Nederman

S-SERIES ELECTRICAL MANUAL

Installation, Wiring, and Troubleshooting

Original Instruction Manual
S-FILTER ELECTRICAL INSTRUCTION MANUAL EN
Rev 3.1 – 06/03/2022 01:27 PM

S-Filter

Electrical Requirements

Nederman S-Filters employ the use of high-efficiency induction motors. These motors have a high startup current, known as “Inrush Current” that lasts for a brief period, usually less-than 10-seconds. When you first start your motor it will experience up to 8x the FLA of the motor current and decrease rapidly until the motor reaches steady state. If your motor starts but does not turn over please see troubleshooting guide near the end of this manual. There are specific electrical codes and standards outlined below that need to be employed when making the electrical connections to the Nederman S- Filter. Failure to adhere to the procedures outlined in this document WILL VOID your Nederman product warranty.

Circuit Sizing

Refer to Table 1, *1 and 3-Phase S-Filter Motor Circuit Sizing Table*, to appropriately size your branch circuit conductors and circuit breaker size. The figures in this table are based on the 2020 NEC and are to be used as ***recommendations only***. Final discretion is the responsibility of the Licensed Electrician, local codes, regulations, and the AHJ.

Due to the inrush current of the motors while ramping up to speed, the fusing/breaker needs to be sized larger. This will protect the wiring in the event of short-circuit. The oversized breaker will not protect the motor. Motor Protection is provided by the motor-overload, which should be set as close to the Full-Load Amperage of the motor as possible for maximum motor protection.

The minimum conductor size listed in the table is calculated based on 75°C wire. If you are using a different type of wire, or the collector is being located a significant distance from the main panel, you will need to adjust your wire size accordingly. Note: AWG #12 is the minimum acceptable wire size

Motor Connections

Under no circumstances shall wire-nuts be used to make motor connections. The use of wire-nuts on Nederman motors WILL VOID YOUR WARRANTY. Per NFPA 79, 13.5.9, wire-nuts and soldering motor leads are unacceptable connection methods for motors. Acceptable alternatives include the use of Split-Bolts, Crimp-Connectors, Eye-Bolts with Screws, or other approved motor connection terminals.

Ensure that you are using dust-tight connections on the motor junction box. The cord-grip used should tightly secure the flexible conduit or cord being used. The motor junction box cover should be secured to the motor so that no dust or water can enter the junction box.

Refer to the wiring diagram to set the motor up for the correct voltage. This diagram is located on the cover of the junction box.

1-Phase S-Filter Motor Circuit Sizing Table[8]

Service Factor 1.0		Motor FLA[1]		Conductor Size[2,7]		Inverse Time Breaker Size[3]		Time-Delay Fuse[4]		Non Time-Delay[5]		O/L Setting[6]		Nederman Starter P/N
S-500	208V	22.8	A	8	AWG	80	A	60	A	100	A	26	A	89115515
	230V	20.2	A	8	AWG	70	A	50	A	90	A	23	A	89115515
S-750	208V	35	A	6	AWG	110	A	80	A	150	A	40	A	89115574
	230V	30	A	8	AWG	100	A	70	A	125	A	35	A	89115574

3-Phase S-Filter Motor Circuit Sizing Table[8]

Service Factor 1.25		Motor FLA[1]		Conductor Size[2,7]		Inverse Time Breaker Size[3]		Time-Delay Fuse[4]		Non Time-Delay[5]		O/L Setting[6]		Nederman Starter P/N
S-500	208V	13.2	A	10	AWG	45	A	30	A	50	A	17	A	89115513
	230V	12.4	A	12	AWG	40	A	30	A	50	A	16	A	89115513
	460V	6.18	A	12	AWG	20	A	15	A	25	A	8	A	89115514
	575V	4.94	A	12	AWG	20	A	15	A	20	A	6	A	89115541
S-750	208V	19.2	A	10	AWG	70	A	45	A	80	A	24	A	89115513
	230V	17.7	A	10	AWG	60	A	40	A	70	A	22	A	89115513
	460V	8.6	A	12	AWG	30	A	20	A	35	A	11	A	89115514
	575V	7.08	A	12	AWG	25	A	20	A	30	A	9	A	89115541
S-1000	208V	26.3	A	8	AWG	80	A	60	A	100	A	33	A	89115521
	230V	23.9	A	8	AWG	70	A	50	A	90	A	30	A	89115521
	460V	12	A	12	AWG	35	A	25	A	45	A	15	A	89115514
	575V	9.55	A	12	AWG	30	A	20	A	30	A	12	A	89115541

[1] Techtop motor nameplate full-load amps. Used for setting overload only.

