BENSHAW®
ADVANCED CONTROLS & DRIVES
A member of UNICO Technologies Group

IN STOCK GUARANTEED!

Medium Voltage Quick Ship Solid State Starters

Medium Voltage Controls

Mission-Critical Motor Control and Protection

With next generation, patented MX³ technology.

- Mission-critical reliability
- Patented soft start technology
- Integrated electronic protection
- Expanded I/O and communications
- Real-time metering/diagnostics
- Switched capacitance systems
- Global standards compliance
- 24/7 service and support

World leader in mission-critical motor control and protection

- 6 million HP installed worldwide
- 5,000+ units installed in over 40 countries

Prepackaged and engineered control solutions

- Induction, two-speed, synchronous, reversing or wound rotor control
- 5 kV, 7.2 kV or 15 kV to 30,000 HP
- 3, 10 or 20 mW class power electronics
- Intelligent control centers and lineups
- Retrofits and turnkey modernization solutions

Since introducing the world's first medium voltage solid state starter back in 1989, Benshaw has gained valuable experience in the design, production and installation of high-performance, mission-critical motor controls for heavy-duty continuous process applications.

We've tackled some of the toughest challenges—in the harshest environments imaginable—for the most demanding industries on earth, and that experience is reflected in every product we build.

That's why—when the application is critical, or the environment harsh—customers specify Benshaw.

Download the RediStart™ Solid State Starter MX³ Control User Manual:
http://www.benshaw.com/Support/Downloads/

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2017 Information Package

MVRXE Series

The upgraded/enhanced design of Benshaw's legacy product that established industry standards for performance and reliability

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c UL us LISTED

Emergency ATL Bypass, Severe Duty, Load Break Fusible Disconnect

Key Advantages:

- NEMA 12, UL 347 listed
- 45 kV BIL
- Built-in self test (BIST) features for "quick commissioning"
- 425 A load break
- Switch-selectable emergency back-up full voltage starter
- MX³-embedded digital control

Standard Features:

- 200 MVA (2300 VAC) / 350 MVA (4160 VAC) short circuit fault rated
- 500%–30 seconds rated solid state starter — UL 347 certified and listed
- "R" class fusing protection
- Door-mounted controls
- ModBus communications standards

MVRXE18 — 4160 V

Model Number	HP	A	Dimensions (in.) H	W	D	Weight (lbs.)
MVRXE18-1000-4160**	1000	133	92	36	32	2,000
MVRXE18-1500-4160**	1500	200	92	36	32	2,000
MVRXE18-3000-4160**	3000	330	92	36	32	2,000

Starters are top entry / bottom exit — top exit available upon request. Dimensions and weights are approximate.

** Insert appropriate option code as shown: NEMA 12 = 12 / NEMA 3R = 3R

Modular Options

Model Number	Description
A406	8-Channel RTD Module, 100 ohm Platinum (Also Available for Remote Mounting)
A407	16-Channel RTD Module(s), 100 ohm Platinum (Also Available for Remote Mounting)
A875	Ground Fault CT, 2000:1, 4.0:Dia. (For MX³ Use)
A876	Ground Fault CT, 2000:1, 8.13:Dia. (For MX³ Use)

2300V options available.

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Spare Part Kits

Want to minimize downtime loss of production?

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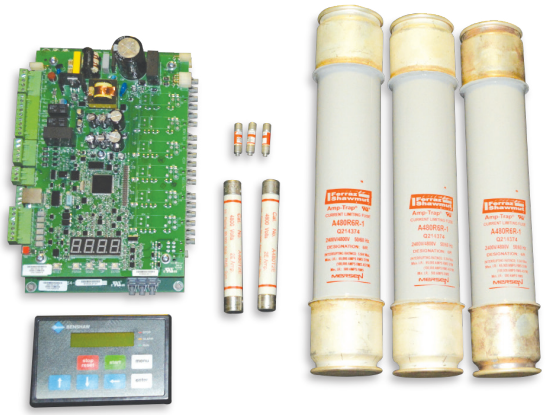
Take advantage of Benshaw's special pricing on our new spare parts kit packages when purchased with a MVRXE and/or BTO starter.

Recommended Spare Parts Kits Include the Following:

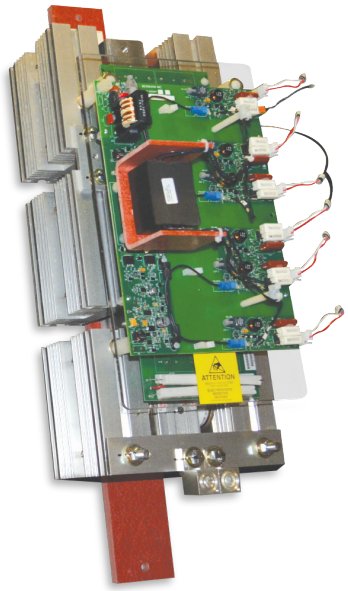
- Power phase/stack assembly (x1)
- Includes the following packaged heat sink assembly:
  - Fiber optic SCR firing card
  - SCRs (x6)
  - DVDT filter cards (x3)
- Main control board
- Voltage divider board
- "R" class line fuses (x3)
- Primary fuses for CPT (x2)
- Secondary fuses for CPT (x3)
- Door-mounted keypad
- Door-mounted pilot lights, pushbuttons and switches
- Overload relay
- Control relays



1,000 HP Starters and 1,500 HP Starters

Model Number	Motor AMPS
MVRXE-400101-SP	46 to 55A
MVRXE-400102-SP	56 to 75A
MVRXE-400103-SP	76 to 90A
MVRXE-400104-SP	91 to 133A
MVRXE-400105-SP	134 to 180A
MVRXE-400106-SP	181 to 220A
3.000 HP Starters	
MVRXE-400107-SP	46 to 55A
MVRXE-400108-SP	56 to 75A
MVRXE-400109-SP	76 to 90A
MVRXE-400110-SP	91 to 133A
MVRXE-400111-SP	134 to 180A
MVRXE-400112-SP	181 to 270A
MVRXE-400113-SP	271 to 361A

*Amp range not shown; consult factory.



Design your customized starter to ship in 1 week or less

Only one option can be selected from each group, with the exception of the "Control Options" section.

Add the appropriate code for the options chosen to the code string across the center of the page.

