INSTALLATION AND MAINTENANCE MANUAL

STAGEMAKER® SM2

English

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CAUTION: Read the instructions supplied with the product before installation and commissioning.

CAUTION: Keep the instructions in a safe place for future reference.

Table of contents

1 INTRODUCTION

1.1 Contact Information

Please do not hesitate to use the following contact information in the event that you may need assistance:

R&M MATERIALS HANDLING, INC.

4501 Gateway Boulevard

Springfield, OH 45502

General Telephone:	**937 - 328-5100**
Toll Free Telephone (US):	**800 - 955-9967**
General Fax:	**937 - 325-5319**
Parts Department Fax (US):	**800 - 955-5162**
Parts Dept. Fax (other):	**937 - 328-5162**
Website:	**www.rmhoist.com**

1.2 Warranty

All sales are subject to the R&M Materials Handling, Inc. Standard Terms and Conditions of Sale (Revision 101707), a copy of which is available at www.rmhoist.com or upon request from R&M Materials Handling, Inc. customer service/sales representatives and the terms of which are incorporated as if fully rewritten herein.

1.3 Disclaimer

This manual has been prepared by R&M MATERIALS HANDLING, INC. to provide information and suggestions for hoist installation, maintenance, and inspection personnel. This manual should be used in conjunction with the ***STAGEMAKER***® COMPACT Concert Hoist Operator's Manual to teach safe operating practices to all personnel associated with hoist operations and maintenance.

It is NOT intended that the recommendations in this manual take precedence over existing plant / site safety rules and regulations or OSHA regulations. However, a thorough study of the following information should provide a better understanding of proper installation, maintenance, and inspection procedures that are to be followed in order to afford a greater margin of safety for people and machinery in the area of hoist operations.

It must be recognized that this is a manual of recommendations for the Hoist Installation, Maintenance, and Inspection personnel and its use is permissive, not mandatory. It is the responsibility of the hoist owner to make personnel aware of all federal, state, and local codes and regulations. The owner is responsible for providing instruction and ensuring that certain installation, maintenance, and inspection personnel are properly trained.

1.4 Safety

Read and understand this manual before using the hoist.

Important issues to remember during installation, operation, maintenance, and inspection are provided at the hoist control stations, at various locations on the hoist, in this manual, and in the **STAGEMAKER® COMPACT Concert Hoist Operator's Manual**. These issues are indicated by **DANGER**, **WARNING**, or **CAUTION** instructions or placards that alert personnel to potential hazards, proper operation, load limitations, and more.

DANGER: Indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury.

WARNING: Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.

CAUTION: Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Taking precedence over any specific rule, however, is the most important rule of all:

"USE COMMON SENSE"

It is a responsibility of the hoist owner / user to establish programs to:

1. Train and designate hoist operators, and
2. Train and designate hoist inspectors / maintenance personnel.

The words **SHALL** and **SHOULD** are used throughout this manual in accordance with definitions in the ASME B30 standards as follows:

SHALL indicates a rule is mandatory and must be followed.

SHOULD indicates a rule is a recommendation, the advisability of which depends on the facts in each situation.

Hoist operation, hoist inspection, and hoist maintenance personnel training programs should be based on requirements in accordance with the latest edition of:

- **ASME B30.16 Safety Standard for Overhead Hoists (Underhung)**

☞ NOTE: When using the ***STAGEMAKER®*** COMPACT Concert Hoist in the Inverted position, ASME B30.16 Section 16-0.1, states that this ASME standard does not apply when "drawing both the load and the hoist up or down the load chain(s) or rope(s) of the hoist." See WARNING section 2.3.

Such training should also provide information for compliance with any Federal, State, or Local Code requirements, and existing plant safety rules and regulations.

If an overhead hoist is installed as part of an overhead crane or monorail system, training programs should also include requirements in accordance with the latest editions, as applicable, of:

- **ASME B30.11 Safety Standard for Monorails and Underhung Cranes**
- **ASME B30.17 Safety Standard for Overhead and Gantry Cranes, Top Running Bridge, Single Girder, Underhung Hoist.**

☞ NOTE: It is a responsibility of the owner / user to install, inspect, test, maintain, and operate a hoist in accordance with the ASME B30.16 Safety Standard, OSHA Regulations, and ANSI / NFPA 70, National Electric Code. If the hoist is installed as part of a total lifting system, it is also the responsibility of the owner / user to comply with the applicable ASME B30 volume that addresses other types of equipment used in the system.

☞ NOTE: Further, it is the responsibility of the owner / user to require that all personnel who will install, inspect, test, maintain, and operate a hoist read the contents of this manual, **STAGEMAKER®** COMPACT Concert Hoist Operator's Manual, ASME B30.16 Safety Standards for Overhead Hoists (Underhung), OSHA Regulations, and ANSI / NFPA 70, National Electric Code. If the hoist is installed as part of a total lifting system, all personnel must also read the applicable ASME B30 volume that addresses other types of equipment used in the system.

⚠ **DANGER: Failure to read and comply with any one of the limitations noted in this manual can result in product failure, serious bodily injury or death, and / or property damage.**

R&M MATERIALS HANDLING, INC. has no direct involvement or control over the hoist's operation and application. Conforming to good safety practices is the responsibility of the owner, user, and operating personnel.

Only those Authorized and Qualified Personnel who have shown that they have read and have understood this manual and the **STAGEMAKER® COMPACT Concert Hoist Operator's Manual** should be permitted to operate the hoist.

The owner / user **SHALL** ensure that all Operators read and understand the **STAGEMAKER® COMPACT Concert Hoist Operator's Manual** prior to operating the hoist.

1.5 Placards and Instructions

READ and OBEY all Danger, Warning, Caution, and Operating Instructions on the hoist and in this manual and **STAGEMAKER® COMPACT Concert Hoist Operator's Manual**. Make sure that all placards are in place and legible.

Failure to comply with safety precautions in this manual and on the hoist is a safety violation that may result in serious injury, death, or property damage.

2 INSTALLATION

DANGER: Before installing, removing, inspection, or performing any maintenance on a hoist, the main switch shall be de-energized. Lock and tag the main switch in the de-energized position in accordance with ANSI Z244.1. Follow other maintenance procedures outlined in this manual and ASME B30.16.

2.1 General

Prior to installation, the unit shall be checked thoroughly for damage during shipment or handling at the job site.

Each complete electric chain hoist is load tested at the factory at 125% of the nameplate-rated capacity.

All hoists are designed for the type of mounting specified by the purchaser. The adequacy of the supporting members (monorail beams, cranes, hangers, supports, framing, etc.) is the responsibility of user / owner and shall be determined or verified by qualified personnel.

Read the instructions contained in this manual and the **STAGEMAKER® COMPACT Concert Hoist Operator's Manual** as well as any other related manuals. Observe the warning tags attached to the unit before the installation is started.

2.2 Lubrication

The hoist gear case comes completely pre-lubricated with grease. The load chain requires lubrication prior to first use. Chain lubricant is included with shipment of each new chain hoist.

2.3 Mounting

Below are the basic mounting positions for ***STAGEMAKER®*** COMPACT Concert Hoists:

Figure 1. Inverted Mounting

The SM2 cannot be mounted in the normal position

INVERTED
(usually associated with a temporary installation)

NORMAL
(usually associated with a permanent installation)

⚠ WARNING:

Do not use hoist to lift people or suspend loads over people.

Do not leave a freely suspended load on hoist unattended.

A suspended load must always be tied off using appropriate chains, cables or other redundant load bearing means before access to the area beneath the load is permitted(1).

Failure to do so could result in property damage, death or serious injury to personnel.

(1) If the load cannot be tied off due to the nature of the application, redundancies and/or advanced safety features, including but not limited to multiple/redundant hoists, dual brakes on the hoist, a minimum ten to one safety factor on load bearing components, load monitoring devices, etc. used either individually or, as circumstances dictate, in conjunction with one another, must be incorporated into the design of the system.

2.4 Load Hook Throat Opening

CAUTION: ANSI B30.16-1998 recommends that the throat opening of a load hook be measured and recorded prior to putting a hoist into service and that a gauge be made to provide a quick visual inspection for a bent hook as required during routine inspections. Record this information before initial start-up. See Section 6.10 for more detailed hook information.

3 ELECTRICAL CONNECTIONS AND DIAGRAMS

The user / owner must provide the main power supply hardware (cable, conductor bar, fuses, disconnect switch, etc.).

CAUTION: Make sure that the power supply voltage is the same as that shown on hoist serial plate / nameplate.

CAUTION: Make sure that fuses and other current overload devices are in place to protect the power supply.

CAUTION: Make sure that power cable or conductors have sufficient capacity to maintain the hoist supply voltage by ±5 percent of nominal voltage under all operating conditions. Poor voltage regulation may cause motor overheating or sluggishness, and chattering / inoperative motor brake(s) and controls.

CAUTION: Do not use power supply cables with solid conductors.

WARNING: Failure to properly ground the hoist presents the danger of electric shock.

WARNING: An improper or insufficient ground connection creates an electrical shock hazard when touching any part of the hoist or trolley.

DANGER: Before installing, removing, inspection, or performing any maintenance on a hoist, the main switch shall be de-energized. Lock and tag the main switch in the de-energized position in accordance with ANSI Z244.1. Follow other maintenance procedures outlined in this manual and ASME B30.16.

3.1 Control Fuses

The control fuse holders for hoists with three phase power supplies are cylindrical and mounted to the printed circuit control boards (labeled F100).

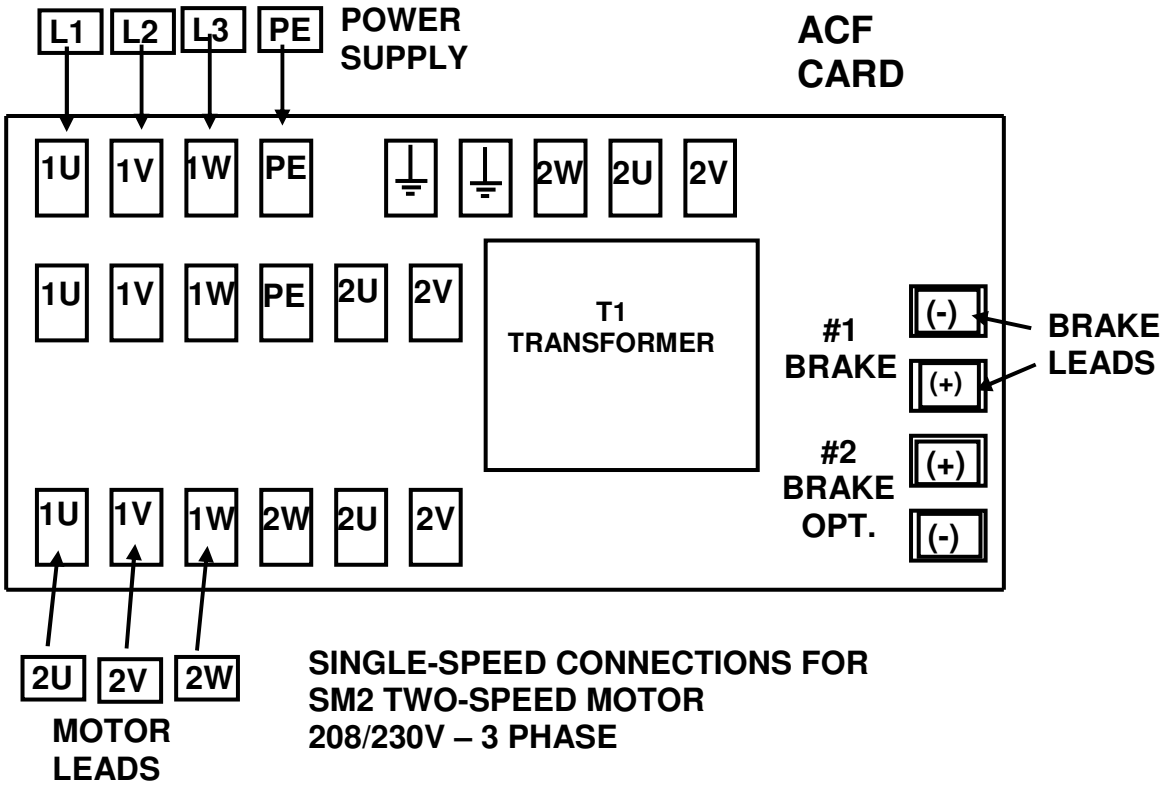
Figure 2. Control Fuses

POWER SUPPLY	CONTROL VOLTAGE	FUSE SIZE
3 – PHASE	115 VAC	500 mA
3 – PHASE	48 VAC	630 mA

3.2 Configuration A - Single-speed – 208 or 230 Volt Connections

Configuration A utilizes direct connection of a three-phase 208 or 230 volt main power supply to the hoist motor leads via a terminal strip. A motor brake rectifier circuit board (ACF) is provided to operate the D.C. hoist motor brake assembly.