[2] Minimum size. Based on 75°C (167°F) insulation and copper, Such as RHW, THHW, THW, THWN, XHHW, XHWN,USE, ZW. Verify with table 310.16. Conductor size may need to be increased based on wire type, length and/or run.

[3] Branch circuit protection to be sized at 250% of motor FLC for (Inverse Time) circuit breaker based on tables 430.52, 430.248, and 430.250. Based on 2020 NEC 70 Article 430 and best-practice.

[4] Branch circuit protection to be sized at 175% motor FLC for Dual Element (Time-Delay) Fuse based on tables 430.52, 430.248, and 430.250. Based on 2020 NEC 70 Article 430 and best-practice.

[5] Branch circuit protection to be sized at 300% motor FLC for Nontime-Delay fuse (Class CC fuses) on tables 430.52, 430.248, and 430.250. Based on 2020 NEC 70 Article 430 and best-practice.

[6] Recommended setting for overload on Nederman Push Button Starters based on motor nameplate multiplied by service factor.

[7] Wire-nuts or soldering are ***NOT*** acceptable means to connect motor leads per NFPA 79, 13.5.9. Use appropriate components to make motor connections such as split bolts, crimp-connections and eye-bolts.

[8] It is the responsibility of the end-user to follow State and Local Codes. This chart is provided as a helpful resource only. Use of a qualified and licensed industrial electrician is required for proper installation.

S-Filter Electrical Troubleshooting

1) Are you using Wire-Nuts in the motor junction box?

Before going any further, remove the wire-nuts from the motor and dispose. Wire nuts & soldered connections are prohibited for motor connections per NFPA 79, 13.5.9.2. Use crimp connections, lugs & split-bolts, Polaris connectors, or some other acceptable connection method.

2) Motor starts but will not turn over?

Set overload adjustment dial as close to the O/L Setting in Motor Circuit Sizing tables for your series of filter and voltage. Move trip class up incrementally until overload does not trip on start up. This is different than your overload adjustment. (These are 10A, 10, 20, and 30)

3) Is the circuit breaker or fuse-protection sized according to the 1/3-Phase Motor Circuit Sizing Table?

Ensure the circuit protection is sized per the table above for your series of filter and voltage.

4) Are the supply conductors the correct size according to the 1/3-Phase Motor Circuit Sizing Table?

If not, size correctly. If the length between the starter and the motor exceeds 150-feet, consider upsizing the conductors 1 size to account for voltage drop in the conductors. Consult your Licensed Electrician about the voltage drop.

5) Is the contactor not pulling in? Is the contactor "chattering?" Is it making an odd sound?

Verify Contactor Voltage of contactor (look on top of contactor for the A1 & A2 connection block.
The voltage label will be one of the following: 200-240v (for 208v, 230v, & 240v applications) ii. 440-480v (for 460v and 480v applications)

6) Does the motor spin freely by hand?

If not, there is a problem with the motor. Contact Nederman to order a replacement.

7) Is ductwork connected?

Ensure that all ductwork is connected to the fan. If not, block the fan intake by 1/2. It is important to introduce static resistance to the airflow. Otherwise, motor will over-amp & potentially fault.

*Note: If none of the above options correct the problem please follow the steps below to verify if the motor is bad. If this is a brand new motor please call Nederman for assistance.

1) Separate the individual motor leads. With an ohmmeter, check the resistance of each of the windings. A standard multi-meter is limited in checking issues with motors, this step can still provide some valuable information.

2) For the 9-wire motors, note the resistance values below:
   a. T1 to T4 =
   b. T2 to T5 =
   c. T3 to T6 =
   d. T7 to T8 =
   e. T8 to T9 =
   f. T7 to T9 =

3) Next, check each value to ground, or the chassis:
   a. T1 to GND =
   b. T2 to GND =
   c. T3 to GND =
   d. T4 to GND =
   e. T5 to GND =
   f. T6 to GND =
   g. T7 to GND =
   h. T8 to GND =
   i. T9 to GND =

4) While the motor is disconnected and the circuit breaker turned off, measure the resistance of the supply leads to ground (this test is to ensure you do not have a direct short from one of your supply leads):
   a. L1 to GND =
   b. L2 to GND =
   c. L3 to GND =

5) If you have access to a MEGGER, perform an Insulation test from each lead to ground (motor frame):
   a. T1 to GND =
   b. T2 to GND =
   c. T3 to GND =
   d. T4 to GND =
   e. T5 to GND =
   f. T6 to GND =
   g. T7 to GND =
   h. T8 to GND =
   i. T9 to GND =

6) Reconnect leads, following the proper wiring pattern shown on the motor wiring label. Before going any further, remove the wire-nuts from the motor and dispose. Wire nuts & soldered connections are prohibited for motor connections per NFPA 79, 13.5.9.2. Use crimp connections, lugs & split-bolts, Polaris connectors, or some other acceptable connection method

7) Start the equipment and measure the running current after the motor is at full-speed.
   a. L1 Amps =
   b. L2 Amps =
   c. L3 Amps =

What is Inrush?