Choose Enclosure Options	
12	NEMA 12
SH	NEMA 12 with space heater
3R	NEMA 3R with space heater

A	B	C				
MVB43	225	B	12	S	G	1N

0 to 1,500 HP

A Choose Core Unit	B Choose Motor Current (A)**	C Choose Exit/Landing Option***
MVB41	025	T
MVB41	025	B
MVB41	025	C
MVB41	045	T
MVB41	045	B
MVB41	045	C
MVB41	055	T
MVB41	055	B
MVB41	055	C
MVB41	080	T
MVB41	080	B
MVB41	080	C
MVB41	090	T
MVB41	090	B
MVB41	090	C
MVB41	133	T
MVB41	133	B
MVB41	133	C
MVB41	170	T
MVB41	170	B
MVB41	170	C

1,501 to 3,000 HP

A Choose Core Unit	B Choose Motor Current (A)**	C Choose Exit/Landing Option***
MVB43	025	T
MVB43	025	B
MVB43	025	C
MVB43	045	T
MVB43	045	B
MVB43	045	C
MVB43	055	T
MVB43	055	B
MVB43	055	C
MVB43	080	T
MVB43	080	B
MVB43	080	C
MVB43	090	T
MVB43	090	B
MVB43	090	C
MVB43	133	T
MVB43	133	B
MVB43	133	C
MVB43	170	T
MVB43	170	B
MVB43	170	C
MVB43	225	T
MVB43	225	B
MVB43	225	C
MVB43	330	T
MVB43	330	B
MVB43	330	C
MVB43	360	T
MVB43	360	B
MVB43	360	C

***Exit / Landing Options	
T	Top exit with landing pad
B	Bottom exit with landing pad
C	Top or bottom exit landing on bypass contactor

Choose Service Entrance Rated
(for stand-alone single units)

S	Yes
N	No

Choose Bus Options+	
8N	800 A non-insulated bus
8I	800 A insulated bus
1N	1,200 A non-insulated bus
1I	1,200 A insulated bus
2N	2,000 A non-insulated bus
2I	2,000 A insulated bus
NR	None required

+Bus not required for single stand-alone unit.

Bus is required for connection of 2 or more units.

Any unit with bus will require additional MLO section. Please contact the factory for pricing and delivery.

Choose Option Zero Sequence Ground Fault CT 2000:1
(Residual included)

G	Yes
N	No

Choose Communications Options
(RS-485 Modbus RTU standard)

D	DeviceNet
E	Ethernet
P	Profibus
N	None

			D	E	F	G	H	I			
1N	D	2	N	B	N	N	E	E			

Choose RTD Options
(100 ohm platinum)

2	8-channel RTD
4	16-channel RTD
N	None

Choose Control Options —
Choose one option for each item below

D	A	ATL option*	D	N	None
E	B	Green start push button and red stop extended push button*	E	N	None
F	C	Red run light and green stop light	F	N	None
G	D	Amber fault light and black reset push button	G	N	None
H	E	Local-off-remote 3-position switch	H	N	None
I	F	Emergency stop push button	I	N	None

* ATL option comes with start and stop push buttons (i.e., start stop push buttons cannot be selected).

No selection = keypad control.
Recommend E-stop option be selected.

Choose Bus Splice Options
(must match bus option selected)

8N	800 A non-insulated bus splice
8I	800 A insulated bus splice
1N	1,200 A non-insulated bus splice
1I	1,200 A insulated bus splice
2N	2,000 A non-insulated bus splice
2I	2,000 A insulated bus splice
NR	None required

****Motor currents vs. HP are typical; confirm actual motor current. Service factor not accounted for; adjust if required.**

Example: A 3,000 HP (**MVB43**), 225 A (**225**) unit with the following options: bottom exit w/landing pad (B), NEMA 12 enclosure (**12**), service entrance rated (**S**), with ground fault (**G**), 1,200 A non-insulated bus (**1N**), 1,200 A non-insulated bus splice (**1N**), with DeviceNet (**D**), 8-channel RTD (**2**), without ATL option (**N**), with start and stop buttons (**B**), without run and stop lights (**N**), without fault and reset lights (**N**), with a local-off-remote switch (**E**), with emergency stop push button (**F**), would build the following code string: **MVB43225B12SG1N1ND2NBNNEF**

Need help sizing your Soft Starter?

Soft Starter sizing guide available on **benshaw.com**, or call an Application Engineer at 412-968-0100.

Standard MX³ Control Features

Multiple Starting Modes:

- Voltage ramp
- Current ramp
  - Adjustable initial current
  - Adjustable maximum current
  - Adjustable ramp time
- Torque ramp (TruTorque)
  - Adjustable initial torque
  - Adjustable maximum torque
  - Adjustable ramp time
- Power ramp
  - Adjustable initial torque
  - Adjustable maximum torque
  - Adjustable ramp time
- Linear / tach feedback control

Fiber Optic SCR Firing

- Integrated technology
- Noise immunity
- High voltage isolation
- Safe, reliable SCR control

Keypad (Included)

Motor Protection:

- Motor thermal overload
- Independent starting and running OLs
- Up to speed timer exceeded
- Low line voltage
- Low line frequency
- High line frequency
- Phase reversal
- Phase loss
- Instantaneous overcurrent
- Overcurrent
- Undercurrent
- Current imbalance
- Ground fault (residual or zero sequence)
- Shorted or open SCR
- Disconnect fault
- Inline contactor fault
- Control power low
- Stack over temperature
- Motor PTC input
- RTD modules

Metering:

- Accuracy:
  - 3% out-of-box
  - 2% factory calibrated
- Average current
- L1 current
- L2 current
- L3 current
- Current imbalance %
- Ground fault current
- Average volts
- L1–L2 voltage
- L2–L3 voltage
- L3–L1 voltage
- Overload %
- Power factor
- Watts
- VA
- VARS
- kW hours
- MW hours
- Phase order
- Line frequency
- Analog input
- Analog output
- Run time — days
- Run time — hours
- # of starts
- Tru Torque %
- Power %
- Peak starting current
- Last starting duration
- RTD temperatures
- Real-time clock

8 Digital Inputs Configurable to:

- Stop
- Fault
- Fault reset
- Bypass / inline confirm
- OL reset
- Local / remote selection
- Heater enable
- Heater disable
- Dual ramp selection
- 1 dedicated start input
- Disconnect
- Slow speed
- Brake enable
- Brake disable