Figure 3. Configuration A Connections

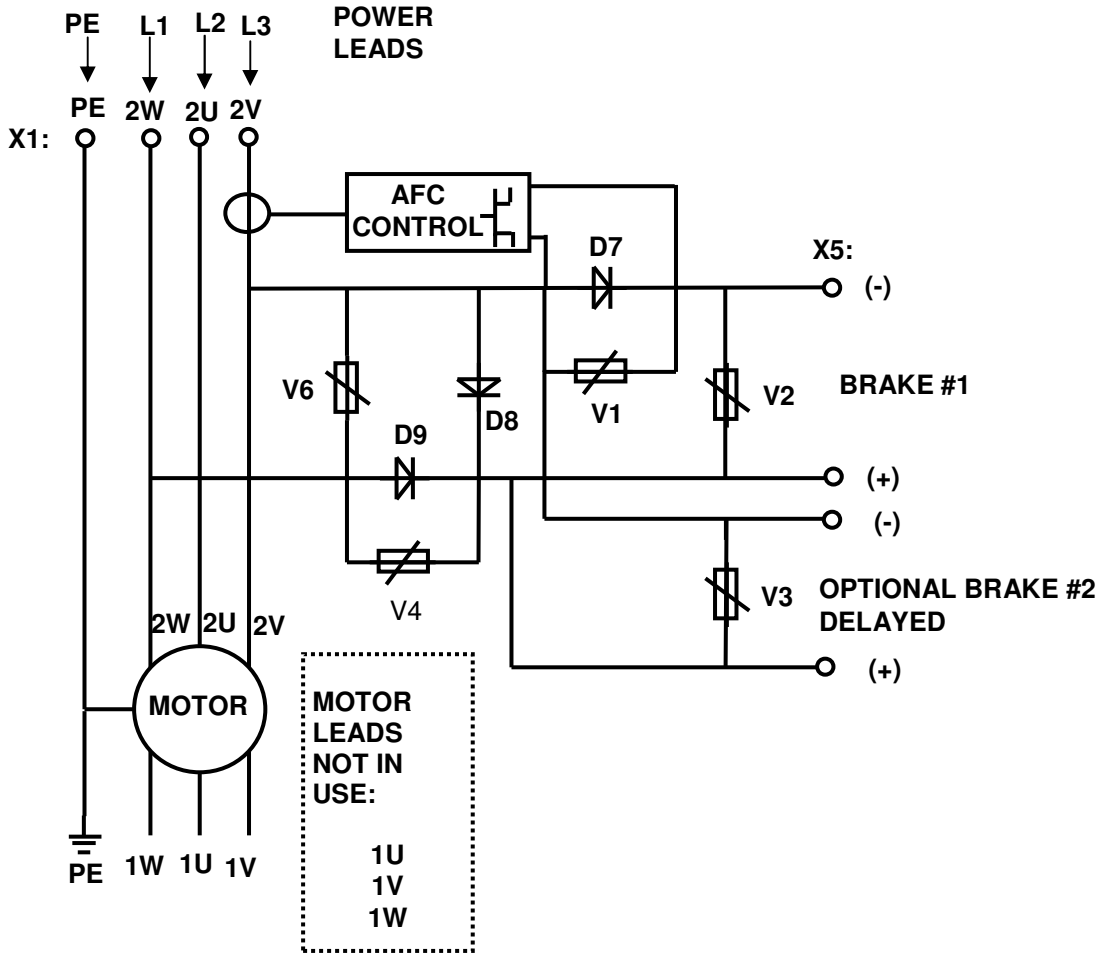


The SM2 three-phase motor is only available as a two-speed. Therefore, the above layout shows the connection of the high-speed motor leads and motor brake coil leads to the ACF direct control board.

The connections are the same for both 208 Volts and 230 Volts. The brake coil supply voltage from the AFC brake control card is 90 - 100 volts DC for both 208 Volts and 230 Volts.

3.3 Configuration A – Single-speed – 208 or 230 Volt Wiring Diagram

Figure 4. Configuration A – Single-speed – 208 or 230 Volt Wiring Diagram



3.4 Configuration A – Pigtail Pin-out Connections – R&M Standard

Table 1. POWER ONLY – PIGTAIL WITH PLUG

WIRE COLOR AWG 12 – 4 COND	CONTROL PANEL CONNECTIONS	MALE CE PLUG BLUE (ME420P9) PIN NUMBER	TWIST LOCK MALE PLUG (L16-20P) 3 POLE + GRD
BLACK	L1	1	X
WHITE	L2	2	Y
RED	L3	3	Z
GREEN	PE (GROUND)	PE (GROUND)	G

Table 2. WIRING DIAGRAM LABELS

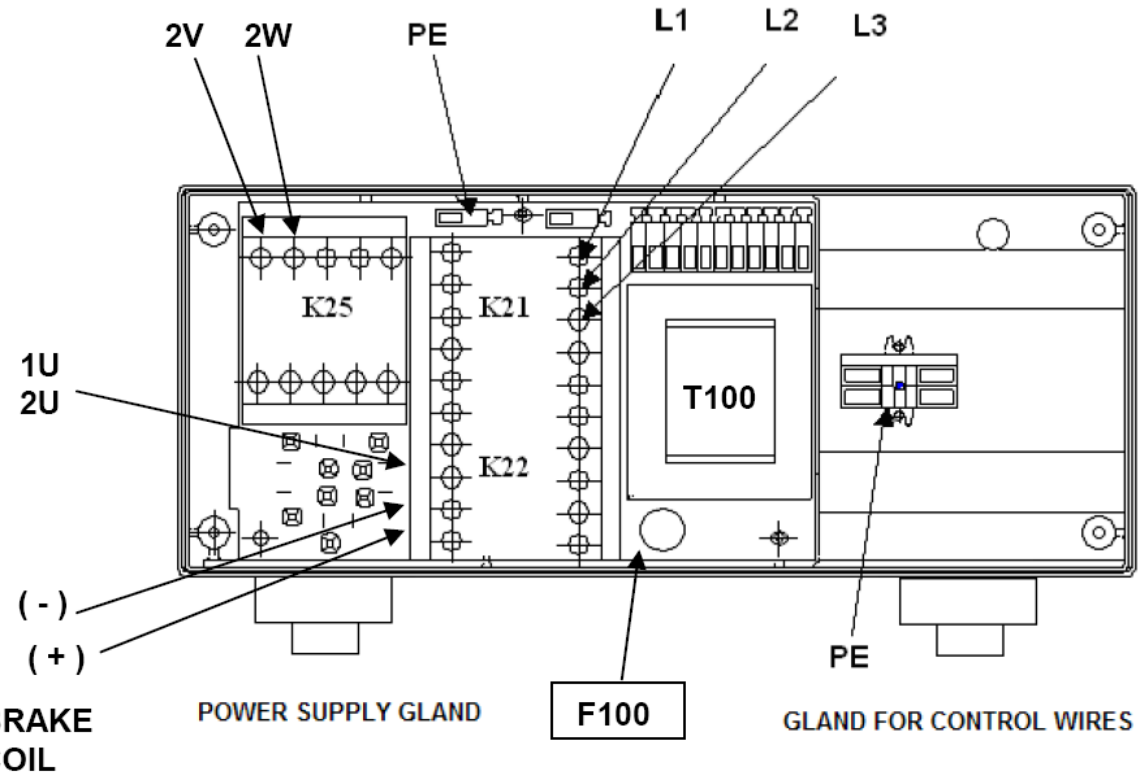
CODE	DESCRIPTION
L1	POWER SUPPLY – PHASE ONE
L2	POWER SUPPLY – PHASE TWO
L3	POWER SUPPLY – PHASE THREE
PE	GROUND
(-)	MOTOR BRAKE COIL SUPPLY – VOLTS DC
(+)	MOTOR BRAKE COIL SUPPLY – VOLTS DC
1W	MOTOR LEAD W
1U	MOTOR LEAD U – SLOW
1V	MOTOR LEAD V – SLOW

⚠ CAUTION: The above pin-out connection reflects R&M's standard connections. There are no industry standards for the above pin connections. Always check the wiring of any equipment before applying power.

3.5 Configuration B – Single-speed – 208 or 230 Volt Connections

NOTE: THIS CONTROL IS NOT RECONNECTABLE!

Figure 5. Configuration B – Single-speed – 208 or 230 Volt Connections

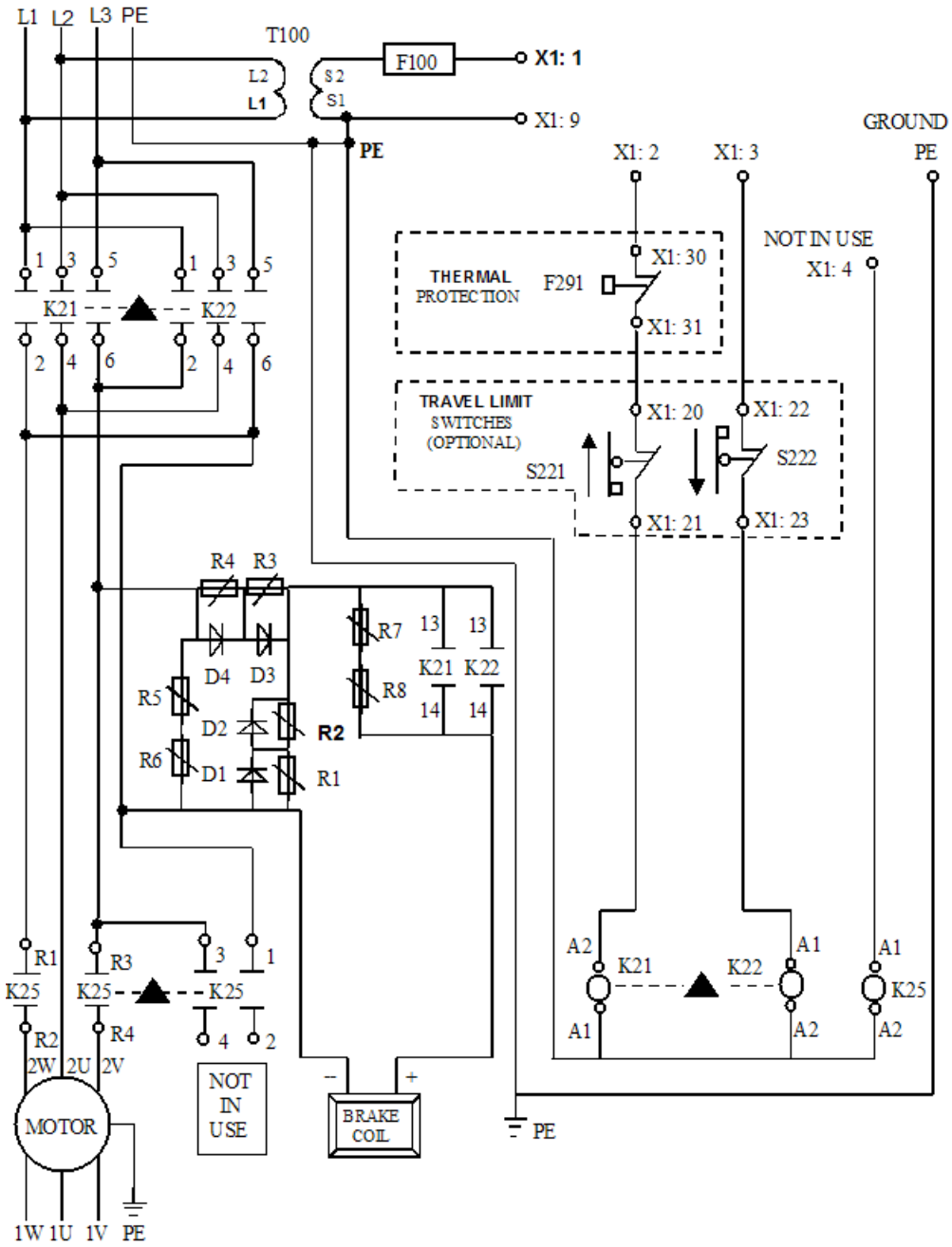


The SM2 can only be connected to the specific voltage noted on the hoist serial tag. The SM2 three-phase motor is only available as a two-speed motor. The single-speed SM2 offering is obtained by connecting the high-speed motor leads of the two-speed motor.

