MARINE SERVICE

# D-C NON-REVERSING STARTERS

## CLASS 8585—SIZES 0, 1, 2, 3, 4, 5 AND 6

### FOR D-C MOTORS • DEFINITE TIME and CURRENT LIMIT ACCELERATION

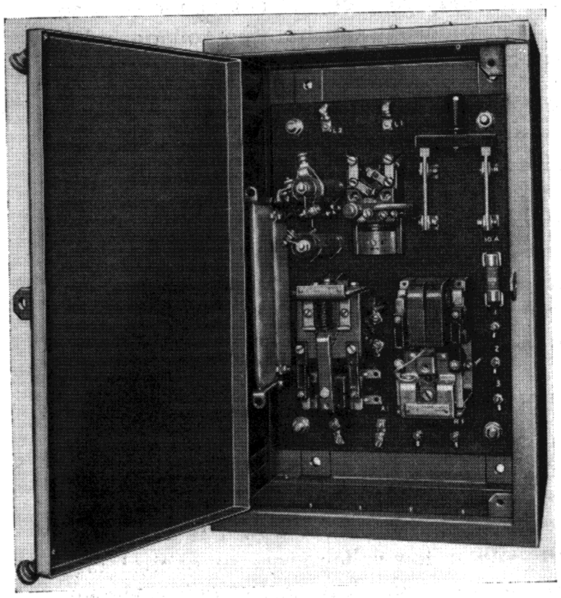

Fig. 1—Class 8585-A Size 1 Starter Enclosed in a Drip-proof Cabinet

| SIZE | RATING OF LINE CONTACTOR IN AMPERES | MAXIMUM HORSEPOWER | | NUMBER OF RESISTOR STEPS |
|---|---|---|---|---|
| | | FOR 115 VOLTS | FOR 230 VOLTS | |
| 0 | 15 | ½* | ½* | 0 |
| 1 | 25 | 3 | 5 | 1 |
| 2 | 50 | 5 | 10 | 2 |
| 3 | 100 | 10 | 25 | 2 |
| 4 | 150 | 20 | 40 | 3 |
| 5 | 300 | 40 | 75 | 4 |
| 6 | 600 | 75 | 150 | 4 |

*Size 0 starters are Linestarters

Fig. 2—Starter Rating Table

## APPLICATION

The Class 8585 Starters are non-reversing, resistor-type, magnetically operated starters for use with shunt or compound wound d-c motors. For most applications, Class 8585 Starters which provide definite time limit acceleration are used. On certain applications where the inertia of the load to be started is very high, such as encountered in oil purifier applications, starters which provide current limit acceleration should be used. The Class 8585 Starters have been designed in accordance with the AIEE Standards and A.B.S. Rules and are recommended for Marine Service.

## RATING

This class of starter is built in various sizes and the ratings are tabulated in Fig. 2.

Each starter is designed for a specific motor rating as the overload relay heater and starting resistor are selected to suit a particular motor rating. These starters will operate satisfactorily from 80% to 110% of the rated voltage.

## CONSTRUCTION

The Class 8585 Starters consist essentially of a line contactor, one or more accelerating Timetactors depending on the size of the starter, a starting resistor, an overload relay, and a control fuse. This apparatus is mounted on an ebony asbestos base and is usually enclosed in either a drip-proof or water-tight enclosure. The standard enclosures are equipped with steel lead plates at the top and bottom. These steel lead plates can be easily removed and drilled for the desired fittings.

Certain optional apparatus, such as line disconnect knife switches, additional low voltage relays, indicating lights, pushbuttons or selector switches, may be incorporated in the starter design depending on the application.

Detailed information on the various control devices used in these starters can be found in the individual instruction leaflets.

## STORAGE AND INSTALLATION

Instruction Leaflet 6100-1 should be referred to for general instructions on storage and installation.

