



EDISON ENGINEERING GROUP
MUNICIPAL • ENVIRONMENTAL • LAND PLANNING

2203 Charles Hardy Parkway, Suite 300 • Dallas, GA 30157 • (770) 505-8115

March 18, 2022

Mr. Brandon Rakestraw
Public Works Director
City of Dallas
129 East Memorial Dr.
Dallas, GA 30132

**Re: Recommendation for Direct Pre-purchase of Regional Lift Station Equipment
West Dallas Collector Sewer Extension Project – Phase I
City of Dallas Project #2020-07
[GEFA Loan No. CW2021008]**

Dear Mr. Rakestraw:

The West Dallas Collector Extension Project is currently being advertised for bid and is set for a bid opening on April 14, 2022. As part of the bid specifications, the City of Dallas has made commitments (following GEFA approval) to provide some of the construction materials and perform some of the early clearing work (*to avoid the Indiana Tree Bat clearing restrictions*).

The purpose of the equipment pre-purchase effort is two-fold; 1) the items selected for pre-purchase include critical components with excessive lead times for delivery, and 2) the city will save approximately \$140,350.00 in sales tax. The equipment selected for pre-purchase and advanced clearing work are outlined below:

Item No.	Equipment/Work Description	Current Status
1.	Gravity sewer, force main, and water service piping	Pipe Ordered ⁽¹⁾
2.	Clearing easement areas for LS and primary sewer route	Contract Awarded ⁽²⁾
3.	Cat Diesel Generator	Awaiting Order
4.	Huber Rakemax-CF[®] Influent Screens	Awaiting Order
5.	Flygt NP 3312 Pumps (3) and Accessories	Awaiting Order
6.	Flygt SR-4620 Submersible Mixer & Accessories	Awaiting Order
7.	Pump Starters & Variable Frequency Drives (VFD's)	Awaiting Order
8.	Lift Station Control Panel ⁽³⁾	Awaiting Final Specs

(1) Pipe contract awarded to Hayes Pipe Supply, Acworth, GA.

(2) Clearing contract awarded to Adams Clearing Co., Tallapoosa, GA.

(3) Specs to be provided and panels to be purchased from MR Systems, Norcross, GA

This recommendation for direct pre-purchase addresses Items 3 - 7 above. The specifications, delivery timeframes and price quotes for each of these items are provided as an attachment.

Item No. 3 - Cat Model C15, 450 kW Diesel Back-up Generator

This item will provide emergency back-up power during full electrical load conditions. The generator is equipped with a Gentset Enclosure for sound attenuation (*75 dBA @ 23-ft*); an automatic transfer switch with 7-day automatic generator exerciser, a 2,200-gallon double walled fuel tank (*72-hrs at 100% load*), a 2-year warranty, and delivery to the L.S. site.

- Delivery Schedule: Approximately 40-46 weeks from submittal approval – actual delivery time confirmed at time of order.
- Quote: \$147,838.00 (*expires on April 9, 2022*)

Item No. 4 – Huber RakeMax CF[®] 11519x500x500/6

This item will provide influent flow screening prior to flow discharge into the lift station wet well under peak hour flow conditions (5 MGD). The screens include all necessary equipment including stainless steel screening, control panel with NEMA 4 enclosure and VFD, 5-years warranty, delivery to the L.S. site and start-up services including up to 3 days of on-site training.

- Delivery Schedule: Approximately 22-28 weeks from submittal approval for both e pumps and mixer – actual delivery time confirmed at time of order.
- Quote: \$245,450.00 (*expires on June 8, 2022*)

Item No. 5 & 6 – Flygt NP3312, 215 HP Pumps & Flygt Model SR-4620 Submersible Mixer

The three (3) pumps will provide the pumping required to transport the basin wastewater directly from the lift station wet well to the plant headworks. The submersible mixer will keep solids suspended and prevent influent sewer from approaching septic conditions. Both the pump and mixer packages will include all necessary mounting, lifting and wiring accessories. Both will include a 5-year warranty, delivery to the L.S. site and initial Flygt start-up services.

- Delivery Schedule: Approximately 22-28 weeks from receipt of order and signed submittals.
- Quote: \$845,465.93 (*expires on September 31, 2022*)

Item No. 7 – Eaton 250 HP VFD's and Pump Starters

The Flygt pumps described above will be equipped with variable frequency drives (VFD's) and starters to provide a wide range of pump flow rates as well as energy efficient operation. The equipment package will be shipped to the Dallas, GA warehouse of Lade Electric Supply for lift station Contractor pick-up. Quote includes a 2-year warranty.