The fuse holder, F100, is located as indicated on the control panel layout. The fuse is easily removed by loosening the top of the cylindrical holder.

3.6 Configuration B – Single-speed – 208 or 230 Volt Wiring Diagram

Figure 6. Configuration B – Single-speed – 208 or 230 Volt Wiring Diagram



3.7 Configuration B – Wiring Labels

Table 3. Configuration B – Wiring Labels

CODE	DESCRIPTION
L1	POWER SUPPLY – PHASE ONE
L2	POWER SUPPLY – PHASE TWO
L3	POWER SUPPLY – PHASE THREE
PE	GROUND
(-)	MOTOR BRAKE COIL SUPPLY – VOLTS DC
(+)	MOTOR BRAKE COIL SUPPLY – VOLTS DC
1W	MOTOR LEAD W – SLOW
2W	MOTOR LEAD W – FAST
1V	MOTOR LEAD V – SLOW
2V	MOTOR LEAD V – FAST
1U2U	MOTOR LEAD U
K21	UP CONTACTOR
K22	DOWN CONTACTOR
K25	FAST CONTACTOR - (NOT IN USE)
T100	CONTROL TRANSFORMER
F100	CONTROL CIRCUIT FUSE
S221/S222	TRAVEL LIMIT SWITCHES (OPTIONAL)
F291	THERMAL PROTECTION SWITCH
X1 – 1	TERMINAL STRIP – CONTROL VOLTAGE SUPPLY - HOT
X1 – 2	TERMINAL STRIP – HOIST UP CONNECTION
X1 – 3	TERMINAL STRIP – HOIST DOWN CONNECTION
X1 – 4	TERMINAL STRIP – HOIST FAST CONNECTION - (NOT IN USE)
X1 – 9	TERMINAL STRIP – CONTROL NEUTRAL
X1 – 30, 31	TERMINAL STRIP – MOTOR THERMAL CONNECTIONS
X1 – 21, 22	TERMINAL STRIP – UPPER LIMIT SWITCH CONNECTIONS
X1 – 23, 24	TERMINAL STRIP – LOWER LIMIT SWITCH CONNECTIONS

3.8 Configuration B – Pigtail Pin-out Connections – R&M Standard

Table 4. POWER ONLY – PIGTAIL WITH PLUG

WIRE COLOR AWG 12 – 4 COND	CONTROL PANEL CONNECTIONS	TWIST LOCK MALE PLUG (L16-20P) 3 POLE + GRD
BLACK	L1	X
WHITE	L2	Y
RED	L3	Z
GREEN	PE (GROUND)	G

Table 5. CONTROL ONLY – PIGTAIL WITH PLUG

WIRE COLOR AWG 16 – 7 COND	CONTROL PANEL CONNECTIONS	TWIST LOCK FEMALE RECEPTACLE (L14-20R) 3 POLE + GRD
ORANGE	UP	W
BLUE	COMMON	X
BLACK on WHITE	DOWN	Y
GREEN	GROUND	G

Table 6. POWER & CONTROL – 7 PIN - PIGTAIL WITH PLUG

WIRE COLOR AWG 12 – 4 COND	CONTROL PANEL CONNECTIONS	MALE PLUG - SOCAPEX 7 PIN (SX07LF) PIN NUMBER
BLACK	L1	1
WHITE	L2	2
RED	L3	3
ORANGE	UP	4
GREEN	PE (GROUND)	5
BLUE	COMMON	6
BLACK on WHITE	DOWN	7

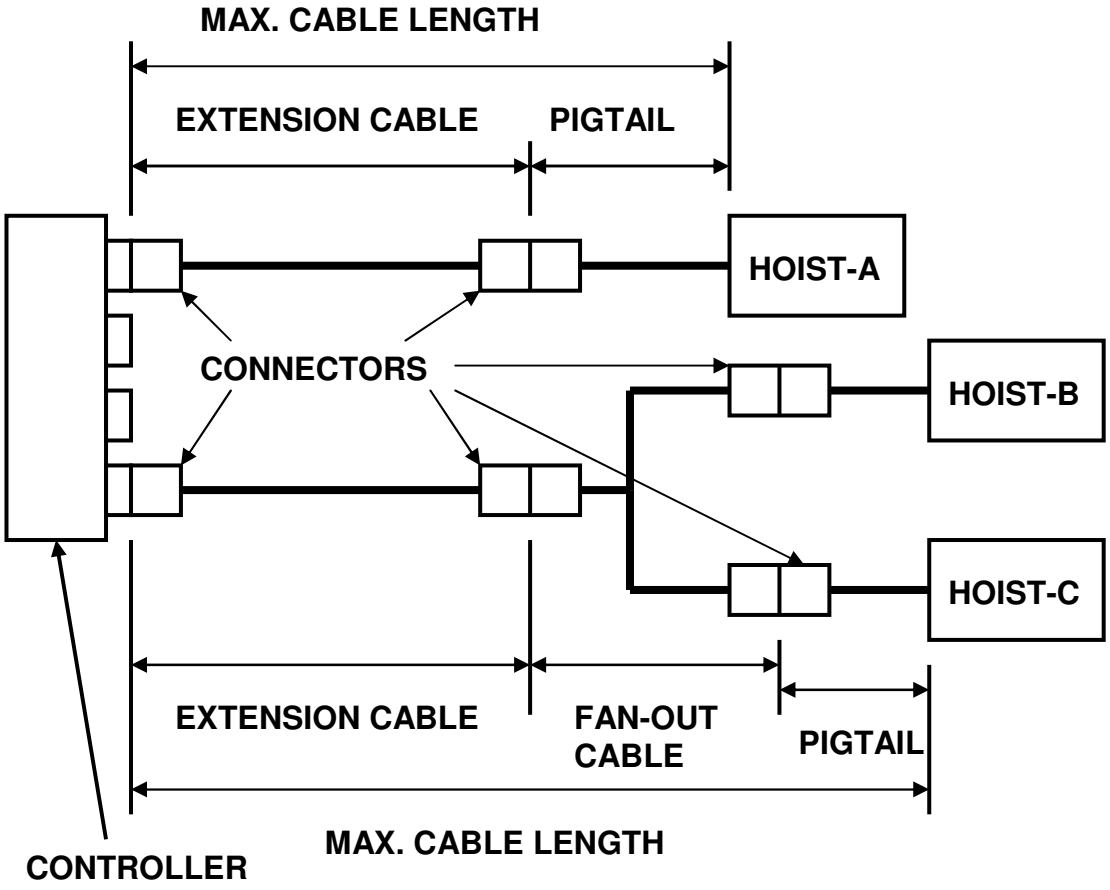
Table 7. POWER AND CONTROL – 14 PIN – PIGTAIL WITH PLUG

WIRE COLOR AWG 12 – 4 COND	CONTROL PANEL CONNECTIONS	MALE PLUG – 14 PIN PIN NUMBER
BLACK	L1	1
WHITE	L2	2
RED	L3	3
ORANGE	UP	4
BLACK on WHITE	COMMON	5
BLUE	DOWN	6
-------	-------	7
-------	-------	8
-------	-------	9
-------	-------	10
-------	-------	11
-------	-------	12
-------	-------	13
GREEN	PE (GROUND)	14

CAUTION: The above pin-out connections reflect R&M's standard connections. There are no industry standards for the above pin connections. Always check the wiring of any equipment before applying power.

3.9 Cable Assemblies

Figure 7. Cable Assemblies



CABLE SYSTEMS

CAUTION: The above cable system diagram should be used to determine the overall length of cable in conjunction with the following maximum cable length limits.

Table 8. Maximum Cable Length Limits

SM2-208V CABLE SYSTEM	MAXIMUM CABLE LENGTH – FEET ---------- [MAXIMUM NOMINAL CURRENT – AMPS]		
	12AWG	14AWG	16AWG
ONE HOIST (HOIST: A)	----------	315 FEET [2.3 AMPS]	198 FEET [2.3 AMPS]
TWO HOISTS (HOISTS: B+C)	----------	157 FEET [2.3 AMPS]	99 FEET [2.3 AMPS]
NOTE: IF ANY CIRCUIT HAS TWO (2) WIRE SIZES, USE SMALLER WIRE SIZE VALUES			

SM2-230V CABLE SYSTEM	MAXIMUM CABLE LENGTH – FEET ---------- [MAXIMUM NOMINAL CURRENT – AMPS]		
	12AWG	14AWG	16AWG
ONE HOIST (HOIST: A)	----------	365 FEET [2.0 AMPS]	230 FEET [2.0 AMPS]
TWO HOISTS (HOISTS: B+C)	----------	186 FEET [2.0 AMPS]	117 FEET [2.0 AMPS]
NOTE: IF ANY CIRCUIT HAS TWO (2) WIRE SIZES, USE SMALLER WIRE SIZE VALUES			

4 INITIAL START-UP

WARNING: Before connecting power to hoist, check all "motion" buttons on control assembly to make sure that they operate freely without binding or sticking. Check pendant cable and strain relief connection, if applicable, to ensure that they are not damaged.

4.1 General

Initial start-up procedures are as follows:

- Read all attached **WARNING** tags and placards affixed to hoist.
- Oil load chain generously over entire length of chain.
- Make sure that load chain is not twisted. If so, untwist load chain before using.
- Make sure fall stop is placed at least 6 inches [150 mm] from last chain link on free end.
- Install chain container.
- If furnished, make sure that trolley wheels have proper spacing in relation to beam flange. See appropriate trolley manual for details.
- Check direction of hook travel to make certain that it corresponds to respective control button that is depressed. That is, does load hook (normal position) or hoist body (inverted position) travel "**UP**" when **UP BUTTON** is depressed? If OK, continue. If not, proceed to section 4.2.
- Perform no-load operational checks as described in Section 4.3.
- Run test with load as described in Section 4.4.

4.2 Correcting the Direction of Hook Travel

WARNING: DO NOT change <u>control</u> leads in controller or at motor relays. DO NOT change nameplates on controller. The upper/lower safety limit switch is wired in series with "UP" control circuit as furnished from factory. Changing control leads or nameplates will prevent the upper safety travel limit switch from functioning properly.

Reversing any two power leads of a three-phase AC motor will reverse the direction of rotation.

- Reverse any two leads of a three-phase power at the main power source or at connections to motor. **Do not change internal wiring of hoist.**
- Use the phase reverse button when supplied with controller.

4.3 Operational Checks – No Load

- Check hoist motor brake function. Run hoist (if inverted position) or empty load hook (if normal position) up or down to check that load hook/hoist does not drift more than 1.0 inch [25mm]. If so, adjust brake as described in section 6.
- Run hoist (if inverted position) or empty load hook (if normal position) down to check that fall stop (located on free end of load chain) makes proper contact with limit switch or hoist body and that limit switch or slip clutch functions properly. Note – limit switches are not provided for inverted position use.
- Run hoist (if inverted position) or empty load block (if normal position) up to check that load block makes proper contact with limit switch or body and that limit switch or slip clutch functions properly. Note – limit switches are not provided for inverted position use.
- Run empty load block up and down several times while checking for proper tracking of load chain.

4.4 Operational Checks – With Load

- After completion of no-load operational tests, the user / owner should perform a full load test even though each complete hoist is load tested at factory.
- Lift a near capacity load about one (1) foot [30cm] above floor level. Check that the brake holds load. Also, check stopping capability of brake when lifting to a stop and lowering to a stop.
- Move trolley the full length of monorail or crane beam. Check for any binding of trolley wheels on flange and/or interference at splice joints, hanger connections / bolts, etc.
- Check contact with stops. Contact with stops SHALL only be made with trolley bumpers. Stops that are designed to make contact with wheels SHALL NOT be used.

5 HOIST OPERATION

For detailed information regarding the operational procedures and recommended safe operating practices for this hoist, please refer to the ***STAGEMAKER®*** Concert Electric Chain Hoist Operator's Manual that was delivered with this hoist.

WARNING: Before proceeding with the normal operation of this hoist, the operator(s) shall be trained in accordance with the STAGEMAKER® COMPACT Concert Hoist Operator's Manual as supplied with this hoist.