When an AC induction motor is started, the supplied voltage creates a magnetic field in the stator, which induces a magnetic field in the rotor. The interaction of these two magnetic fields produces torque and causes the motor to turn. The creation of the magnetic field causes an induced voltage, which opposes the supply voltage. This opposing, induced voltage known as “back EMF” also works to limit the amount of current in the motor.

However, the amount of “back EMF” produced is directly proportional to the speed of the motor. So at startup when the motor speed is near zero there is very little “back EMF”, and high “inrush” current is allowed to flow. The highest level of inrush current occurs during the first half-cycle of motor operation and can be more than 10 times the motor’s full-load amperage. As the motor beings to move, the current decreases to the level of the motor’s locked rotor current, which is often six to eight times the motor’s normal operating current. As the motor speed and, therefore, “back EMF” increases, the current further decreases, until normal operating speed and normal operating current are reached.

High inrush current can cause nuisance tripping of protective devices or motor damage. It can also cause voltage dips in the supply line (which can affect other equipment), or even prevent the motor from starting properly. High inrush current also leads to high torque production at startup sometimes as much as twice the rated torque which can cause sudden, severe acceleration that damages mechanical loads.

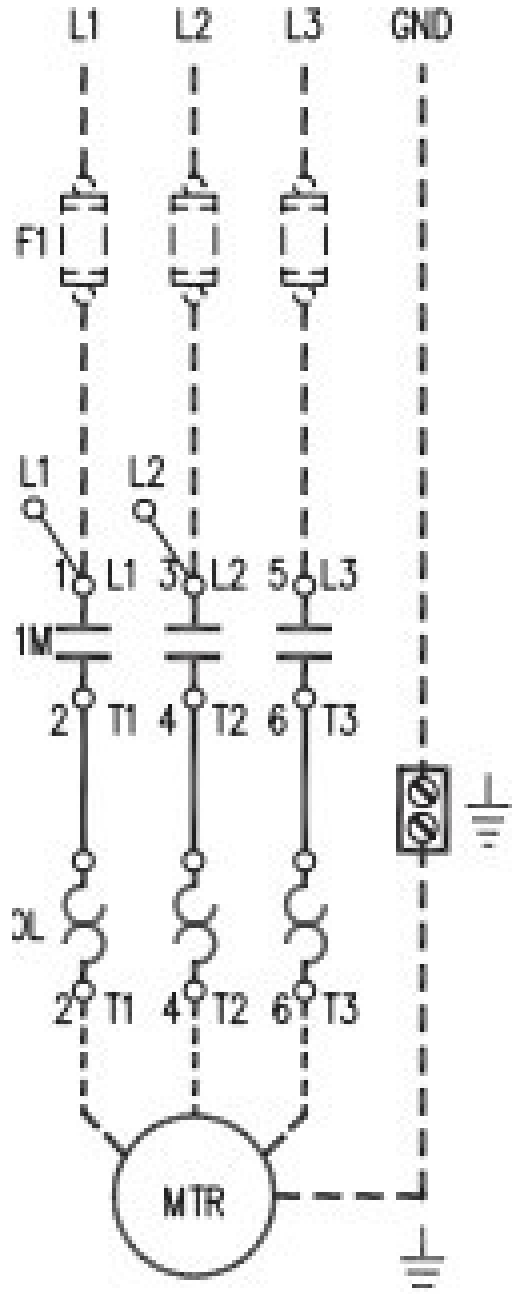
Tips for Inrush

Use the adjustable trip class function on your overload. This will increase the time in which the overload can experience the locked rotor current until the motor reaches steady state. You can tell that this is happening because the motor will try to start and then trip the overload. Below you will see an example of an adjustable trip class.