## OPERATION

**1. LOW-VOLTAGE-PROTECTION CIRCUIT—DEFINITE TIME LIMIT ACCELERATION**—The schematic diagram for a typical starter is shown in Fig. 3. While various control devices such as pressure switches, limit switches, low voltage relays and other auxiliary relays, may also be used, the fundamental starter operation is the same. The circuit shown in Fig. 3 is known as a low-voltage-protection scheme. The pushbuttons used are of the momentary contact or spring return type. Such a scheme always makes it necessary for the

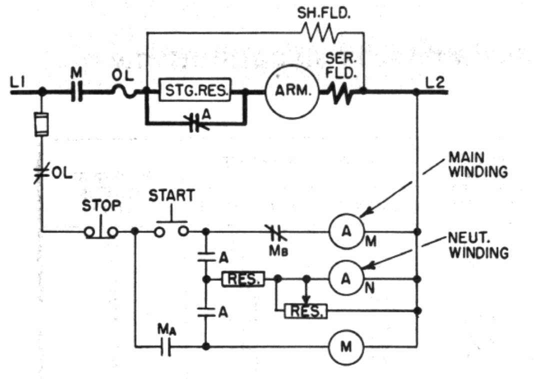


Fig. 3—Typical Size 1 Starter Circuit for Definite Time Limit Acceleration and for Low-voltage-protection Operation (Dwg. 13-D-8182)

operator to press the "Start" button to restart the motor regardless of whether the motor has been stopped by voltage failure, operation of the "Stop" button, or operation of the overload relay. This prevents unexpected and unsupervised restarting of the motor.

When the "Start" button is operated, the main winding "$A_M$" of Timetactor "A" is energized and the main contact "A" opens to remove the short from around the starting resistor. At the same time, the two normally open auxiliary contacts on Timetactor "A" close. The neutralizing winding "$A_N$" and coil "M" are then energized. The contacts "M" close, and the motor starts with the starting resistance in series with the armature.

Interlock contact "$M_A$", actuated by contactor "M", is now closed, and the circuit to the "M" coil is maintained through the overload relay contact, the "Stop" button, and contact "$M_A$".

A second interlock contact "$M_B$" on the line contactor is now open and the main winding of Timetactor "$A_M$" is de-energized. Windings "$A_M$" and "$A_N$" are wound on a section of copper tubing. This tube causes the flux in the Timetactor to decay slowly; consequently, there is a time delay before the Timetactor armature opens to close its main contact "A". The auxiliary contacts "A" will then open to disconnect the neutralizing winding "$A_N$" from the power supply.

The winding "$A_N$" neutralizes the residual flux in the magnetic circuit or iron frame of the Timetactor "A". This insures that the armature will open when winding "$A_M$" is de-energized. By adjusting the voltage on the coil winding "$A_N$", the time delay can be varied in a range of approximately ¾ to 3 seconds.

When the main contact "A" closes, the starting resistor is shorted out and full line voltage is impressed across the motor armature.

If the power fails, if the "Stop" button is pressed, or if the overload relay contact opens because of a sustained overload on the motor, the circuit to the contactor coil "M" will be interrupted and contact "M" will open to stop the motor. Since the "M" coil holding circuit through its own auxiliary contact "$M_A$" is broken when the coil is de-energized, the motor can be restarted only by operation of the "Start" button.

**2. LOW-VOLTAGE-RELEASE CIRCUIT—DEFINITE TIME LIMIT ACCELERATION**—For applications such as ventilating fans or water pumps where it is necessary that the motors be kept running at all times or be ready to run whenever power is available, a starter with a low-voltage-release control circuit is generally used. A typical circuit is shown by Fig. 4. An automatic switch is shown in the diagram to illustrate its control function in the circuit. This switch may be a pressure switch, float switch or any other device necessary to control the operation of the motor.

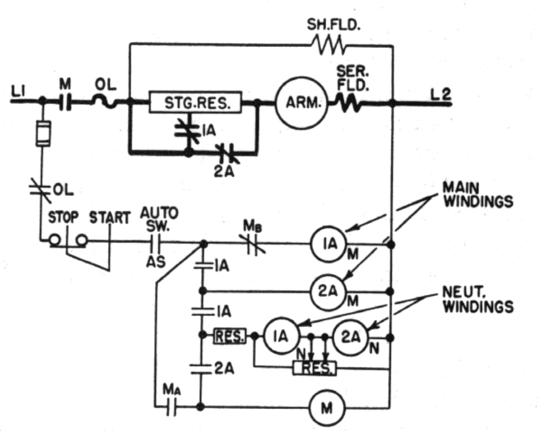


Fig. 4—Typical Size 2 Starter Circuit for Definite Time Limit Acceleration and for Low-voltage-release Operation. Starter Controlled by an Automatic Switch. (Dwg. 13-D-8183)

In this diagram the pushbutton is of the maintained contact type. After the "Start" button is operated, the contact remains closed until the "Stop" button is depressed to open the contacts.