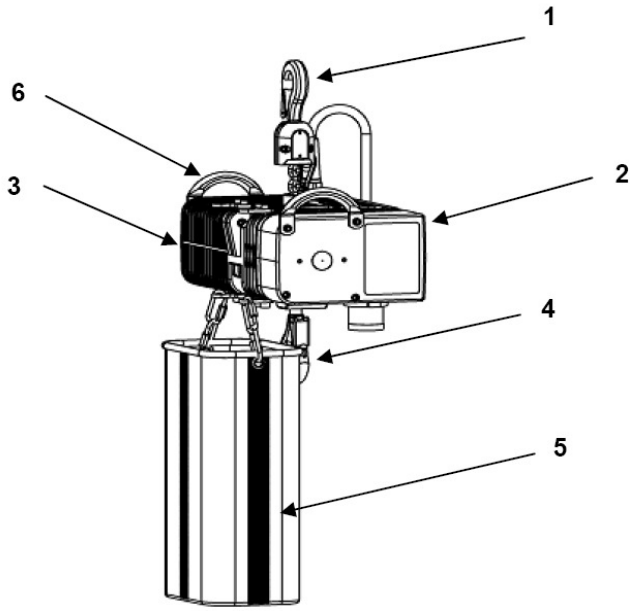
WARNING: Failure to read and comply with any one of the limitations noted in this manual and the STAGEMAKER® COMPACT Concert Hoist Operator's Manual furnished with this hoist can result in product failure, serious bodily injury or death, and / or property damage.

WARNING: Refer to section 1.0 of this manual for contact information if additional assistance is needed.

6 MAINTENANCE

6.1 Basic Hoist Construction (Inverted Position)

Figure 8. Basic Hoist Construction (Inverted Position)



INVERTED POSITION

1. **SWIVEL LOAD HOOK ASSEMBLY**
2. **ELECTRICAL CONTROL ENCLOSURE**
3. **HOIST BODY / MOTOR**
4. **BODY HOOK ASSEMBLY**
5. **CHAIN CONTAINER AND HARDWARE**
6. **FLEXIBLE HANDLES**

6.2 Motor / Body

The hoist motors are designed to provide dependable hoisting service. The standard motors and control enclosures are enclosed for IP55 rated protection (NEMA 3R type) against normal hazards of dust and moisture. The motor bearings are sealed and do not require further greasing.

The hoist body is coated with epoxy paint and constructed of aluminum. Remove from service and replace the hoist body if damaged.

6.3 Hoist Motor Brake and Load-Limiting Device

The hoist is equipped with a D.C. electromagnetic disc brake. The brake brings the load to a smooth and quick stop and holds the load when the motor is not energized. An energized coil releases the hoist brake.

A load-limiting device (slip clutch) is integrated into the design of the hoist motor brake. Even if the clutch slips, once power is removed the brake will engage to stop and hold the load.

6.4 Motor Brake Specifications

Table 9. Motor brake specifications

MAIN VOLTAGE	COIL VOLTAGE	SM5
115	90 - 100 VDC	436 OHMS
208 or 230	90 - 100 VDC	436 OHMS
460	190 VDC	1650 OHMS
575	240 VDC	2550 OHMS

6.5 SM2 Motor Data

Table 10. SM2 motor data

HOIST SPEED 60 HZ	POWER SUPPLY	START AMPS	NOM. AMPS	NO LOAD AMPS	FIELD OHMS	HOIST RPM NOMINAL	HP
16 FPM	115V / 1 PH / 60HZ	18.5 A	11.5 A	9.3 A	1.8 OHMS	1800	0.64
16 FPM	208V / 3PH / 60HZ	7.74 A	3.1 A	1.5 A	9.5 OHMS	1800	0.64
16 FPM	230V / 3PH / 60HZ	7.0 A	2.8 A	1.4 A	9.5 OHMS	1800	0.64
16 FPM	460V / 3PH / 60HZ	3.5 A	1.4 A	0.7 A	38.0 OHMS	1800	0.64
32 FPM	208V / 3PH / 60HZ	17.3 A	4.9 A	1.8 A	4.1 OHMS	3600	1.3
32 FPM	230V / 3PH / 60HZ	15.6 A	4.4 A	1.6 A	4.1 OHMS	3600	1.3
32 FPM	460V / 3PH / 60HZ	7.8 A	2.2 A	0.8 A	17.7 OHMS	3600	1.3
32/8 FPM	208V / 3PH / 60HZ	21.8 A	5.8 A	4.4 A	5.8 OHMS	3600	1.4
32/8 FPM	230V / 3PH / 60HZ	19.2 A	5.2 A	1.6 A	5.8 OHMS	3600	1.4
32/8 FPM	460V / 3PH / 60HZ	9.6 A	2.6 A	2.0 A	24.6 OHMS	3600	1.4
Note: Above values for two-speed motors are for high speed							

SM5 HOIST WEIGHT (WITHOUT CHAIN)	CHAIN WEIGHT
58 LBS	0.363 LBS / FT

6.5.1 Slip Clutch Operation (see Figure 9)

Sequence of events during normal operation:

1. When either the UP or DOWN circuit is energized, the motor brake is activated.
2. When the motor brake is energized, ITEM 5 pulls ITEM 8 away from ITEM 9.
3. ITEM 9 is free to rotate.
4. ITEM 4 applies pressure to ITEM 9 that forces ITEM 9 to engage ITEM 10.
5. The face-to-face contact between ITEMS 9 & 10 creates an adjustable slip clutch between the motor and the load chain sprocket.
6. When the slip clutch adjustments are correct and loads are within the maximum limits, the pressure from ITEM 4, the spring, onto ITEMS 9 & 10, the rotor and disc, allows the motor torque and rotation to be transmitted to the load chain sprocket.
7. As ITEM 2 is tightened, ITEM 4 applies more pressure on the interface between ITEMS 9 & 10.
8. More pressure increases the load capacity of the hoist and less pressure decreases the capacity of the hoist.
9. ITEM 2 is adjusted to allow the hoist to lift 110 – 125 percent of the rated capacity of the hoist.

In the event that the slip clutch begins to slip during the lifting or lowering process, release the hoist motion control button to stop the motor. This will de-energize the brake. ITEM 8 will now press against ITEMS 9 & 10 to stop rotation and slippage between ITEMS 9 & 10. This will stop and hold the load. Re-adjustment of ITEM 2 will be necessary to eliminate slipping. See section 6.4.2.

Figure 9. Slip Clutch and Motor Brake Assembly

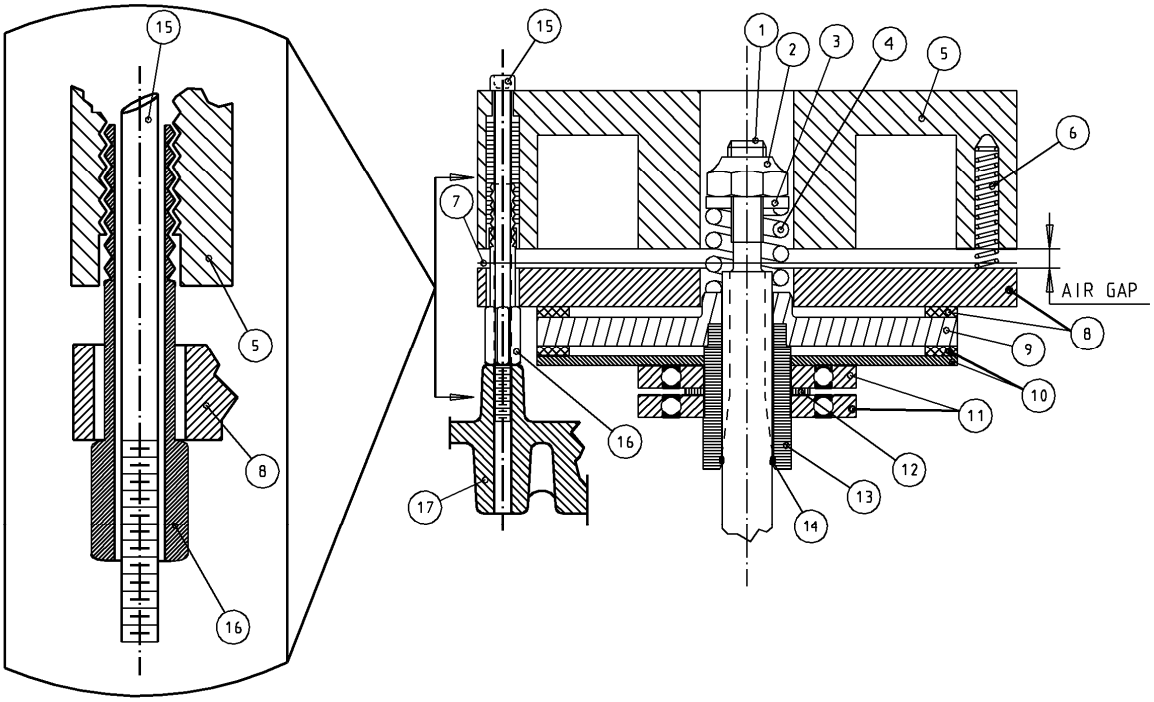


Table 11. Slip Clutch and Motor Brake Assembly Parts List

ITEM	DESCRIPTION
1	MOTOR SHAFT
2	ADJUSTING NUT
3	WASHER
4	SPRING
5	COIL ASSEMBLY
6	SPRING
7	SPACER
8	THRUST DISC
9	ROTOR
10	DISC
11	BEARING
12	BEARING SPACER
13	DRIVE HUB
14	O-RING
15	MOUNTING SCREW
16	ADJUSTING SLEEVE
17	BRAKE HOUSING

NOTE: See Figure 9.

CAUTION: Make sure the motor is not running before placing tool on the nut to adjust it. Do not touch any moving components.

CAUTION: The slip-clutch generates heat when slipping. ITEMS 9 & 10 absorb this heat. When these items become too hot, clutch adjustment may be difficult due to unstable behavior of friction surfaces. If this happens, allow brake & clutch assembly to cool before trying to re-adjust slip-clutch.

CAUTION: Decreasing torque too much when adjusting slip-clutch will allow a suspended load to free-fall when trying to lift. If this occurs, release the motion button and the brake will engage to stop and hold the load.

6.5.2 Slip Clutch Adjustment after Installation

1. Hook a load of at least 110 percent but not more than 125 percent of nameplate capacity.
2. Remove brake cover.
3. Raise load at slow speed and fast speed to test slip clutch operation.
4. Use a socket (10 mm), slide it over nut (item 2 - Figure 9).
5. Turn nut in required direction:
   - INCREASE CAPACITY - Turn nut clockwise to increase the torque.
   - DECREASE CAPACITY - Turn nut counterclockwise to decrease the torque AND then clockwise ¼ turn.
6. Repeat steps 3 and 4 until load can be barely lifted in fast speed. The slip clutch is now adjusted.

CAUTION: DO NOT OVERHEAT. If overheated, clutch may not adjust due to instability of friction surfaces.

7. Once adjustment is completed, replace brake cover.
8. Check function of clutch at 100 percent of nameplate-capacity while in fast speed.

NOTE: The slip clutch / torque limiter is a safety device to prevent overloading of the hoist. This device is not intended for use as means to measure the weight of load being lifted.

6.5.3 Hoist Motor Brake Adjustment (see Figure 9)

If maximum air gap of brake has been reached or will be exceeded before next inspection, re-adjust air gap.

Minimum air gap	Maximum air gap
X = 0.008” [0.20 mm]	X = 0.020” [0.5 mm]

Before adjusting brake, remove load. Per ANSI Z244.1, lockout and tag main disconnect switch in de-energized position. Follow other maintenance procedures outlined in this manual and ASME B30.16.

1. Remove brake cover and gasket.
2. With a feeler gauge, check three places near each mounting bolts, to measure air gap **(X)** between the brake lining (item 8 – Figure 9) and the coil (item 5 – Figure 9).
3. To adjust air gap use a 0.008” feeler gauge and proceed as follows:

   A. Loosen motor brake mounting screws (item 15).
   B. To reduce air gap, tighten three adjusting sleeves (item 16).
   C. To increase air gap, loosen three adjusting sleeves (item 16).

   Repeat step “A” until air gap is snug against feeler gauge and then measure the same in three places.

4. Check brake operation. Run hoist (if inverted position) or load hook (if normal position) up and down several times without a load to test operation of brake. Then, lift a capacity load about one foot above floor, stop, and check that brake holds load.

5. Install gasket and brake cover.

6.6 Load Chain

6.6.1 General

CAUTION: A hoist SHALL NEVER be used if the load chain shows any evidence of mechanical damage or excessive wear. Never use the load chain as a sling. Use only original equipment chain as supplied by a factory authorized source. Improper load chain storage or installation can render the load chain unusable prior to the first lift.