- Delivery Schedule: Approximately 18-20 weeks from submittal approval – actual delivery time confirmed at time of order.
- Quote: \$81,343.49 (*expires on April 10, 2022*)

Should you have any questions, please do not hesitate to call.

Sincerely,

EDISON ENGINEERING GROUP

A rectangular box containing a handwritten signature in black ink. The signature is cursive and appears to read "Michael L. Jones".

Michael L. Jones, P.E.
Principal

Attachments

450 kW Diesel Generator Set

One (1) CAT Model C15 Diesel Engine Driven Generator Set, rated 450kW standby, 562.5 kVA at 0.8 PF, 480Y/277 Volts, 3 phase, 4 wire, 60 Hertz at 1800 RPM, equipped as follow for outdoor application:

Emissions

- This engine meets **US EPA Emergency Standby**
- **UL 2200 Listed**

Cooling System

- ◆ **Radiator for 122 degree F ambient**, unit mounted.
- ◆ **Jacket water heater** with thermostatic controls, **240 VAC** single phase input.

Starting System

- ◆ **Electric Starting Motor**, 24VDC.
- ◆ **Battery set**, CAT High Output 24 volt DC lead acid type, with rack and cables.
- ◆ **Automatic Dual Rate Battery Charger**, 10 amps, Installed in genset enclosure, 120 VAC input required. Includes DC voltmeter, DC ammeter, AC fuse, DC fuse, automatic float/equalize control, and low voltage alarm.

Instrumentation & Controls

- ◆ **Electronic Governor**, with solid state speed control board, +/- 0.25% regulation.
- ◆ **CAT EMCP 4.2 Genset Controller**
 - **Instrumentation:** LCD Display with adjustable contrast and backlight with auto power off. AC metering: Volts 3-phase (L-L & L-N); Amps (per phase & average); Frequency; kW (total & per phase); kVA (total & per phase); kVAr (total & per phase); Power Factor (overall & per phase); kW hours; kVAr hours DC metering: Battery Volts; Engine Hours run; Engine Jacket Water Temperature (in °C or °F); Lube Oil Pressure (in psi, kPa or bar); Engine Speed (rpm); Crank attempt counter; Start counter
 - **Protection:** Fail to start shutdown, Low oil pressure shutdown, High engine temperature, Approaching high coolant temperature alarm, Approaching low oil pressure alarm, Not in auto mode alarm, Underspeed / Overspeed, Loss of Engine Speed Detection, Low / High battery voltage, Battery charger failure (if fitted), Under volts, Over volts, Under frequency, Over frequency, Overcurrent, 4 spare fault channels 20 Event fault log (name of event, engine hours at first occurrence of event, time stamp at first, occurrence, engine hours at latest occurrence of event, time stamp at latest occurrence, number, of occurrences of event)
 - **Controls:** 2 LED status indicators (1 red shutdown, 1 amber warning), Run key and LED indicator, Auto key and LED indicator, Stop key and LED indicator, Lamp test key, Alarm acknowledge key, Menu navigation keys, Engine and AC metering shortcut keys, All control module keys have tactile feedback, Lock down emergency stop push button

Generator (Alternator)

- ◆ **CATERPILLAR AC power single bearing generator standby rated at 125 degree C rise**, 3 phase, 4 wire, direct connected with:
 - **3 phase voltage regulator +/- .25% regulation** from 0% load to 100% load.
 - **PMG Excitation**
 - **Internal ERMS switch**
 - **Circuit Breaker, Unit Mounted, One (1) 100% rated, 1000 Amps, 3 pole, LSIG,**

Genset Enclosure – Sound Attenuated 75 dBa @23ft.

- 14 gauge steel construction with two (2) single access doors per side
- Painted standard alkyd enamel finish, color is **White**.
- Internal load center, prewired from factory.