After the "Start" button is operated, the automatic switch controls the starting or stopping of the motor. When the automatic switch closes, the Timetactor main winding "$1A_M$" is energized and the main contact "1A" opens. At the same time, two normally open auxiliary contacts "1A" close and main winding "$2A_M$" on Timetactor "2A" is energized and opens main contact "2A". The neutralizing windings "$1A_N$" and "$2A_N$" are now energized. The auxiliary contact "2A" closes and the contactor coil "M" is energized. Contacts "M" close and the motor starts with the starting resistance in series with the armature. Interlock "$M_A$" will close to by-pass the auxiliary contacts "1A" and "2A". These auxiliary contacts open after the timing periods elapse.

The interlock "$M_B$" on the line contactor is now open and main winding "$1A_M$" is de-energized. After a definite time delay period, main contact "1A" closes to short out the first section of the starting resistance, and the auxiliary contacts "1A" open to de-energize the main coil "$2A_M$". After another definite time delay period, main contact "$2A_M$" closes to short out the remaining section of the starting resistance. Auxiliary contact "2A" will open to de-energize the neutralizing windings "$1A_N$" and "$2A_N$".

If the voltage fails, contactor "M" will open to stop the motor. When the voltage is restored, the motor will restart as described above, provided the "Start" button is still depressed and the automatic switch contact is closed.

A sustained overload will cause the overload relay to trip and stop the motor. In a low-voltage-release circuit, the overload contact remains

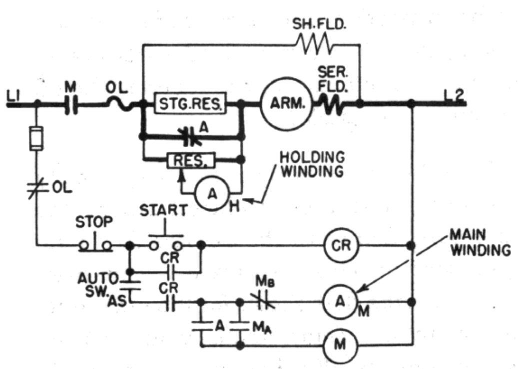


**Fig. 5—Typical Size 1 Starter Circuit for Current Limit Acceleration and for Low-voltage-protection Operation. Starter Controlled by an Automatic Switch. (Dwg. 13-D-8184)**

latched open and must be reset by hand. This prevents an unattended and overloaded motor from restarting after once stopping.

**3. LOW-VOLTAGE-PROTECTION CIRCUIT—CURRENT LIMIT ACCELERATION**—Although definite time limit acceleration is most frequently used, certain applications where the inertia of the load is high, require starters with current limit acceleration. This type of acceleration limits the starting current peaks to permissible safe values.

Fig. 5 shows a typical diagram for a starter for current limit acceleration. A low-voltage relay is incorporated in the circuit to illustrate its operation when the starter employs an automatic switch, such as a pressure switch, in a low-voltage-protection circuit.

The low-voltage-protection circuit is established by pressing the "Start" button. Coil "CR" is energized and contacts "CR" close. One "CR" contact forms a holding circuit around the "Start" button. The closing or opening of the automatic switch contact "AS" now controls the starting or stopping of the motor. When the automatic switch "AS" contact closes, the Timetactor main winding "$A_M$" is energized, main contact "A" opens, and the normally open auxiliary contact "A" closes. Coil "M" is then energized. The main contact "M" closes and connects the motor, with the starting resistor in series with the motor armature, across the line. Interlock "$M_B$" then disconnects the main winding "$A_M$". However, the holding winding "$A_H$" is energized and produces sufficient magnetic force to keep the Timetactor armature closed and the main contact "A" from closing until the motor current drops to approximately 125% of full load current, or for whatever dropout value the relay is calibrated. When main contact "A" closes, the starting resistor is shorted out. The circuit to coil "M" is maintained around auxiliary contact "A" through contact "$M_A$" which is now closed.