6.6.2 Maintenance Inspection

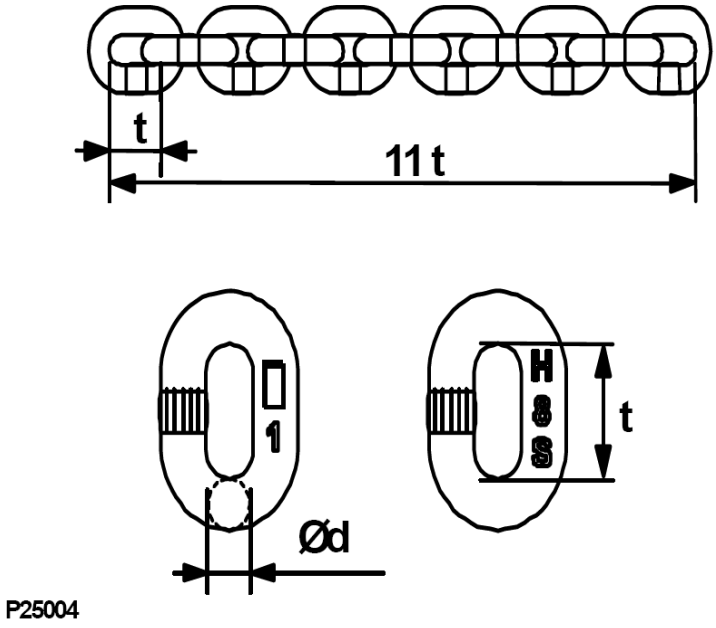
The hoist operator SHALL perform a visual inspection prior to first daily use. This inspection shall include the following:

1. Wear or cracks of the load chain links
2. Twisted or deformed load chain
3. Dirty or poor lubrication of load chain

A qualified person SHALL be designated to routinely conduct an in-depth inspection of load chain (See Section 7 – Preventative Maintenance for schedule recommendations). This designated person SHALL inspect load chain using good judgment in evaluating the remaining service life. Any deterioration of load chain resulting in appreciable loss of original strength SHALL be noted and evaluated.

An in-depth inspection SHALL include a written record that is dated and signed by the inspector.

Figure 10. Chain Dimensions



Measure the following chain dimensions at several points on chain: (see Figure 10)

- Dimensions of one link (d x t), where d = diameter and t = pitch
- Length over 11 links (11t)

Replace load chain if any one of these dimensions exceeds maximum allowed wear.

Maximum allowed wear:

Minimum link diameter allowed	(d):	0.142” [3.6 mm]
Maximum pitch allowed	(t):	0.496” [12.6 mm]
Maximum length allowed	(11t):	5.301” [134.64 mm]

NOTE: If load chain needs replaced, then inspect chain guide and chain (load) wheel on hoist and idler sprocket in 2-fall load hook assembly for excessive wear. A chain sprocket showing evidence of scored pockets or sharp edges generated from wear SHALL be replaced. A worn chain sprocket or idler sprocket can greatly reduce the life of load chain.

6.6.3 Load Chain Specifications (see Figure 10)

Chain use:	Load chain
Chain type:	Black Coated (Entertainment Industry Use)
Size: (d) diameter x (t) pitch:	0.157” x 0.472” [4.0 x 12.0 mm]
Cross-sectional area:	[15.1 mm^2]
Class:	T
Grade:	RT
Hardened surface:	380-400 HV [Vickers Hardness]
Standard:	EN 818-7
Marking (6 x t):	RT or T
Safe working load limit, 1-fall:	550 lbs. [250 kg]
Min. Breaking force:	4520 lbs [20.1 kN]
Minimum breaking stress:	116,030 lbs/in^2 [800 N/mm^2]
Weight per foot [meter]:	0.213 lbs/ft. [0.35 kg/M]

6.6.4 Removing the Load Chain

1-FALL CHAIN

1. Remove load from load hook assembly or hoist body hook if inverted.
2. Remove load hook assembly from load chain. Some disassembly of 1-fall load hook assembly is required.
3. Attach a 12” [300 mm] or longer zip tie to the end of the load hook assembly end of the chain.
4. Run hoist in “UP” direction until all of chain is in container.
5. Remove chain container with all of old chain in chain container.
6. Remove fall stop from old chain and save for use with new chain.

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6.6.5 Installing the Load Chain

Figure 11. Installing the Load Chain

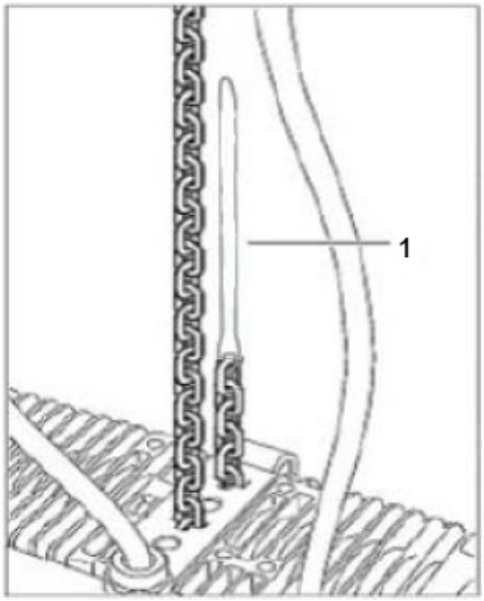
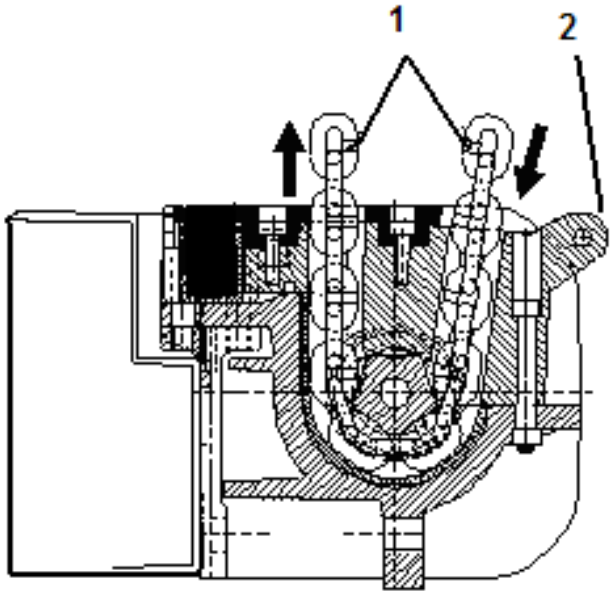


Figure 12. Chain Insertion



1-FALL CHAIN INSTALLATION

1. Attach a 12" [300 mm] or longer zip tie to the last link of the chain (item 1 - Figure 11).
2. Insert the zip tie into chain opening closest to the center of the hoist ("UP" direction) by slowly feeding it through the chain sprocket.
3. Ensure that the chain is laying correctly on the sprocket and chain guides, then, while holding the zip tie taut, continue to feed the chain through the sprocket until it emerges out the other side.

> ⚠ **CAUTION: Make sure the chain weld on chain link faces inward toward chain wheel pocket on hoist load sprocket.**

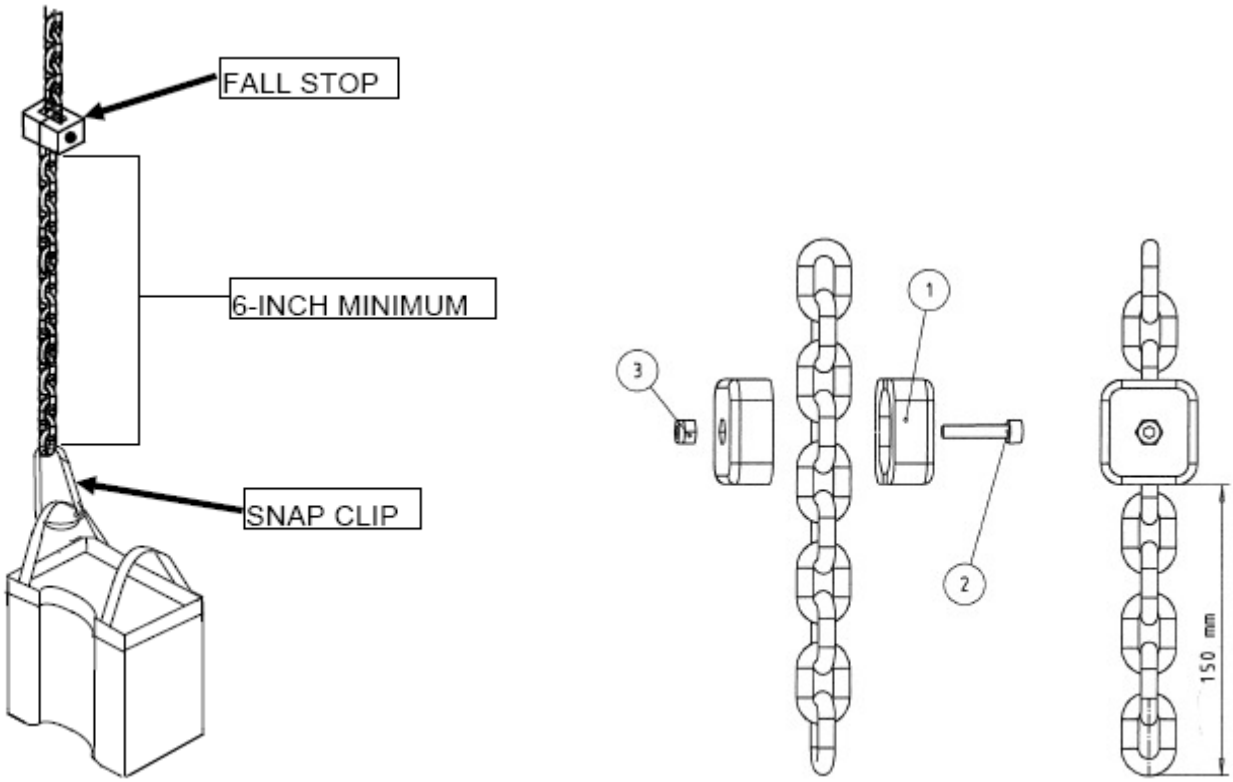
4. Run hoist "UP" to feed the rest of the chain through the sprocket and out other side.
5. Attach fall stop at least 6 inches [150 mm] from end of chain closest to the center of the hoist. Attach load block assembly on other end of load chain. Refer to Figure 13 for details.
6. Make sure that load chain is not twisted or deformed.
7. Attach chain container. Lubricate chain.

6.7 Fall Stop Assembly

6.7.1 General

The slack fall stop is a safety stop, not a functional stop. The fall stop must be located at least 6 inches [150 mm] from end of last chain link.

Figure 13. Fall Stop Assembly



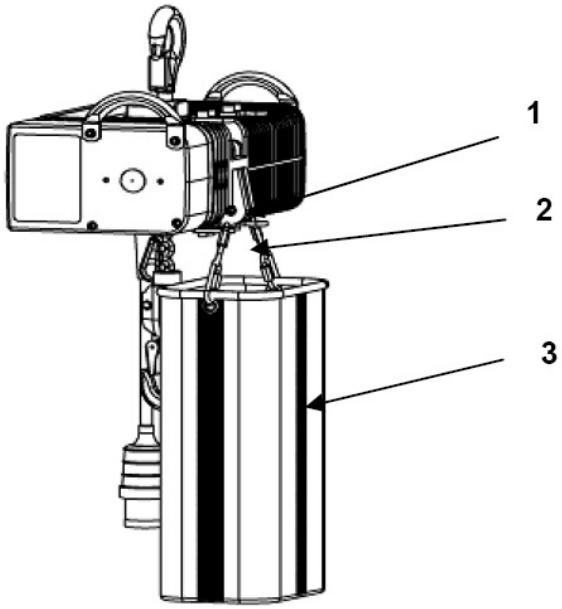
6.7.2 Fall Stop Installation

1. Position two fall stop halves (item 3 - Figure 13) on chain link at least 6 inches [150 mm] from end of load chain. Attach end of chain to chain container strap with snap clip provided.

2. Insert bolt (item 2) through two halves and attach nut (item 3). Tighten per section 7.4.

6.8 Chain Container

Figure 14. Chain Container Installation



Removing Chain Container

1. Run chain out of container until fall stop approaches hoist body.
2. Open threaded links (item 1).
3. Remove chain container by slipping handles of chain container from threaded links.

Installing Chain Container

1. Reverse the above process.
2. Slip handles into open threaded links.
3. Close and tighten threaded links.
4. Guide end of chain into chain container.
5. Run chain into chain container.