Exhaust System

- ◆ **Critical grade silencer** with flexible exhaust connector and vertical discharge, installed internal to enclosure



Yancey Power Systems
 259 Lee Industrial Blvd.
 Austell, GA 30168-7406

Quotation # 22SRA0010-01

Project: Dallas Regional Lift Station

Date Issued: March 8, 2022

Expiration: April 9, 2022

www.YanceyPower.com

Page # 2 of 3

Fuel System

- ◆ **2,200 gallon (72hr @ 100% Load) double wall, UL142 listed, Subbase Fuel Tank** with low fuel level switch and alarm, re-circulation pump and rupture basin leak detection alarm.

Automatic Transfer Switch

- ◆ **One (1) ATS rated 1000 amps, 3 pole, Service Entrance Rated with ERMS switch and Ground Fault Indication on breakers**, in a NEMA 1 (Indoor) enclosure with 7 day automatic generator exerciser. Voltage is 480/277 VAC.

Other Services Provided by Yancey Power Systems Included for this project:

- ◆ **Project Management**
- ◆ **Delivery to job site** (offloading & installation by others)
- ◆ **Start-up and testing services** including **4 hour** resistive load bank test on site during start-up.
- ◆ **Operator training:** up to 4 hours on site – single trip.
- ◆ **Operation and Maintenance Manuals:** 3 Sets
- ◆ **Warranty, CAT Equipment: Two (2) years from the start-up date.**

NET PRICE: \$ 147,838.00

CLARIFICATIONS

This quotation is based on spec section 16623.

Scheduling:

Generator Set: Currently 40-46 weeks from submittal approval, confirmed at time of order.

ATS: Currently 10-16 weeks from submittal approval, confirmed at time of order.

Price DOES NOT include the following:

- State and Local Sales Tax
- Installation of the Equipment (including shipped loose accessories)
- Wiring Terminations (power conductors)
- Offloading & Assembly of Equipment at the Jobsite
- Fuel for Startup and Testing

Start-Up, Testing, & Training to be performed during normal business hours unless specifically indicated otherwise. Telephone and verbal orders are to be confirmed in writing. We reserve the right to correct stenographic or clerical errors. Yancey Power Systems is not responsible for occurrences beyond our control. This quotation is made subject to Yancey Power Systems Standard Terms and Conditions.

Thank you for your request and for your consideration of this quotation.

ACCEPTANCE:

BY YANCEY POWER SYSTEMS

_____ DATE _____

_____ DATE _____

Standard Terms and Conditions -V1

1. **CONTRACT.** Unless otherwise stated, all sales transactions are expressly subject to these terms and conditions. Credit sales likewise are subject to credit approval. No understanding, promise or representation, and no waiver, alteration or modification of any of the provisions hereof shall be binding upon Yancey Power Systems ("Company") unless assented to expressly in writing by an authorized representative of Company. Buyer shall not rely on any statement or representation of any party (including, without limitation, any Company sales representative) that alters, adds to or differs from these terms and conditions, and no such statement or representation shall be recognized by or be binding upon Company. Any and all provisions of Buyer's Purchase Order or other documents that add to or differ from these Terms and Conditions are EXPRESSLY rejected. No waiver of these Terms and Conditions or acceptance of others shall be construed from any failure of Company to raise objection.
2. **QUOTATIONS AND PUBLISHED PRICES.** Quotations automatically expire thirty (30) calendar days from the date issued unless otherwise stated in the Quotation and are subject to withdrawal by notice within that period. Company reserves the right unilaterally to extend such Quotation up to six (6) months from the date of issuance. Company's price for equipment, unless otherwise specified, does not include an allowance for installation and/or final on-site adjustment. Prices shall be subject to adjustment to those in effect at time of shipment.
3. **TAXES.** Company's prices do not include any applicable sale, use, excise or similar taxes; and the amount of any such tax which Company may be required to pay or collect will be added to each invoice unless Buyer has furnished Company with a valid tax exemption certificate acceptable to the taxing authorities. Where a buyer fails to furnish the required documentation, the previously unpaid sales, use, excise, or similar tax will be billed to the Buyer. If upon subsequent sales, use, excise or similar tax audit, an exemption certificate provided to Company by Buyer is, through no fault of Company, determined to be invalid, Company will attempt to acquire a valid exemption certificate, notarized affidavit of exempt use, or other necessary documentation from Buyer. If Buyer fails timely to furnish a valid exemption certificate, notarized affidavit, or other necessary documentation, the previously unpaid sales, use, excise or similar tax will be billed to Buyer.
4. **TERMS.** Except as otherwise provided herein, TERMS ARE CASH, NET THIRTY (30) DAYS, from date of invoice. Amounts past due are subject to a service charge of 1.5% per month (or fraction thereof), or maximum contract rate as permitted by law, and any payments will be applied first to service charges due. If Company deems that, by any reason of the financial condition of the Buyer or otherwise, the continuance of production or shipment on the terms specified herein are not justified, Company may require full or partial payment in advance. The terms provided herein supercede any customer or trade practice regarding service charges, time of payment or any other term of payment.
5. **DELIVERY.** Delivery dates indicated in the contract documents are approximate and are based on prompt receipt of all necessary information regarding the equipment covered by the contract. Company will use reasonable efforts to meet the indicated delivery dates, but cannot be held responsible for its failure to do so. Company shall not be liable for delays in delivery or in performance or failure to manufacture or deliver, due to causes beyond its reasonable control; acts of God, acts of Buyer, acts of civil or military authority, priorities, fires, strikes or other labor disturbances, floods, epidemics, war, riot, or delays in transportation; or inability on account of causes beyond its reasonable control to obtain the necessary labor, materials, components or manufacturing facilities. In the event of any such delay, the date of delivery or of performance shall be extended for a period equal to the time lost by reason of the delay. In the event of any delay caused by Buyer, Company will store and handle all items ordered at Buyer's risk and will invoice Buyer for the unpaid portion of the contract price, plus storage, insurance and handling charges, on or after the date on which the equipment is ready for delivery, payable in full within thirty (30) days from invoice date.
6. **DELIVERY AND HANDLING CHARGES.** Unless otherwise specified, shipments are F.O.B. factory. Delivery and handling charges will be prepaid and billed as a separate item on the equipment invoice on the basis of Company's current freight policies. Buyer may also specify and use a designated freight carrier. In the absence of such specification, goods will be shipped by the method and via the carrier chosen by Company.
7. **SHIPPING AND PACKING.** All material shall be carefully packed for shipment and Company will not be responsible for loss, delay or breakage after having received "in good order" receipts from the carrier. All claims for breakage, loss, delay and damage should be made to the carrier. Shipping weights and dimensions given in Company's materials are as close to actual as predictable, but are not guaranteed. No claims will be allowed because of any discrepancy between actual weight or dimensions shipped and listed data.
8. **SUBSTITUTIONS.** Unless specifically restricted on a purchase order, Company reserves the right to substitute the latest superseding design and manufactured equivalent product where the interchangeability of the product is based on form, fit, and function, in place of the product offered.
9. **CHANGES.** Buyer may, with the express written consent of Company, make changes in the specifications for equipment or work covered by the contract. In such event, the contract price and delivery dates shall be equally adjusted. The Company shall be entitled to payment for reasonable profit plus costs and expenses incurred by it for work and materials rendered unnecessary as a result of such changes, and for work and materials required to effect such changes.
10. **NONCONFORMITY.** All equipment sold by Company is to be inspected before shipment, and should any of such equipment prove defective due to faults in manufacture, or fail to meet the written specifications accepted by Company, Buyer shall not return the goods, but shall notify Company immediately, stating full particulars in support of its claim, and Company will either replace the goods upon return of the defective or unsatisfactory material or shall adjust the matter fairly and promptly, but under no circumstances shall Seller be liable for consequential or other damages, losses or expenses in connection with or by reason of its use of or inability to use materials purchased for any purpose.