6 Relay Outputs Configurable to:

- Faulted
- Running
- Up to speed
- Alarm condition
- Ready condition
- Locked out
- Over current
- Under current
- OL alarm
- Shunt trip
- Ground fault
- Energy saver indication
- Heating indication
- Cooling fan

1 Analog 4 – 20 mA 0 – 10 VDC Input Configurable to:

- Trip high level
- Trip low level

1 Analog 4 – 20 mA / 0 – 10 VDC Output Configurable to:

- Current (0–200%/0–800%)
- Voltage (0–150%)
- OL (0–150%)
- kW (0–10 kW/0–100 kW)
- MW (0–1 MW)
- Analog input (0–100%)
- Firing (0–100%)
- Calibration

User Interface:

- Event log (99 events)
- Door-mounted LCD display
  - Set / examine operating parameters
  - View status information, line current, voltage and frequency
  - Start and stop the solid state starter

1 Communication Port:

- Modbus / RS485

Advanced Functionality:

- Dual ramp selection
- Adjustable kick current
- Programmable decel modes
- MV BIST test (built-in self test)

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Medium voltage Starter Order Check List

For additional customized MVSS solutions to satisfy any application

Medium Voltage Check List to assist in the engineering process of providing a properly manufactured Solid State Starter, which will meet customer specific requirements. Complete each section as this will ensure a timely and accurate response.

Project Name and/or End-User _____

Contact Name _____

Email _____

Phone Number _____

SECTION A — Starter Application

Type of Application	_____				
Present Starting Method:	☐ Across the Line	☐ Wye-Delta	☐ Auto Transformer	☐ Other: _____	
Starts / Stops per Day:	☐ 1–5	☐ 6–10	☐ 11–15	☐ 16–20	☐ Over 20 (please specify) _____
Current Acceleration Time	☐ 1–5 seconds	☐ 6–10 seconds	☐ 11–15 seconds	☐ 16–20 seconds	☐ >20 seconds (please specify) _____
Current Deceleration Time (if applicable)	☐ 1–5 seconds	☐ 6–10 seconds	☐ 11–15 seconds	☐ 16–20 seconds	☐ >20 seconds (please specify) _____
Power Source	☐ Utility (Transformer feed capacity – kVA) (please specify) _____				
	☐ Short Circuit MVA (I) (please specify) _____				
	☐ Delta	☐ Wye (please specify)			
	☐ 3 wire	☐ 4 wire			
	☐ Delta, Corner Grounded				
	☐ High Resistance Ground	☐ Solid Ground	☐ Ungrounded		
	☐ Generator (Generator kW rating) (please specify) _____				
Distance from Line to Starter:	☐ < 250 ft.	☐ 251–500 ft.	☐ 501–750 ft.	☐ > 750 ft. (please specify) _____	
Conductor Type:	☐ Shielded	☐ Non-Shielded			
Distance from Starter to Motor:	☐ < 250 ft.	☐ 251–500 ft.	☐ 501–750 ft.	☐ > 750 ft. (please specify) _____	
Size and Quantity of Conductors:	☐ Line Side Size:	_____	☐ Line Side Quantity:	_____/Phase	
	☐ Load Side Size:	_____	☐ Load Side Quantity:	_____/Phase	

Medium Voltage Starter Order Check List

Continued

SECTION B — Motor Data

Type of Motor:	☐ Induction	☐ Synchronous	☐ Wound Rotor		
Horsepower:	_____ (If Synchronous or Wound Rotor, see Section "E" or "F" for additional questions.)				
Motor Voltage:	☐ 2300	☐ 4160	☐ 6900	☐ 13,800	☐ Other: (please specify) _____
Frequency:	☐ 25 Hz	☐ 50 Hz	☐ 60 Hz	☐ Other: (please specify) _____	
NEMA Design:	☐ "A"	☐ "B"	☐ "C"	☐ "D"	☐ "E"
FLA: _____	Service Factor: ____	Motor LRA: _____	Motor Speed (rpm): _____		

SECTION C — Enclosure / Environment Data

Expected Ambient Temperature:	Minimum: _____ (Space Heater required if less than 0˚ C)		Maximum: _____		
Space heater:	☐ Yes	☐ No	Physical Location:	☐ Indoor	☐ Outdoor
Size Limitation:	_____" High	_____" Wide	_____" Deep	(please indicate dimensions)	
Altitude:	☐ up to 3,300 ft.	☐ above 3,300 ft. (please specify) _____			
Excessive Vibration and/or Noise:	☐ Vibration	☐ Noise	☐ Neither		
Color:	☐ ANSI 61 Grey (standard)	☐ Beige	☐ Other: (please specify) _____		
Cable Entry Location:	☐ Top (option)	☐ Bottom (standard)	Cable Exit Location:	☐ Top (standard)	☐ Bottom (option)
Horizontal Bus:	☐ None (standard)	☐ 800 Amp	☐ 1200 Amp	☐ 2000 Amp	☐ Other: (please specify) _____
Insulation on Bus:	☐ Yes (price adder)	☐ No (standard)			
UL Rating (NEMA Type):	☐ 1	☐ 3R	☐ 12 (standard)	☐ Other: (please specify) _____	

SECTION D — Miscellaneous

Disconnect:	☐ Fusible Disconnect		☐ None	
Starting Method:	☐ Keypad (standard)	☐ 2-Wire Control	☐ 3-Wire Control	☐ Other: (please specify) _____
Across-the-Line Starting Option:	☐ Yes	☐ No (standard)		
Will any of the following be present?:	☐ Power Factor Correction Capacitors Note: PFCC must be located on the line side of the starter and must be isolated from the line during starting.		☐ Lightning Arrestors Note: May be placed on either the line or load side of the starter.	☐ Surge Capacitors Note: Must be at the motor terminals and must be isolated during starting to prevent damage.