6.9 Brake Coil Specifications

Table 12. Brake Coil Specifications

MAIN VOLTAGE	COIL VOLTAGE	SM2
208 or 230	90 - 100 VDC	615 OHMS

6.10 SM2 Motor Data

Table 13. SM2 Motor Data

HOIST SPEED 60 HZ	POWER SUPPLY	START AMPS	NOM. AMPS	NO LOAD AMPS	FIELD OHMS	HOIST RPM	HP
16 FPM	115V / 1PH / 60HZ	5.31	3.45	3	7.15	1800	0.16

Table 14. SM2 Hoist and Chain Weight

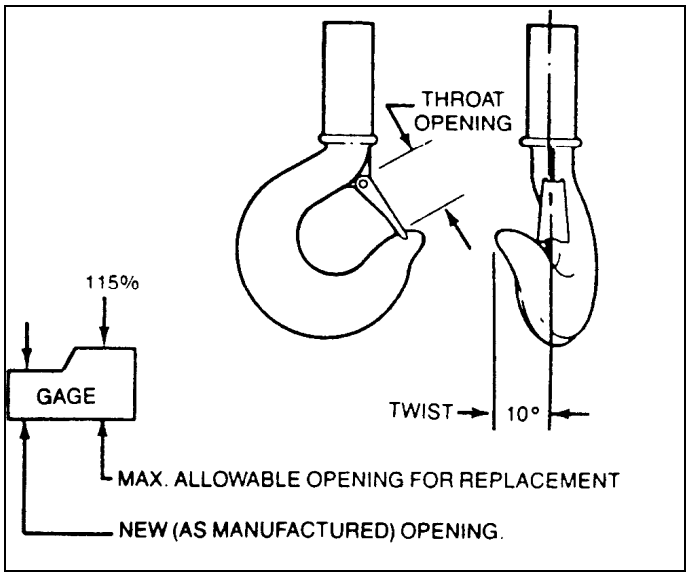
SM2 HOIST WEIGHT (WITHOUT CHAIN)	CHAIN WEIGHT
38 LBS (17kg)	0.213LBS / FT

6.11 Hooks

6.11.1 General

Check hooks for deformation or cracks. Hooks must be replaced if throat opening has increased by more than 15%, or if throat opening has more than 10-degree twist from plane of straight hook.

Figure 15. Measuring Hook Deformation



Due to many types and sizes of hooks that can be furnished and / or specified by the user / owner, it is recommended that the user / owner measure the actual throat opening of hook as originally furnished. See Figure 15. Record the throat dimension on above sketch. Retain as a permanent record. This record can then be used for determining when hook must be replaced due to deformation or excessive throat opening.

CAUTION: Abuse or overloading of hoist is indicated when any hook is twisted or has a throat opening in excess of normal. Other load bearing components SHALL be checked for damage.

CAUTION: Safety latches SHALL be replaced if missing, bent, or broken.

CAUTION: A safety latch SHALL function properly at all times.

CAUTION: Repairing hooks by welding or reshaping is strictly forbidden.

6.11.2 Inspection

Inspection for wear on body hook and load hook **SHALL** be checked routinely. Measure the throat opening (dimension-*a*2). If throat opening exceeds maximum opening allowed, replace hook. Damaged safety latches **SHALL** be replaced immediately.

Maximum throat opening allowed:

Hook Class:	012P load hook	top hook
Maximum opening allowed:	0.906” [23 mm]	0.906” [23 mm]

6.11.3 Hook Dimensions and Specifications

Figure 16. Hook Dimensions

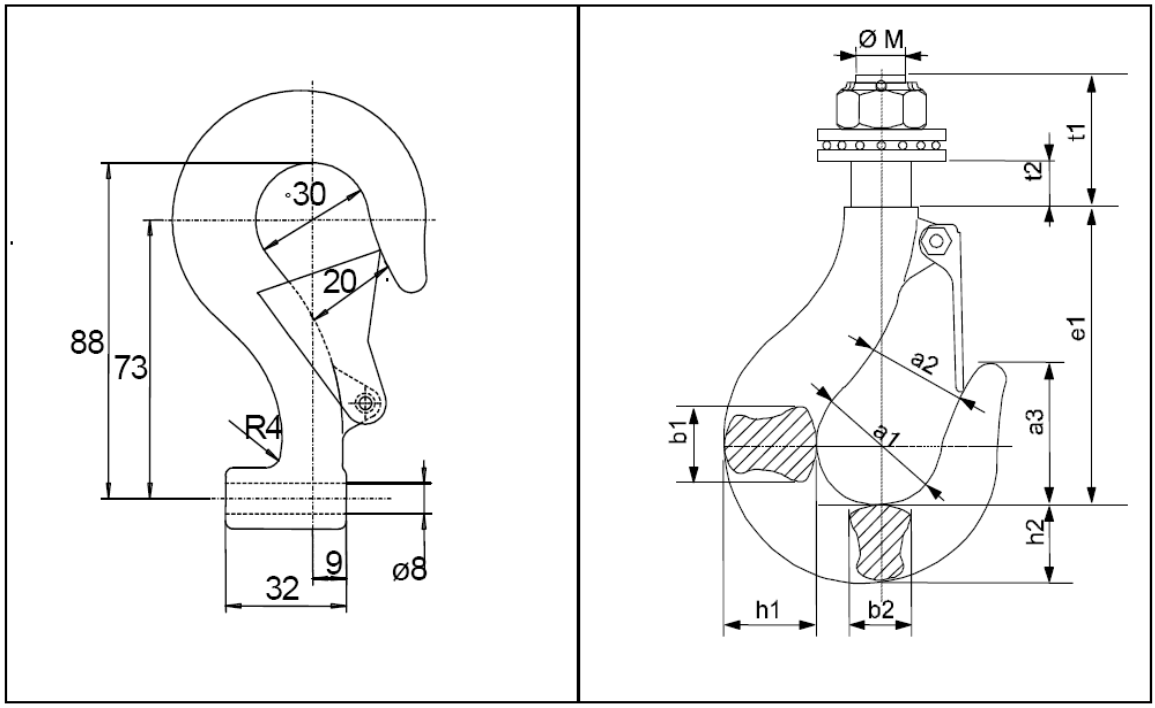


Table 15. Hook Specifications

SPECIFICATIONS				
CAP tons	**CAP kg**	**TEST kg**	**FALLS**	**HOOK CLASS**
1/4	250	1102	1	012P

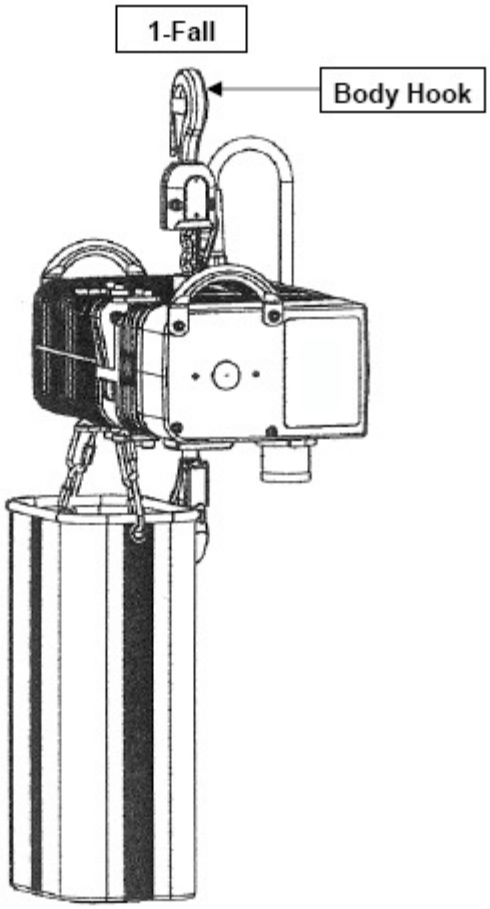
Table 16. Hook Dimensions

HOOK DIMENSIONS											
	Ø M	**Ø a1**	**a2**	**a3**	**b1**	**b2**	**e1**	**h1**	**h2**	**t1**	**t2**
Inches	0.551	1.181	0.787	1.339	0.748	0.591	3.268	0.866	0.748	1.260	0.394
mm	14	30	20	34	19	15	83	22	19	32	10

Standard: **DIN 15401**
Quality class: **T**
Material: **34CrMo4**
Re mini: **490 MPa**

6.11.4 Body Hook

Figure 17. Body Hook



CAUTION: Before removing body hook, de-energize the power to the hoist per ANSI Z244.1 and make certain that any load is removed from the load hook assembly. Also support the total weight of the hoist, including chain, prior to removing the body hook.

Removing Body Hook

1. Remove locking plate and pin.
2. Pull pin out and remove hook.

CAUTION: Proper installation of body hook is critical for hoist balance.

Installing Body Hook

1. Determine number of chain falls: 1-fall.
2. Select proper placement of body hook relative to number of chain falls:
   - If 1-fall, align body hook so that tip of hook faces toward chain container.
3. Place hook into the slot on hoist body. Verify that body hook saddle and load hook saddle are in line with each other. Install locking plate and pin.

7 PREVENTATIVE MAINTENANCE

7.1 Maintenance and Inspection Table

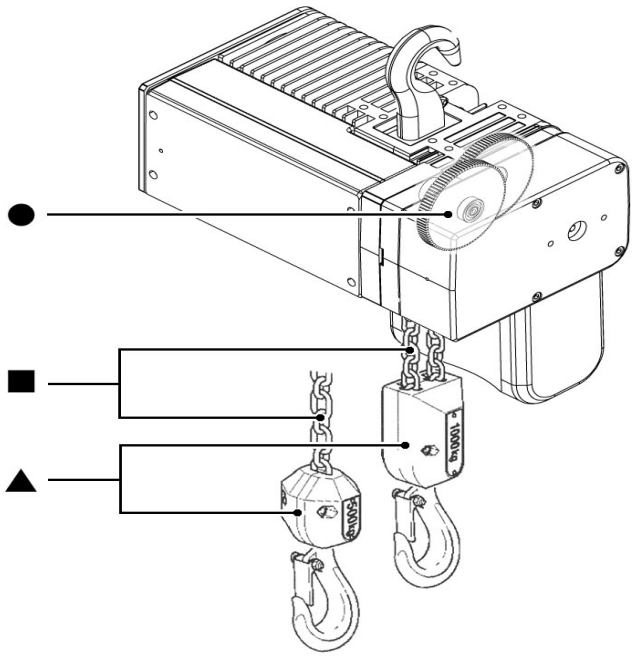
Table 17. Maintenance and Inspection Schedule

INSPECTION CHECK	INTERVAL	QUALIFIED PERSON
BRAKE OPERATION FOR HOLDING AND RELEASING	DAILY	OPERATOR
LOAD CHAIN FOR DAMAGE	DAILY	OPERATOR
POWER AND/OR CONTROL CABLE SUPPORTS	DAILY	OPERATOR
CLEANLINESS & LUBRICATION OF LOAD CHAIN	DAILY / MONTHLY	OPERATOR
UPPER / LOWER LIMIT SWITCHES	MONTHLY	OPERATOR
CHECK LOAD CHAIN FOR WEAR – MEASURE AND RECORD	QUARTERLY	INSPECTOR
CHECK HOOKS FOR WEAR MEASURE AND RECORD	QUARTERLY	INSPECTOR
CHECK LOAD HOOK ASSEMBLY HARDWARE TO VERIFY TIGHTNESS	QUARTERLY	OPERATOR
CHECK BODY HOOK / COUPLING HARDWARE FOR TIGHTNESS	QUARTERLY	OPERATOR
CHECK SLIP CLUTCH & HOIST BRAKE ADJUSTMENT	QUARTERLY	MAINTENANCE
CHECK LUBRICATION OF OPEN WHEEL GEARING	QUARTERLY	MAINTENANCE
CHECK WIRE TERMINALS TIGHTNESS	SEMI-ANNUALLY	MAINTENANCE
LUBRICATE 2-FALL LOAD HOOK ASSEMBLY SPROCKET	ANNUALLY	OPERATOR
CHECK ALL HARDWARE FOR TIGHTNESS AND CORROSION	ANNUALLY	MAINTENANCE
CLEAN MOTOR COOLING FINS	ANNUALLY	MAINTENANCE
CHECK LUBRICATION OF HOIST GEARING	ANNUALLY	MAINTENANCE
INSPECT LOAD HOOK THRUST BEARING	ANNUALLY	MAINTENANCE

CAUTION: Inspection and maintenance intervals should be adjusted based upon owner / user knowledge of application, environment, and frequency of use to prevent damage to people, equipment, and facilities.