11. **CANCELLATION.** Undelivered parts of any order may be canceled by the Buyer only with the written approval of Company. If Buyer makes an assignment for the benefit of creditors, or in the event that the Company for any reason feels insecure about Buyer's willingness or ability to perform, then Company shall have the right to cancel this sales transaction. In the event of any cancellation of this order by Buyer, Buyer shall pay to Company the reasonable costs and expenses (including engineering expenses and commitments to suppliers and subcontractors) incurred by Company prior to receipt of notice of such cancellation, plus Company's usual rate of profit for similar work. In the event Company agrees to accept equipment for restocking, a minimum charge of twenty-five percent (25%), based on the sales price to Buyer of said equipment, will apply.
12. **SECURITY INTEREST.** Buyer agrees to pay for the equipment according to the Company's payment terms and does hereby grant the Company a purchase money security interest in the equipment until such time as it is fully paid. Buyer hereby appoints Company as its Attorney-in-Fact and authorizes Company, at Buyer's expense, to take such action as may be necessary to perfect and protect Company's security interest, including the filing and/or recording of Uniform Commercial Code Financial Statements, and grants Company the right to execute Buyers name thereto. In the event of a default by Buyer, Company shall be entitled to any of the rights and remedies provided by law. Buyer hereby authorizes Company, at Buyer's expense, to file or record any statement, memorandum or other instrument showing the interest of Company in the equipment, including Uniform Commercial Code Financing Statement, and grant the Company the right to execute Buyer's name thereto. Buyer agrees to pay or reimburse Company for any searches, filings, recording or stamp fees or taxes arising from the filing or recording of any such instrument or statement. Buyer shall at its expense protect and defend Company's title against all persons claiming against or through Buyer, at all times keeping the equipment free from any legal process or encumbrance whatsoever, including, but not limited to liens, attachments, levies and executions, and shall give Company immediate written notice thereof and shall indemnify Company from any loss caused thereby.
13. **DEFAULT.** Upon default and placing of this instrument with an attorney for collection or repossession of the equipment, Buyer agrees to reimburse Company for its reasonable attorney's fees and court costs incurred in connection therewith.
14. **BUYER ACCEPTANCE.** Any apparatus delivered hereunder shall be deemed to be fully accepted by Buyer unless Company receives written notice of rejection of any such apparatus within ten (10) days after the date of delivery to Buyer.
15. **WARRANTIES.** COMPANY MAKES NO REPRESENTATION, GUARANTY OR WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO QUALITY, MERCHANTABILITY, AND/OR FITNESS FOR A PARTICULAR PURPOSE, THAT EXTEND BEYOND THE DESCRIPTION OF EQUIPMENT, UNLESS REDUCED TO WRITING AND MADE A PART OF THIS CONTRACT. IN ADDITION, ALL EQUIPMENT SHALL BE WARRANTED SOLELY BY THE MANUFACTURER OF SAID EQUIPMENT PURSUANT TO THE TERMS OF THAT MANUFACTURER'S SUPPLIED WARRANTY.
16. **DISCLAIMER OF DAMAGES AND LIMITATION OF LIABILITY.** IN NO EVENT SHALL COMPANY BE LIABLE FOR ANY TYPE OF SPECIAL, CONSEQUENTIAL, INCIDENTAL, OR PENAL DAMAGES, WHETHER SUCH DAMAGES ARISE OUT OF OR ARE A RESULT OF BREACH OF CONTRACT, WARRANTY, TORT (INCLUDING NEGLIGENCE), STRICT LIABILITY OR OTHERWISE, EXCEPT DAMAGES ARISING OUT OF OR RESULTING FROM COMPANY'S GROSS NEGLIGENCE OR WILLFUL MISCONDUCT.
Such damages shall include but not be limited to loss of profits or revenues, loss of use of the equipment or associated equipment, cost of substitute equipment, facilities, down-time costs, increased construction costs or claims of Buyer's customers or contractors for such damages. Buyer agrees that in the event of a transfer, assignment or lease of the equipment sold hereunder, Buyer shall secure for Company the protection afforded to it in the paragraph set forth immediately below.
Company shall not be liable for any loss, claim, expense or damage caused by, contributed to, or arising out of the acts or omissions of Buyer or third parties (including carriers), whether for negligence or otherwise. In no event shall Company's liability for any cause of action whatsoever exceed the cost of the item giving rise to the claim, whether based in contract, warranty, indemnity or tort (including negligence). Buyer agrees to defend and hold Company harmless from any claim or suit arising hereunder.
17. **REGULATORY LAWS AND/OR STANDARDS.** Company takes reasonable steps to keep its products in conformity with various nationally recognized standards and such regulations which may affect its products, however, Company recognizes that its products are utilized in many regulated applications and that from time to time standards and regulations are in conflict with each other. Company makes no promise or representation that its product will conform to any federal, state or local laws, ordinances, regulations, codes or standards, except as particularly specified and agreed upon for compliance in writing as a part of the contract between Buyer and Company. Company prices do not include the cost of any related inspections or permits or inspection fees.
18. **NO RESPONSIBILITY FOR GRATUITIOUS INFORMATION OR ASSISTANCE.** If Company provides Buyer with assistance or advice which concerns any parts, products, or services supplied hereunder or any system of equipment in which any such part, product or service may be installed and which advice is not required pursuant hereto, the furnishing of such assistance or advice shall not subject Company to any liability whether based in contract, warranty, tort (including negligence) or otherwise.
19. **NONASSIGNMENT.** This order may not be assigned by Buyer, in whole or in part, without Company's prior written consent.
20. **ENTIRE AGREEMENT AND AMMENDMENT.** This Quotation constitutes the entire agreement between Company and Buyer with respect to the transactions hereunder and no representation, promise, or condition not set forth herein has been relied upon by Buyer or shall be binding upon either party hereto.