Trip Class

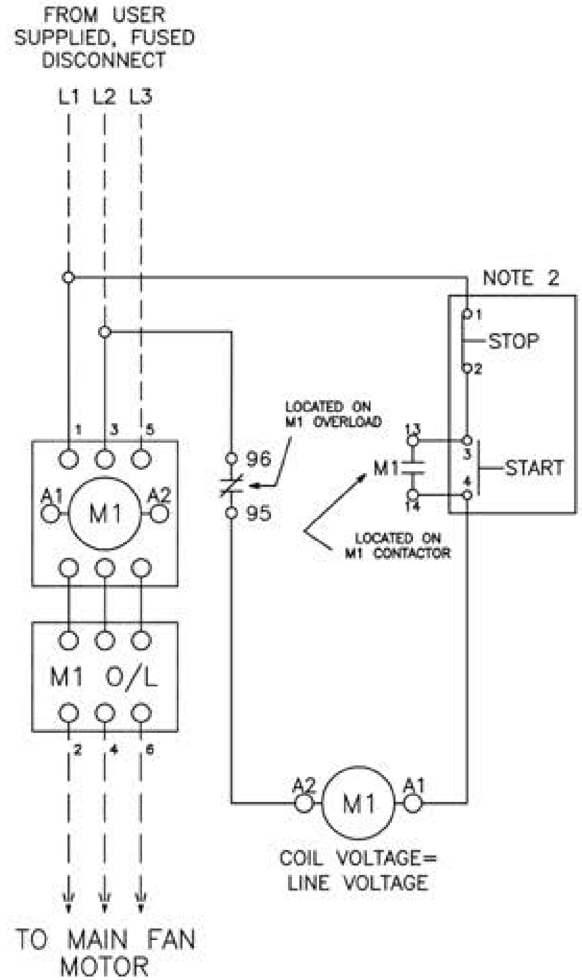
10A	2 < Ti ≥ 10
10	4 < Ti ≥ 10
20	6 < Ti ≥ 20
30	0.5 < Ti ≥ 30

Customer shall provide Branch circuit protection. See the Motor Circuit Sizing Table8 on page 3 for max breaker and fuse size. *Note F1 represents fuses. If using an Inverse Time Breaker it would replace the fuses (F1) in the below circuit example.



DO NOT SCALE | IF IN DOUBT ASK

Revisions				
Zone	Rev	Description	Date	Approved



MOTOR FLA			
HP	208V	230V	460V
2 1ø	--	12A	--
2 3ø	7.5A	6.8A	3.4A
5 3ø	16.7A	15.2A	7.6A
7.5 3ø	24.2A	22A	11A
10 3ø	30.8A	28A	14A

NOTE:
1. DASHED LINES ARE CUSTOMER SUPPLIED WIRING.