7.2 Lubrication

Figure 18. Lubrication



OPEN WHEEL GEARING: MOBILUX EP1 OR EQUIVALENT

Table 18. Lubrication Specifications

LUBRICATION POINT / QTY	SPECIFICATIONS	POSSIBLE BRANDS
■ AS REQUIRED CHAIN	Oil or liquid grease	Chain lubricant (Ceplattyn or similar) EP-90 Aral: Aralub FK 2
▲ AS REQUIRED IDLER SPROCKET SLIDE BEARING & BEARING	GREASE (without MoS2) KP 2 (DIN 51 502) Soap-based lithium Temperature -4°F to 266°F OPERATING	BP Energrease LS - EP 2 ESSO Unirex N2 Mobil: obilgrease HP Shell: Alvanio EP Grease 2 DEA: Paragon EP 2 Fuchs: Renolit Duraplex EP 2
● 0.05 LITER GEARS	KP 0 K grease (DIN 51502) Soap-based lithium + MoS2 Temperature -30°C to 130°C	Mobil: MOBILITH SHC 460

7.2.1 Load Chain Cleaning and Lubrication

The frequency of cleaning and lubrication depends upon the application environment. Dirt and grit will reduce the life of the chain.

When cleaning, run all of the chain out of the chain container to clean the entire length of chain. Inspect the empty chain container and remove any dirt to prevent running a clean chain into a dirty container.

Generously, lubricate the entire length of chain with the above specified lubricant or equivalent. In the event that the chain gets wet, immediately inspect, clean, and lubricate the entire chain.

7.3 Recommended Technical Support for Various Spare Parts

Table 19. Recommended Technical Support for Various Spare Parts

SPARE PART	REPLACED BY
Upper chain guide	Qualified electrician & mechanic
Output shaft	Qualified electrician & mechanic
PG cable gland	Qualified electrician
Gear shaft + nuts	Qualified mechanic
Motor end cap	Qualified mechanic
Gearing (1st/2nd stage)	Qualified electrician & mechanic
Brake & end cap sealing	Qualified mechanic
Other seals and O-rings	Qualified mechanic
Brake-limiter	Qualified electrician
Brake end cap	Qualified mechanic
Lower chain guide	Qualified mechanic
Rubber buffer	Qualified mechanic
Electric box	Qualified electrician
PC-board	Qualified electrician
Plugs	Qualified electrician
Chain	Qualified mechanic
Chain container	Qualified mechanic
Slack fall stop	Qualified mechanic
Body hook	Qualified mechanic
Load hook assembly	Qualified mechanic
Control box	Qualified electrician

NOTE: Once a part has been replaced, perform an operational check of hoist per sections 4.3 and 4.4.

7.4 Torque (lb-ft) Specifications for fasteners

Table 20. Torque Specifications (lb-ft)

	M5	M6	M8	M10	M12
STANDARD SCREWS	4	7	18	35	61
SELF-TAPPING SCREWS	4	6	15	30	53

7.5 Troubleshooting

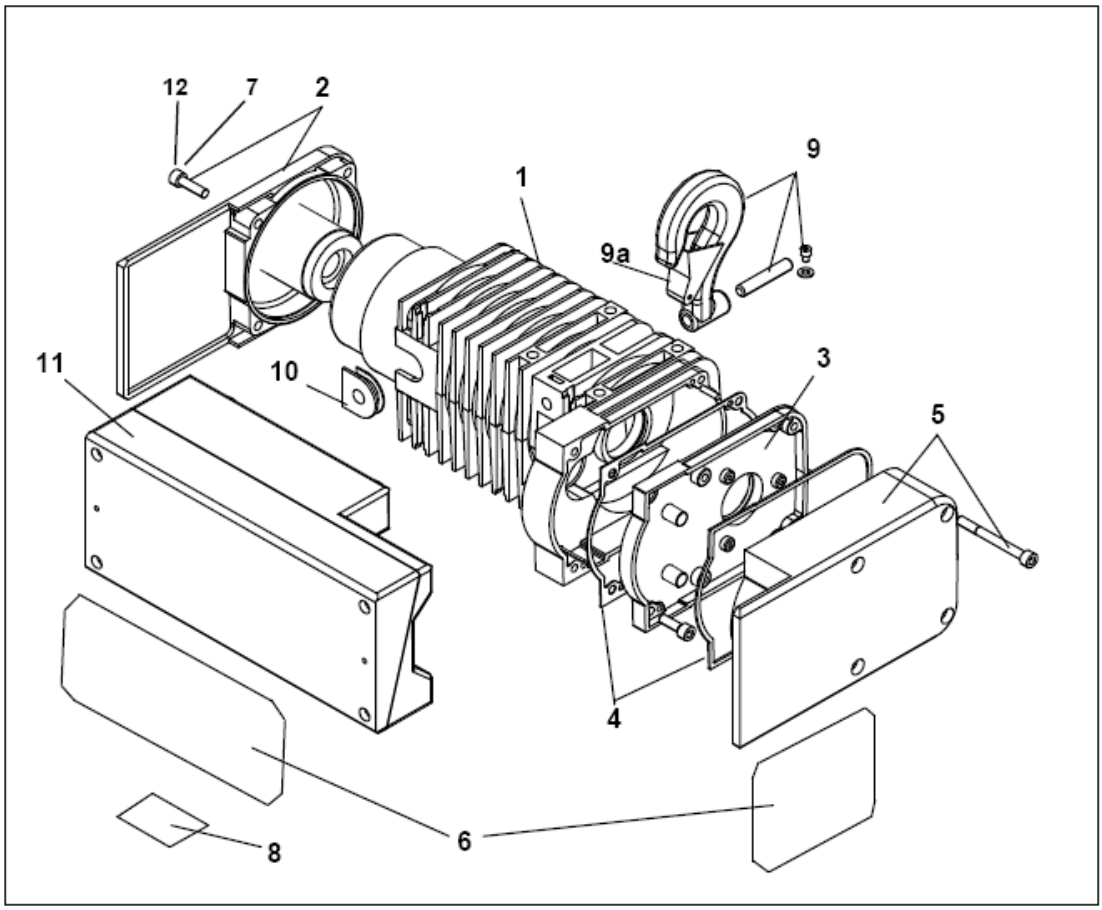
Table 21. Troubleshooting

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTION
Hoist does not lift or lower	Blown fuse	Replace the fuse
	Motor thermal protection activated	Allow motor to cool down
	Contactor terminal screws loose	Tighten screws
	Mainline switch shut off	Turn switch on
Hoist does not lift load	Overload condition	Reduce load
	Slip clutch worn or incorrectly adjusted	Replace wear items or re-adjust slip clutch torque
	Brake not releasing	Check brake coil resistance. Check air gap setting. Adjust if necessary. Check rectifier output voltage.
Load drifts more than 4 inches [100 mm]	Brake lining worn Air gap on brake is too wide	Replace wear items as necessary Adjust air gap setting
Travel direction does not correspond to that indicated on push button	Power supply incorrectly connected	See section 4
Abnormal noises while lifting or lowering	Load chain and its components are not lubricated	Clean and lubricate load chain.
	Load chain is worn	Replace chain
	Chain wheel or chain guide is worn	Replace chain wheel or chain guide
	Idler sprocket is worn	Replace idler sprocket
	A supply phase is missing	Connect the three phases
	Twist or kink in load chain	Remove twist or kink

8 PARTS ILLUSTRATION

8.1 Hoist Body (Normal position shown)

Figure 19. Hoist Body (Normal Position)



NOTE: FLEXIBLE HANDLES NOT SHOWN – SEE FOLLOWING PARTS LIST

Table 22. Hoist Body Parts List

ITEM	PART NUMBER	DESCRIPTION	QTY
---	52387024	2-SPEED BODY ASSY – CONF. A 208 / 230V – 3 PHASE	1
---	52393314	2-SPEED BODY ASSY – CONF. B 208 / 230V – 3 PHASE	
1	N/A	MACHINED HOIST BODY WITH STATOR	1
2	2218055	MOTOR END CAP ASSEMBLY	1
3	2218057	GEAR COVER SET	1
4	2218058	GASKET SET	1
5	2218056	BRAKE COVER SET	1
6	52319644	SM2 BRANDING STICKER SET – 3 PCS	1
7	2213547001	CLAMP (NOT SHOWN)	1
8	2213309001	BODY CAPACITY STICKER - 1/4 TON	1
8	2213309007	BODY CAPACITY STICKER – 250 KG	1
9	2218060	BODY HOOK ASSEMBLY	1
9a	2212016	SAFETY LATCH ASSEMBLY – STEEL PLATE TYPE	1
10	2218004	WIRE GROMMET	1
11	(Section 8.4)	ELECTRICAL ENCLOSURE	1
-	2257018	FLEXIBLE HANDLE (OPTIONAL NOT SHOWN)	2
-	2213445002	ELECTRICAL HAZARD WARNING SIGN	1
-	2213445001	ELECTRICAL WIRING INFORMATION LABEL	1
12	2213547002	RING (NOT SHOWN)	1

8.2 Gear Mechanism & Brake

Figure 20. Gear Mechanism / Brake

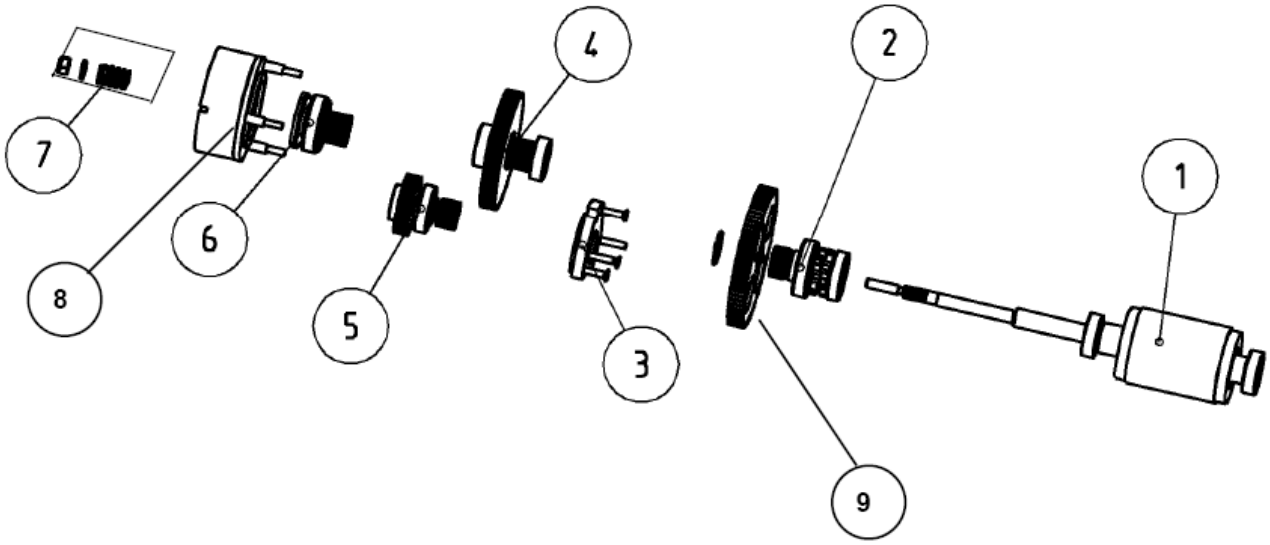


Table 23. Gear Mechanism and Brake Parts List

ITEM	PART NUMBER	DESCRIPTION	QTY
1	52328299	ROTOR ASSEMBLY	1
2	52328297	CHAIN SPROCKET ASSEMBLY	1
3	52328280	CAP	1
4	52328298	COMPLETE GEAR 2ND STEP	1
5	52328308	COMPLETE GEAR 1ST STEP	1
6	52330765	FRICTION DISC ASSEMBLY FOR SLIPPING CLUTCH	1
7	2218044	SLIPPING CLUTCH SPRING ASSEMBLY	1
8	2218030	COMPLETE BRAKE 190V/400V	1
8	2218031	COMPLETE BRAKE 100V/230V	1
9	52253278	COMPLETE GEAR 3RD STEP	1

