open the isolation switch.
3) Remove the Type GCLS-78 power fuses.
4) Remove the two bolts securing the isolation switch to the starter structure. These are in the cross bar attached to the rear of the front casting.
5) Slide the isolation switch out of the cabinet.

Caution - While it is safe to remove the contactor and isolation switch from the enclosure with the main line bus energized, once the isolation switch has been removed, the line stab assembly at the back of the enclosure is uncovered, is energized, and is thus a hazard. Be sure to close and latch the doors and display a DANGER -HIGH VOLTAGE sign on the enclosure.

Examination - (See Figures 4 and 5) - With the isolation switch on a table or bench, check the following points:

1) Move the operating handle through its full range of operation from the HORIZONTAL position, through OFF to ON (the door interlock has to be cheated manually). The handle and all of the operating mechanism of the switch should move freely, without binding. This includes the interlock mechanism behind the handle, the line fingers and carrier, the insulating shutter at the back of the switch, and the shutter operator. Make sure the Flex-Loc nut fastening the carrier link (15) had full thread engagement, but allows the link to pivot freely.
2) With the handle in the ON position, the ends of the line fingers should project through the openings in the shutter and rear barrier.
3) When the isolation switch interlock extension rod (See Fig. 6), is pushed toward the front of the switch, the mechanical interlock must lock the handle mechanism, preventing handle movement in either the OFF or ON position. In the OFF position, it is normal for the shutter to open slightly when an attempt is made to force the interlocked handle. The shutter should never come in contact with the line fingers.

Isolation Switch Adjustment - Normally, the isolation switch will not require any adjustment; however, if for any reason parts are removed or replaced, it may be necessary to make some adjustments in the switch mechanism. The adjustment procedure is as follows:

1) (Nos. in text refer to Figures 3 & 5). Remove the bolt and Flex-loc nut fastening the carrier link (15) to the carrier (16). With the handle in the ON position, turn the carrier link in or out of the handle clevis (22) until the line fingers (2) extend beyond the rear barrier by $2.18 \pm .12$ inches. Tighten the Flec-loc nut only enough to engage all its threads.
2) Adjust the insulating link (15) and the guide rail (16) to obtain $1.62 \pm .12$ inches from the bottom of the line fingers to the inside rim of the rear insulating barrier. (See Figure 6). Tighten the bolts fastening these two pieces.
3) Adjust the rocker latch (23) so that when the handle moves from the OFF to the ON position, the rocker latch clears the handle clevis (22) by .03 to .06 inches. This is done by tightening or loosening the adjusting clevis (24). Make sure the cotter pin is reinstalled in the clevis pin after this adjustment.
4) Adjust the position of the ground bar (18) so that the grounding fingers (19) are deflected by the guide rail (21) and the phase barriers are pushed tight against the rear insulating barrier of the switch.
5) With the handle in the OFF position, move the cam follower mounting bracket attached to the guide rail (21) toward the operating handle until the tip of the shutter operator extending thru the shutter just touches the left end of the slot in the rear barrier.
   Note - Make sure the cam follower is centered vertically on the shutter cam, and its line of travel parallel with the shutter cam. Tighten all bolts.
6) With the starter incoming line de-energized, install the isolation switch in the enclosure. With the contactor interlock rods pulled up against the interlock stops, check that the latch clearance in step (3) above is maintained. If not, adjust the isolation switch and contactor rods to the interlock box as required to eliminate forward movement of the horizontal extension rod on the side of the isolation switch.

Caution - Since the following test is an interlock adjustment procedure, the adjuster should be sure that the incoming power line to the starter is not energized, as the interlocks will not provide any protection.

As a final check, install all the contactors along with the isolation switch. With the incoming power line de-energized, check that:

a) The isolation switch can be operated normally when all the contactors are open.
b) The isolation switch handle cannot be moved from either the ON or OFF position when one or more of the contactors are closed. When the low speed contactor is closed, both high speed contactors must be locked open. If either high speed contactor is closed, the low speed contactor must be locked open.
   In making this check, the contactors may be blocked closed mechanically or energized from a separate control supply, through the test plug.