If the voltage fails, the "Stop" button is pressed, or the overload relay contact opens due to a sustained overload on the motor, the coil "CR" will be de-energized causing the contacts "CR" to open and de-energize main contactor coil "M". Contact "M" then opens to stop the motor. The "Start" button must be pressed again to re-establish the low-voltage-protection circuit to restart the motor as described above.

## TESTS AND ADJUSTMENTS

**1. PRELIMINARY STARTER TEST**—The operation sequence of the starter should be checked with the motor leads disconnected. Reference should be made to the diagram and description of operation leaflet mounted on the enclosure door.

**2. AUXILIARY CONTROL DEVICES**—All pushbuttons, master switches, pressure switches, limit switches, etc., should be operated to make certain that they function correctly.

**3. DIRECTION OF MOTOR ROTATION**—The direction of rotation of the motor should be checked by referring to the instruction card attached to the motor.

**4. PERMANENT CONNECTIONS**—After the suggested tests have been made, the leads should be securely fastened and properly insulated to make a permanent installation.

**5. CONTROL CIRCUIT FUSE**—If the control circuit fuse blows, check the starter for short-circuited coils, damaged wiring, or incorrect external control connections.

**6. OVERLOAD RELAY**—An incorrectly applied heater, an incorrect calibration or setting of the overload relay adjusting lever, or an intermittent or continuous motor overload will cause the overload relay to trip.

The trip rating of the heater should be in an approximate range of 115% to 125% of the ampere rating stamped on the motor name plate. The number stamped on the heater terminal is the ultimate trip rating of the heater in amperes. The tripping range of the overload relay can be adjusted in a range of ±10% by means of the adjusting lever. If it is suspected that a motor overload is causing the relay to trip, the motor current should be checked by inserting an ammeter in the motor line. The current value that is measured should be compared with the one stamped on the motor name plate. It should also be determined whether the overload conditions are intermittent or continuous. In the case of intermittent overloads, the relay setting or heater rating can sometimes be judiciously increased without danger of damaging the motor. If the overload condition is continuous, the application should be carefully checked, and if it exceeds the rating of the motor, steps should be taken to correct the situation.

**7. ACCELERATING TIMETACTORS**—If the Timetactors are connected to give a definite time delay period, such as illustrated in Fig. 3 or 4, the time delay period may be adjusted from approximately ¾ second to 3 seconds by moving the slider on the potentiometer tube. The slider is marked "Increase," and the arrow indicates the direction to move the slider. Increasing the voltage on the neutralizing coil reduces the time delay period.

On the current limit acceleration type of starters, the Timetactors are set to drop out at approximately 125% of rated full load current. On applications where motors have to start and run on temporary overloads, such as oil pump applications, it may be necessary to set the dropout value higher than 125%, because if the motor current never decreases to 125% of full load, the Timetactor armature will never drop out to accelerate the motor with full line voltage. For such applications, the tap on the potentiometer should be moved. (The less resistance in parallel with the holding winding, the higher the current dropout point.)

## REPLACEMENT OF PARTS—MAINTENANCE

**1. GENERAL**—Data for individual contactors, relays, etc., may be found on the specific instruction sheets for each device. General information on maintenance may be found in Instruction Leaflet 6100-1.

A periodic inspection should be made to insure that the equipment is clean and all parts are in good operating condition. All connections should be kept as tight as possible.

**2. CONTACTS**—Contacts which become badly burned or worn should be replaced before the contact pressure decreases to an unsafe value. The proper contact gaps, overtravels, and pressures are given in the data sheets for the individual pieces of apparatus. Emery cloth should not be used to clean contacts. If it becomes necessary to dress the contact surfaces, a fine file should be used.

3. **WARNING**—The disconnecting switch in the incoming power circuit should always be open before any inspection or maintenance work is done on a starter.

## SPARE PARTS

Any parts that are removed from the spare parts box should be noted and reordered at the earliest opportunity. When a part is ordered, state the name of the part, style number, and the type of relay, contactor, Timetactor, etc., on which it is used. The ordering information can usually be found for these parts on the "List of Spare Parts" which is furnished and fastened to the spare parts box.

In addition to the above information, also give the complete starter name plate reading as it helps to identify the proper replacement parts. If the starter drawing number is known, this information should be included with the order.