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8.3 Lifting Assembly

Figure 21. Lifting Assembly

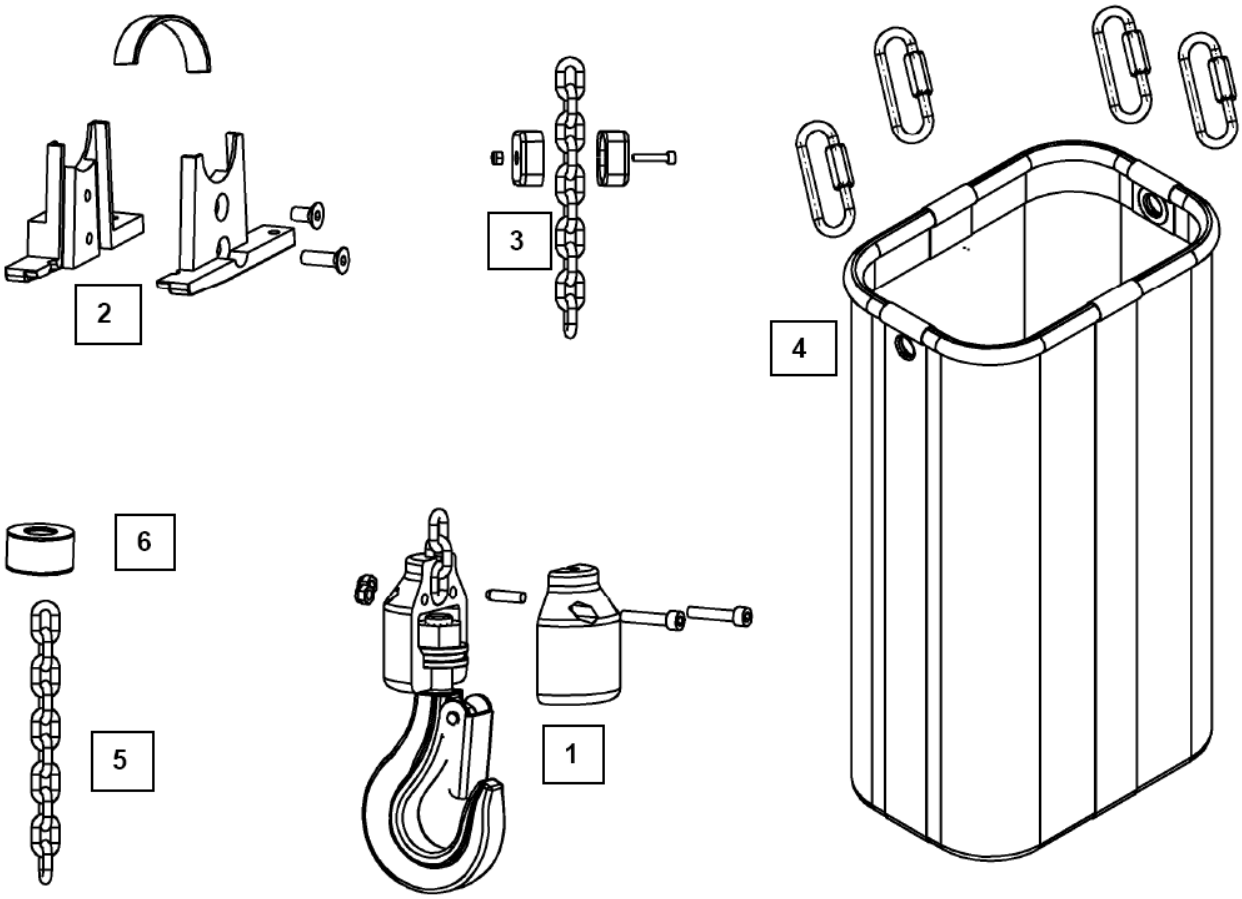

Figure 22. Lifting Assembly Parts List

ITEM	PART NUMBER	DESCRIPTION	QTY
1	52328303	1-FALL LIFTING HOOK BLOCK	1
1	001512	1-FALL WIRE HOOK LATCH	1
1	2212016	1-FALL PLATE HOOK LATCH	1
1	2212011	LIFTING HOOK AND BOTTOM BLOCK	1
2	52330761	UPPER AND LOWER CHAIN GUIDE ASSEMBLY	1
3	52328304	SLACK FALL STOP ASSEMBLY	1
4	52333407	CHAIN CONTAINER - 20m CHAIN LENGTH CAPACITY	1
5	52328290	LOAD CHAIN – BLACK	-
6	52328580	RUBBER BUFFER	2
	9995008	LOAD CHAIN LUBRICANT	1

8.4 Control Panel Assembly – Configuration A

Figure 23. Control Panel Assembly – Configuration A

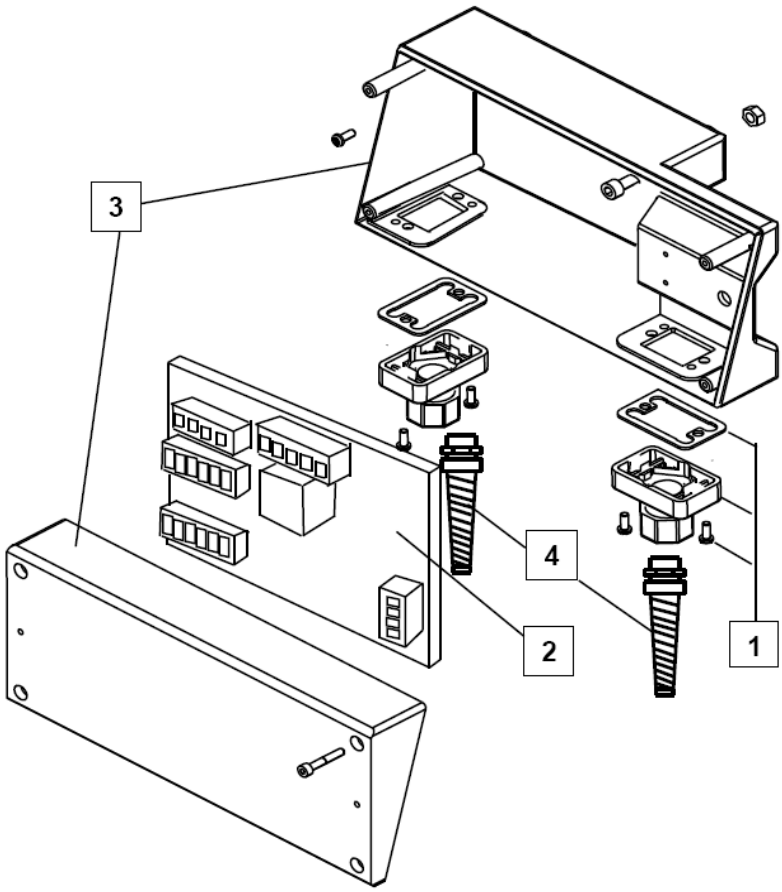

Table 24. Control Panel Assembly – Configuration A - Parts List

ITEM	PART NUMBER	DESCRIPTION	QTY
1	2249947	CABLE GLAND SET	2
2	834176	AFC BRAKE CONTROL CARD (208V / 230V)	1
3	52328295	SM2 ELECTRICAL ENCLOSURE SET (BASE & COVER)	1
4	52283994	FLEXIBLE CABLE PROTECTOR	2

8.5 Control Panel Assembly – Configuration B

Figure 24. Control Panel Assembly – Configuration B

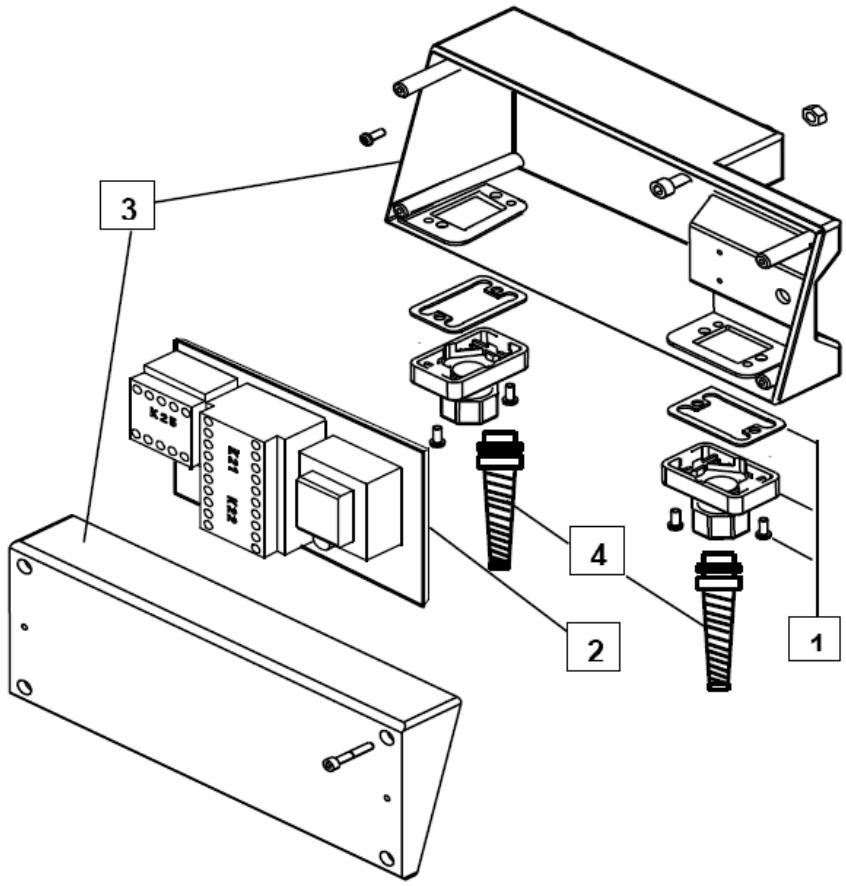

Table 25. Control Panel Assembly – Configuration B – Parts List

ITEM	PART NUMBER	DESCRIPTION	QTY PER
1	2249947	CABLE GLAND SET	2
2	52283268	PC BOARD 208 or 230VAC – TWO SPEED (115V CONTROL VOLTAGE)	1
3	52328295	ELECTRICAL ENCLOSURE SET – BASE & COVER	1
4	52283994	FLEXIBLE CABLE PROTECTOR	2
--	52314754	CONTROL CIRCUIT FUSES – 115V CONTROL VOLTAGE – SET OF 10	1

8.6 SM2 Pigtail Connectors

Table 26. SM2 Pigtail Connectors

PIGTAILS		CONNECTOR PART NUMBERS		
CONF.	TYPE CONNECTOR	POWER ONLY CONNECTOR	CONTROL ONLY CONNECTOR	POWER & CONTROL CONNECTOR
A	CE STYLE 3P + G	2213428001	--------	--------
A	NEMA L16 – 20P 3P + G	2213428017	--------	--------
B	NEMA L16 – 20P 3P + G	2213428017	--------	--------
B	NEMA L14 – 20R 3P + G	--------	2213428014	--------
B	SOCAPEX 7 PIN MALE PLUG	--------	--------	2213428015
B	P14	--------	--------	2309888001

8.7 Pickle Assembly

Figure 25. Pickle Assembly

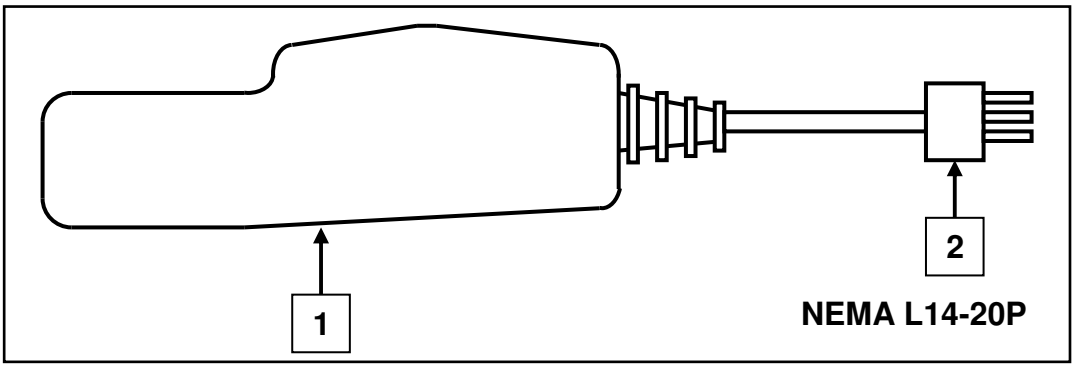

Table 27. Pickle Assembly Parts List

ITEM	PART NUMBER	DESCRIPTION
-	2309772102	COMPLETE ASSEMBLY – 18 INCH PIGTAIL WITH PLUG
1	2212932060	"PICKLE" - SINGLE UP AND DOWN PUSHBUTTON
2	2213428013	NEMA L14 - 20P MALE PLUG – TWIST LOCK

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