2. START/STOP CONTROLS MAY BE DUAL STYLE OR INDIVIDUAL PUSHBUTTONS.

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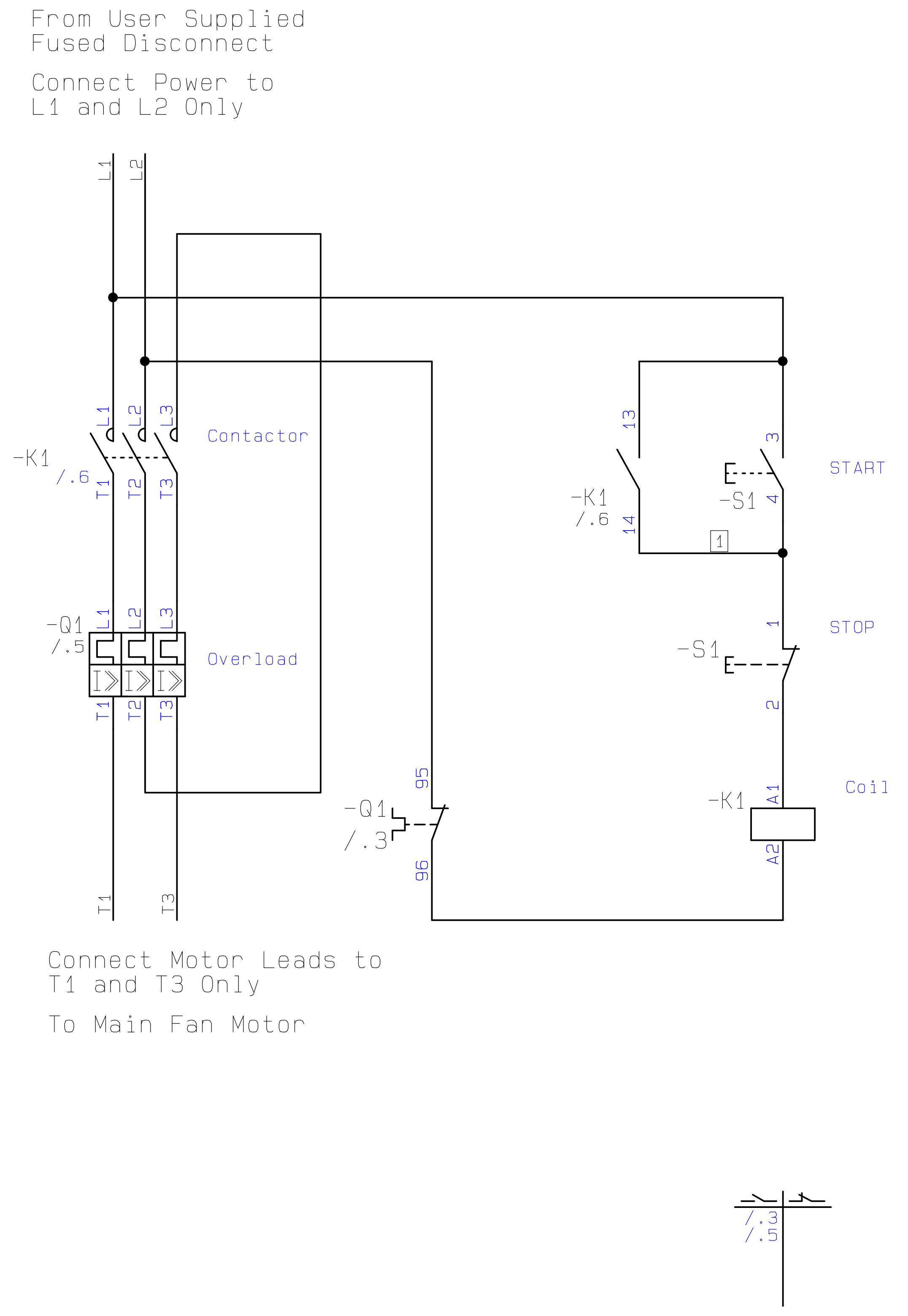
	Date	Name
Drawn	2/23/2006	GJL
Checked	4/12/2012	JGR

Part Number

Title: SCHEMATIC DIAGRAM
STANDARD, ACROSS-THE-LINE MOTOR STARTER FOR S-FILTER

Size	Scale	Drawing Number	Rev	Sht
A	N/A	SFLTSCH001-1	1	1/1



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	Customer Name	Nederman LLC		Revision:	B		
				Constructor:	CHPHI		
				Approved By:	JOROB	Previous page:	
	Project Number		Schematic			Next page:	

TECHTOP
electric motors

CONNECTION RECOMMENDATIONS

MOTOR LEAD TERMINATION FOR FLYING LEADS WITHOUT TERMINAL BLOCK
LOW VOLTAGE MOTORS (1Kv AND LESS)

1. Properly sized crimp style ring terminals
2. Ensure all strands of wire are inserted into the lug.
3. Using the appropriate sized crimping device for the lug, crimp the lug onto the wire.
4. Connect the lugs using properly sized bolts, washers on each side and locking washers (do not drill out ring terminals to it bolts, do not use LOC-TITE)
5. Tape the connection using 2 layers of cambric tape adhesive side up
6. Tape the cambric layer with 130°C rubber tape, 4 half lapped layers stretched to 1/3 of original width
7. Tape final layer with 33 Plus Electrical Tape, 2 half lapped layers extended two tape widths beyond the rubber tape. Pull with tension to compress the runner tape.
8. Ensure no wire is exposed on any of the leads.

   - Or multiple wire connectors like the Burndy-Hubbell series

   - Or split bolt style connectors can be used ensuring the multi stand type is used when connecting more than two wire. Tape as above.

- **Twist on connectors (wire nuts) are expressly prohibited**
   - NFPA 79-2007, Clause 13.5.9.2 states, "Electrical connections at motor termi nal boxes shall be made with an identified method of connection. Twist-on wire connections shall not be used for this purpose."
   - NEC 70HB-2014 695.6 Power Wiring (D) Pump Wiring. All wiring from the controllers to the pump motors shall be in rigid metal conduit, intermediate metal conduit, electrical metallic tubing, liquidtight flexible metal conduit, or liquidtight flexible nonmetallic conduit Type LFNC-B, listed Type MC cable with an impervious covering, or Type MI cable. Electrical connections at motor terminal boxes shall be made with a listed means of connection. Twist-on, insulation-piercing–type, and soldered wire connectors shall not be permitted to be used for this purpose.

FOR ADDITIONAL HELP - CALL TECHTOP TECHINICAL SUPPORT
1-855-TECHTOP