Medium Voltage Starter Order Check List

SECTION E — Synchronous Motor Data:

Normal Field Current: (ADC)	_____	Max. Field Current: (ADC)	_____
Field Discharge Resistor Rating:	_____	Synchronous Motor Field Voltage: (VDC)	_____

SECTION F — Wound Rotor Motor Data:

Wound Rotor Motor:	☐ Starting Duty Resistor		☐ Continuous Running Duty Resistor
Quantity of Steps/ Resistance:	_____	Present Number of Steps:	_____
Secondary Voltage: (VAC)	_____	Secondary Current: (Amps)	_____

SECTION G — Additional Modifications, Accessories and/or Information:

_____

_____

_____

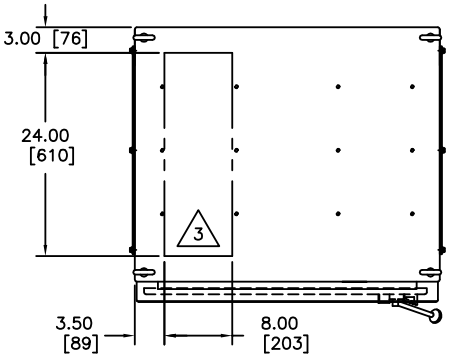
_____

Customer's Signature _____

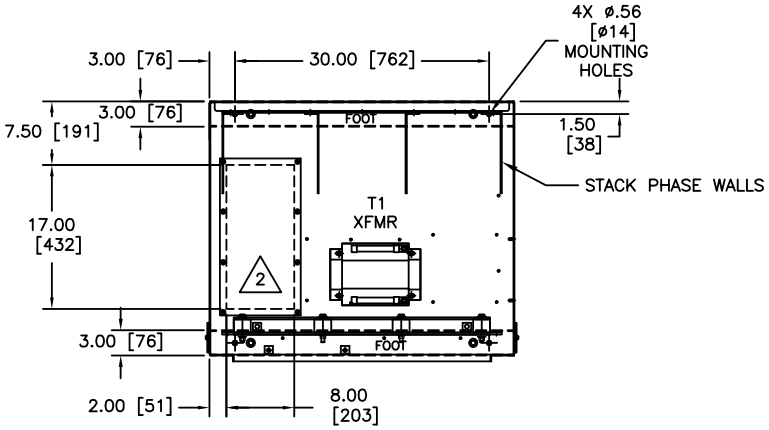
Customer's Company _____

Date _____

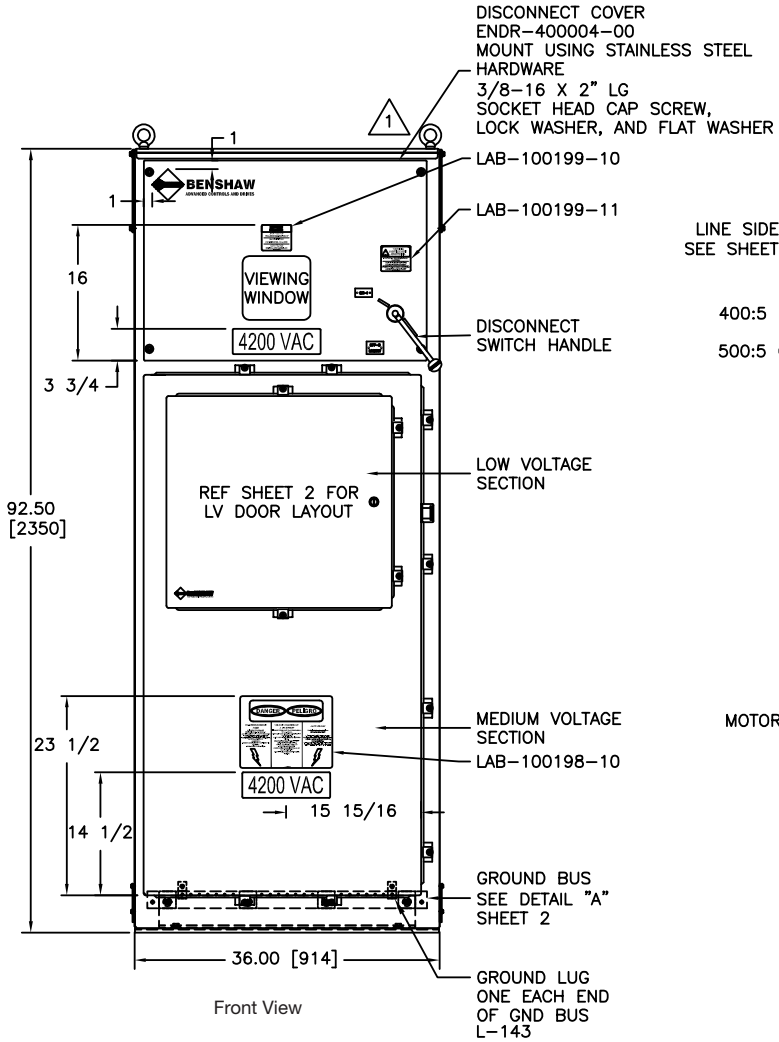
Drawings



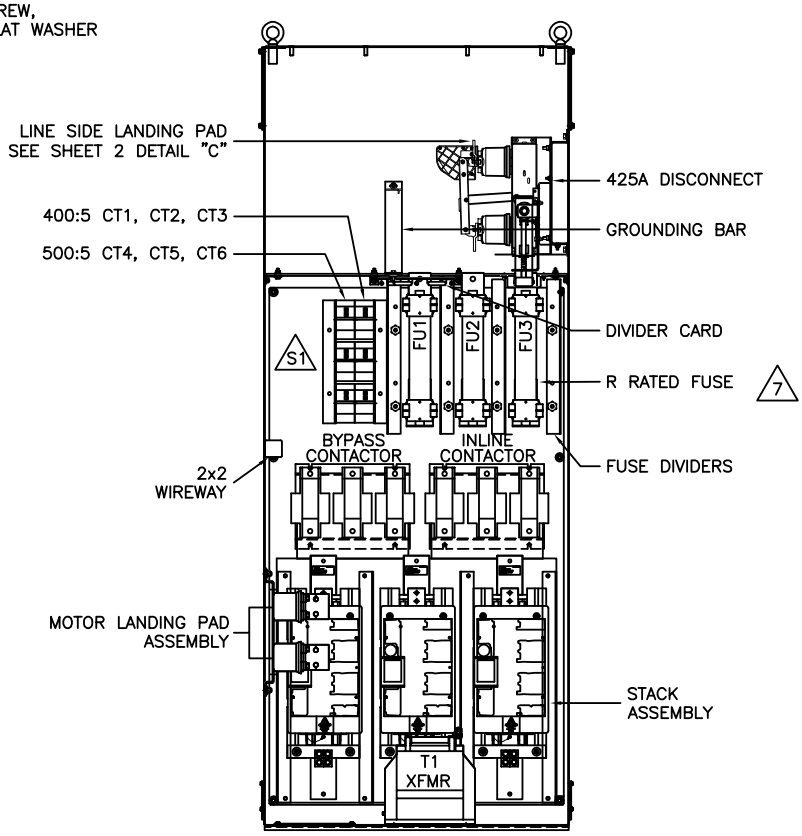
Top View



Front of Enclosure
Plan View