Interlock adjustment is accomplished by lengthening or shortening the vertical interlock rods connecting the isolation switch and contactors to the interlock box. With all the contactors open, the isolation switch should operate freely without interference with the rocker latch. A small amount of downward movement of the isolation switch interlock rod should, however, cause the handle latch to engage and prevent opening or closing of the isolation switch. Interlock rods to the contactors should be shortened as much as possible so that a minimum amount of armature movement is required to provide positive interlocking of the various devices, but not so much that the interlock mechanism goes solid and applies an abnormal load on the contactor magnet. When the contactors are sealed, the interlock rollers should rest lightly against the interlock arms on the contactor shafts. This is a positive interlock - it cannot be cheated without disassembly of the interlock.

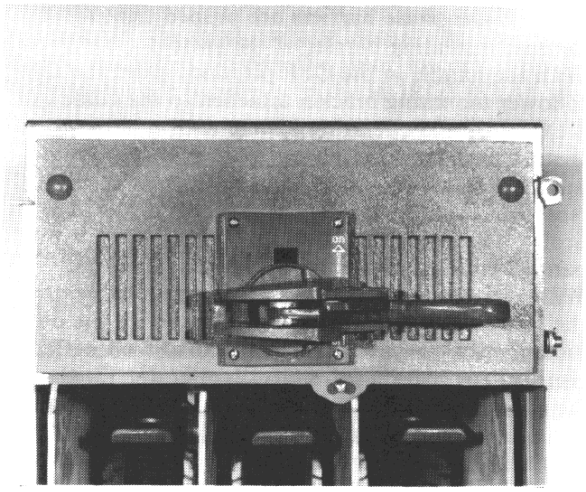


Figure 5 *Photo (69-0274)*
Type LFM-7 Isolation Switch Interlock Mechanism

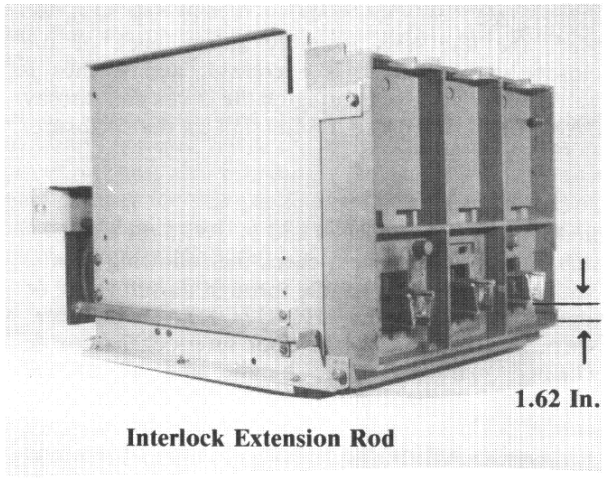


Figure 6
Type LFM-7 Line Finger Adjustment

Opening the High Voltage Door Under Abnormal Conditions - In the unlikely event that either the isolation switch line fingers or the contactor contacts should weld closed, or if any other event should occur such that the isolation switch handle cannot be moved from the ON to the OFF position, provision has been made so that the high voltage door can be opened by using the following emergency procedure:

1) Make sure that the incoming power line to the starter is de-energized, to avoid a hazardous situation when the door is opened.
2) Remove the four screws holding the rectangular handle housing of the isolation switch to the front casting.
3) The complete handle housing can now be pushed up far enough to provide clearance for the door. The door can be opened and any emergency maintenance carried out. The handle housing cannot be removed - it is held by a retaining screw installed from the rear of the front casting.

Contactor Adjustments - All adjustments pertaining to the contactor are described in the contactor instruction leaflet I.L. 16-200-26. See table below for list of publications for devices used in this starter.

List of Publications Applying to Devices in These Starters

Device	Instruction Leaflet No.	Renewal Parts Data No.
Type LFM7 Isolation Switch	This Instruction	LFM-7
Type LFM-72H430 & LF-72H730	I.L. 16-200-26	———————
Slipsyn Synchronous Motor Control	I.L. 14-000-1C	———————
Ampgard Installation Instruction	200P026	———————

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Printed in U.S.A.