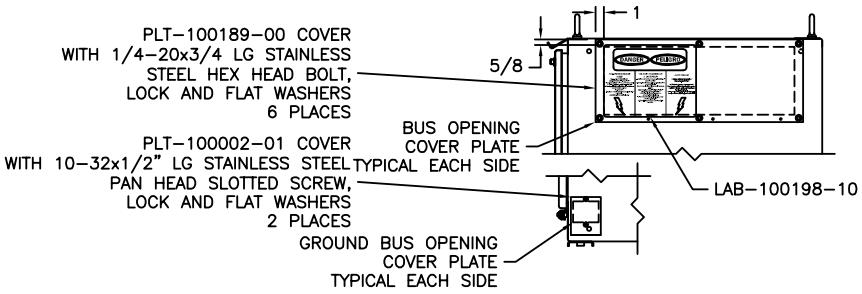


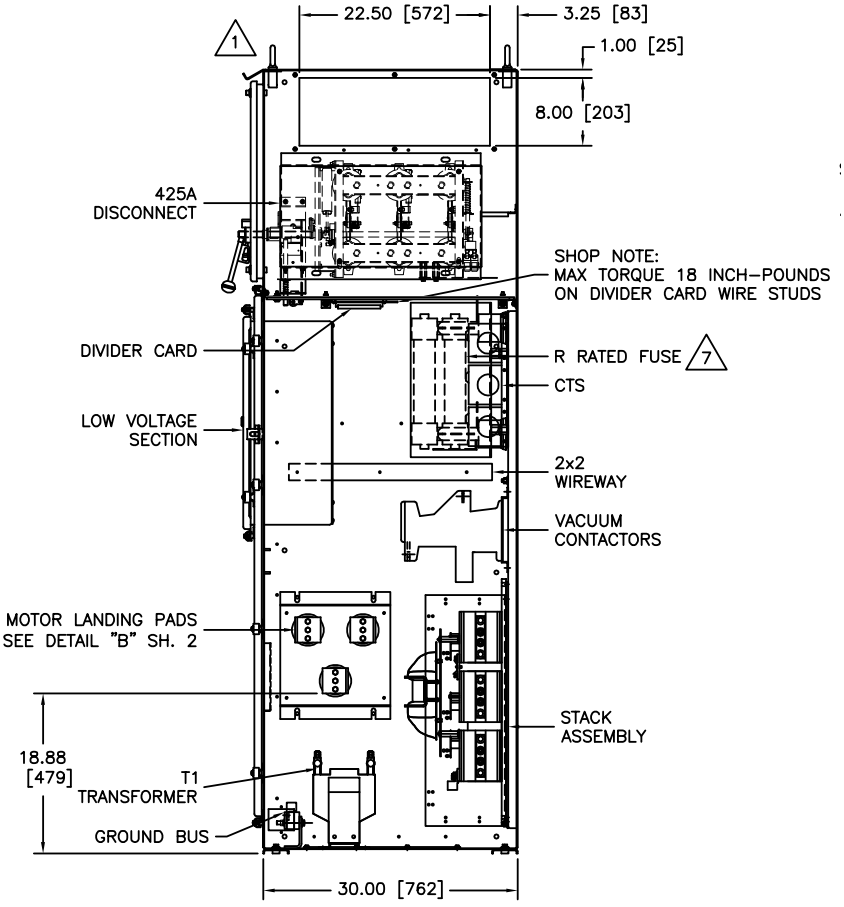
Front View



Front Interior View

All drawings packages are available on BenshawExpress.com.





Right Side Interior View

Shop notes:

S1 Add BUINS-PMC1203 insulation sleeving to power cable thru CT's, 2" minimum past edge of CT each side. Tie wrap CT's to bracket BRKT-100302-01 where applicable.

S2 Ensure encl. side holes are plugged when not used to bolt adjacent enclosures together. Use sealing plugs for 3R enclosures (EN-SP1/2-13/16-.5). Non 3R enclosures use EN-100007-01.

Notes:

1 Removable lifting eyebolts.

2 Cable entry /exit area. Cutout with cover plate supplied.

3 Cable entry/exit area. No cutout supplied. Customer to cut as required.

4. Enclosure color: ANSI 61 grey.

5. Tighten bolts per chart below.

Steel bolt — Torque in pound-foot [Newton-Meter]

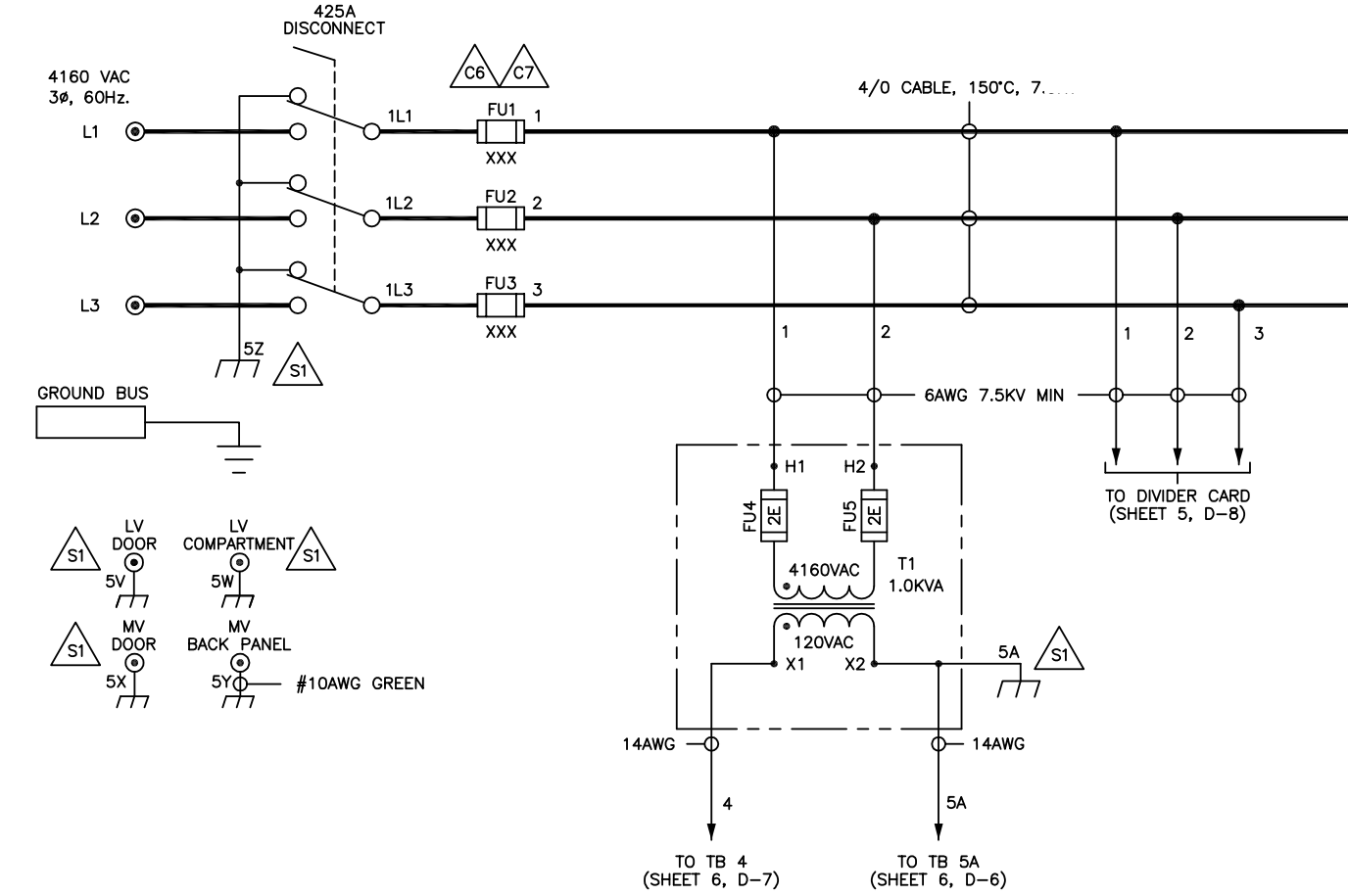
1/4–20	5/16–18	3/8–16	1/2–13	5/8–11
5 (6.8)	12 (16.3)	20 (27)	50 (67.8)	95 (128.8)

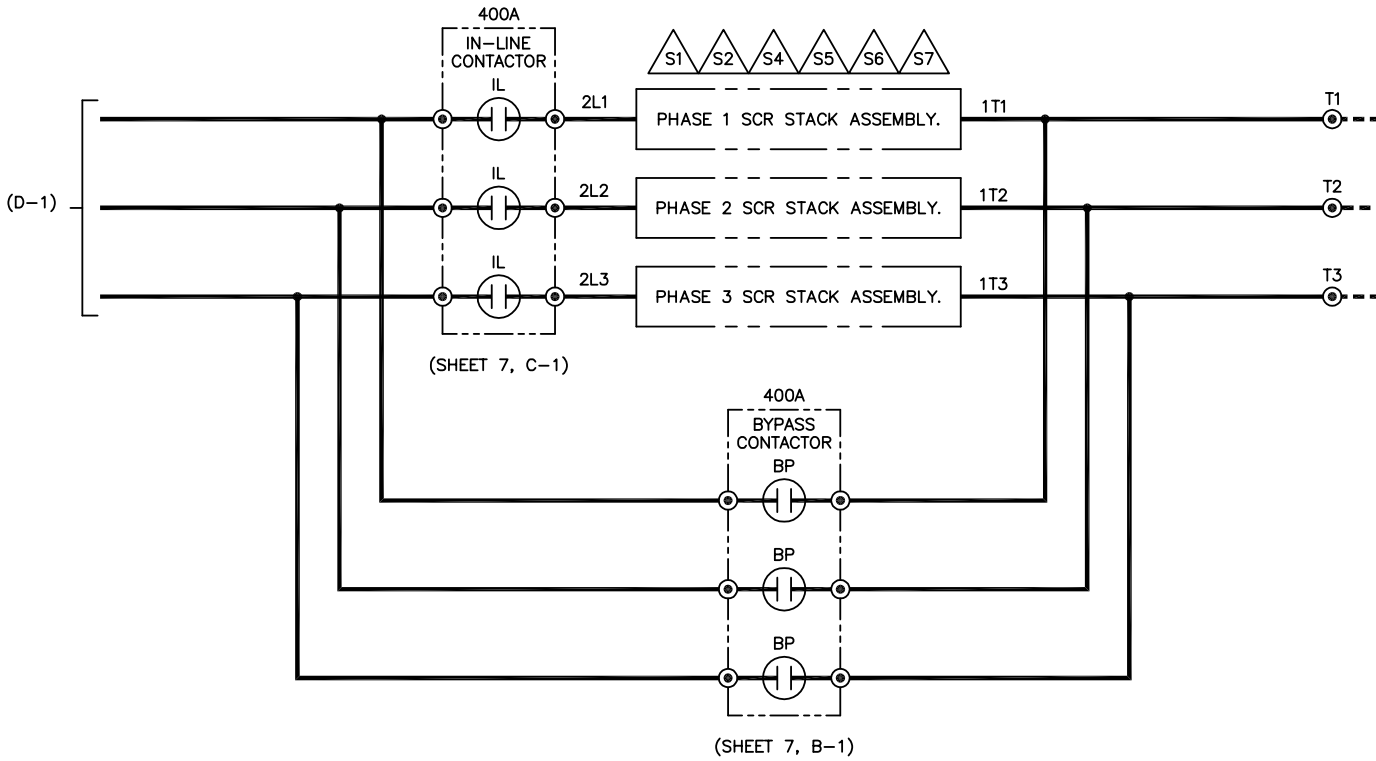
6. Approximate weight is 1600 lbs (726 kg).

7 R-fuses shown for reference. Reference sales order for fuse size.

All drawings packages are available on BenshawExpress.com.

Drawings





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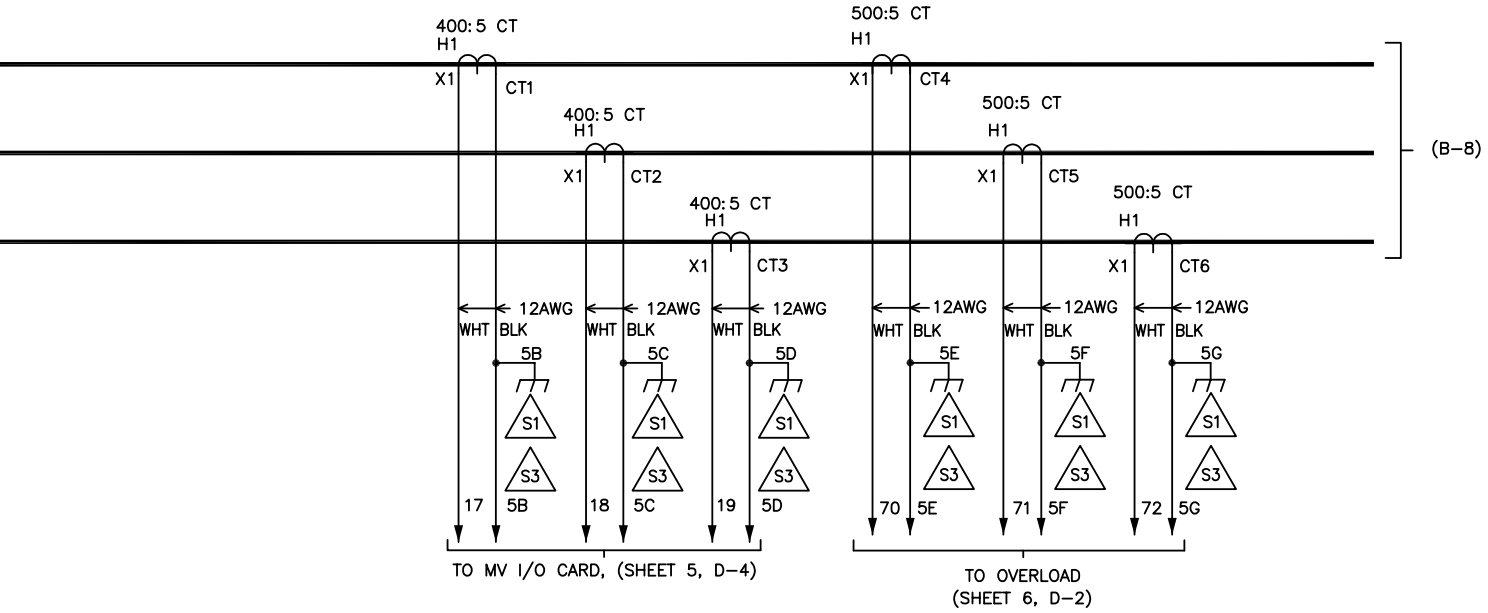
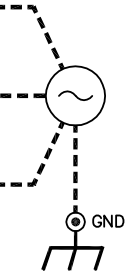


C7

3000 HP NOMINAL
AC MOTOR
4160 VAC
3ø, 60Hz
360 FLA MAX

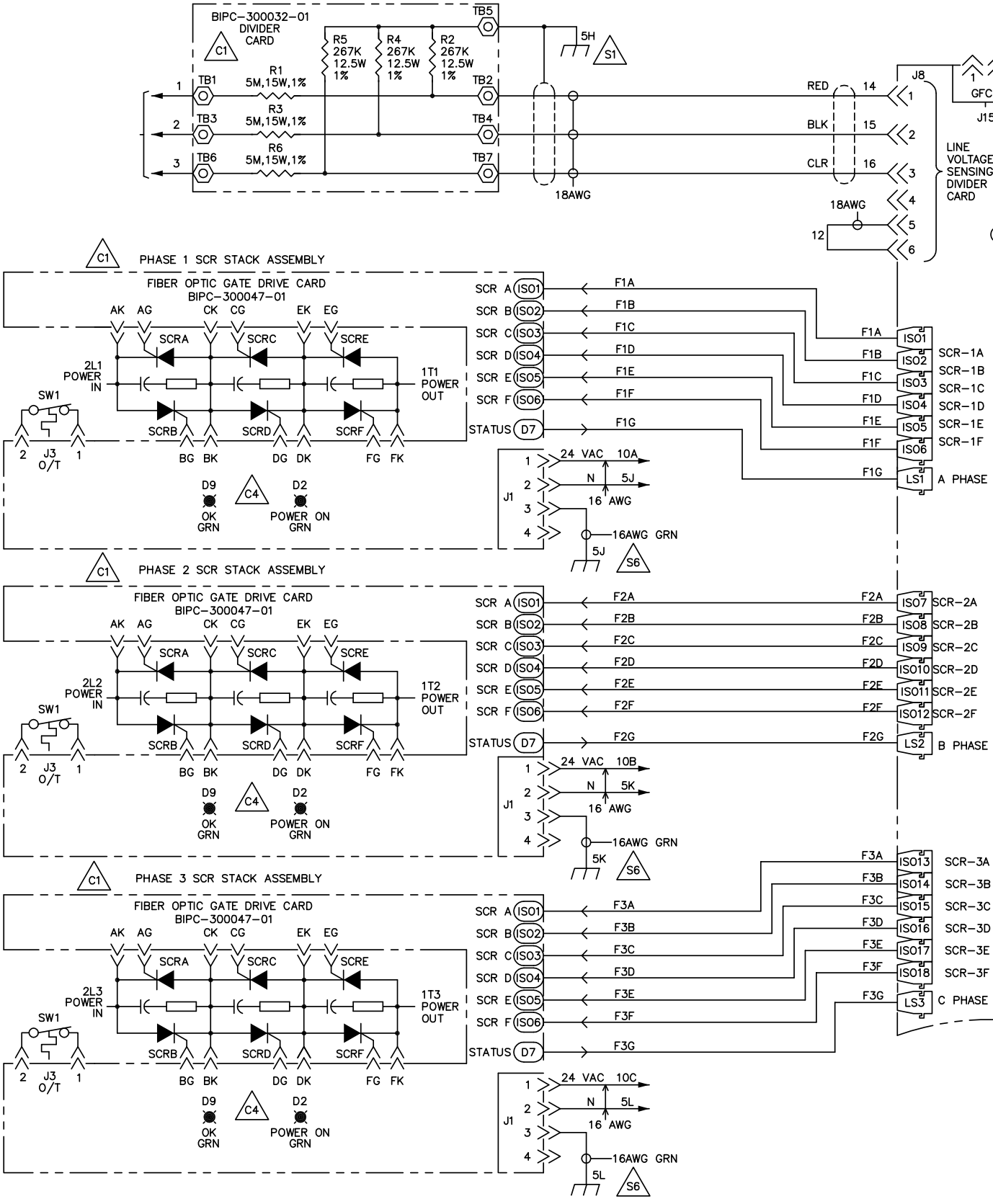


CAUTION:

SEVERE DAMAGE MAY RESULT IF SURGE CAPACITORS. LIGHTNING ARRESTERS, OR POWER FACTOR CORRECTION CAPACITORS ARE CONNECTED TO THE LOAD SIDE OF THE SOLID STATE STARTER. CONSULT FACTORY BEFORE USING ANY OF THESE POWER QUALITY ENHANCEMENT DEVICES.

All drawings packages are available on BenshawExpress.com.

Drawings



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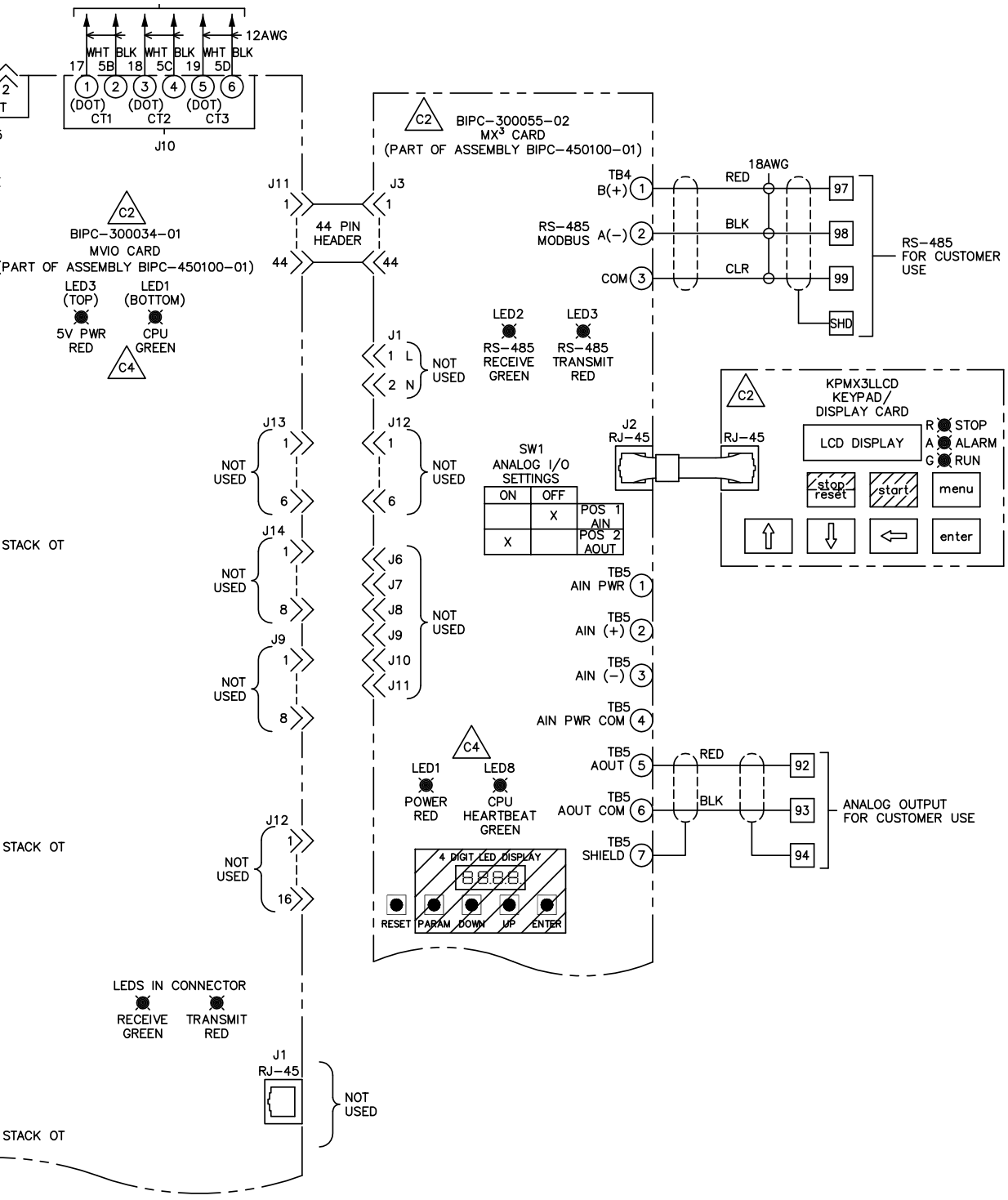

All drawings packages are available on BenshawExpress.com.

Notes

Notes

Advanced Controls and Drives

- Full Voltage Controls
- Variable Frequency Drives
- Low Voltage Solid State Starters
- Medium Voltage Drives
- Medium Voltage Controls
- Medium Voltage Switchgear

UNICO Technologies Group

Power and Precision in Motion

Taking care of our customers' power needs has been our single focus for 88 years. Our two leading brands bring innovative control and electrical solutions to solve your challenges. Through thousands of systems in a broad array of applications, we've learned what it takes to make your system live up to its potential.

At a glance: With facilities in 12 countries, we combine the convenience of local service with the economies-of-scale and efficiency of a large global organization.

Innovative solutions via technology: We bring you mission-critical motor control and protection products, designed and built with expertise and precision to maximize your output and minimize downtime.

Engaged and knowledgeable: We like to think of ourselves as "Application Smart," which always includes critical dependencies such as standards, compliance and regulatory issues.

UNICO TECHNOLOGIES GROUP

Power and Precision in Motion

Visit us online at unicotg.com, or contact:

UNICO Technologies Group

3725 Nicholson Road
PO Box 0505
Franksville, WI 53126-0505

After Hours Tech Support

Phone: 800.203.2416

BENSHAW®
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24/7 Technical Support

- 24/7 hotline support from Pittsburgh (USA) and Listowel (Canada)
- Overnight parts shipment
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- Trained, experienced, field personnel
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Benshaw Product Line

- Solid state starters fractional to 30,000 HP at 15 kV
- LV AC drives to 700 HP
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- Electromechanical controls to 800 A

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- 24/7 online inventory and order system for authorized Benshaw distributors
- 24/7 shipment
- Air or truck delivery

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