BUDGET PROPOSAL

West Dallas Regional Pump Station - Dallas, GA

Equipment:

HUBER Multi-Rake Bar Screen: RakeMax-CF®

Represented by:

Templton and Associates

Stanley Mize

678-521-6212

Stanley@templton-associates.com

Regional Sales Director:

Steve Frank

(704) 330-9378

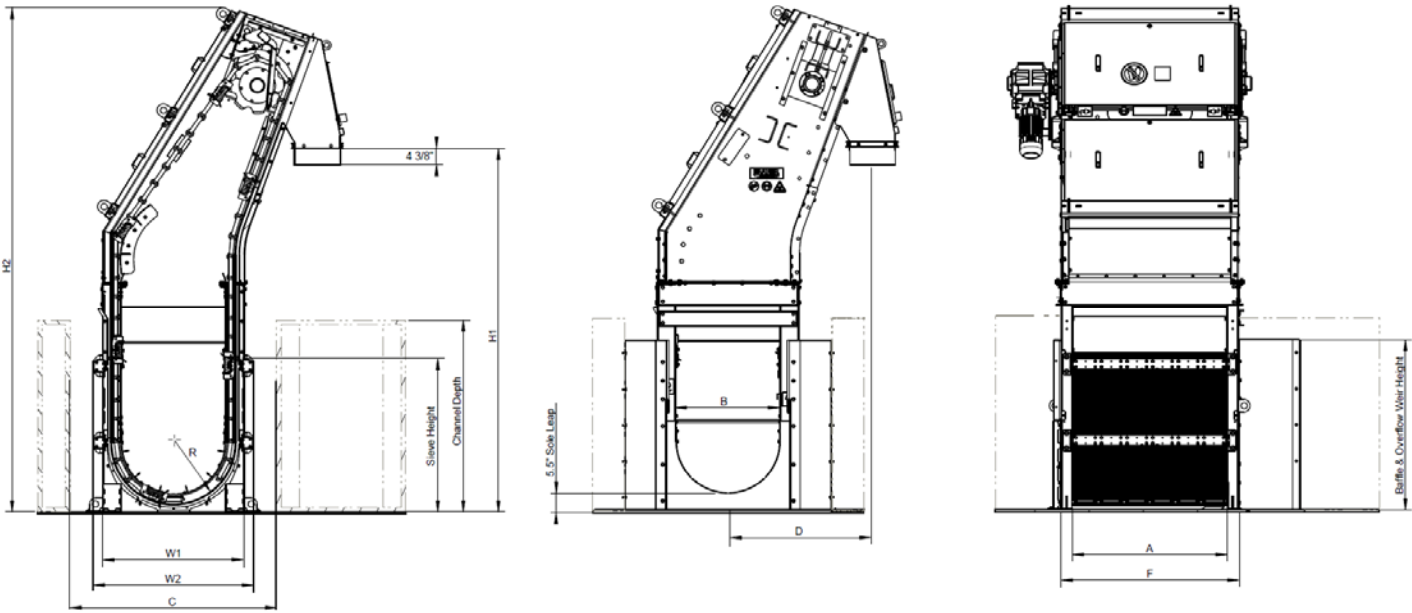
Steve.Frank@hhusa.net

Project Number: 465410

Revision: 3

Date: 3/15/2022

Technical Data



Project & Hydraulic Data

		Imperial		Metric	
Channel Width (@ Screen)	C	4.00	ft	1219	mm
Approach Channel Width (if Applicable)		4.00	ft	1219	mm
Channel Depth		32.51	ft	9909	mm
Depth to Operation Deck EL (if Applicable)		32.51	ft	9909	mm
Peak Hourly Flow (per Screen)		5.00	MGD	219	l/s
Clear Bar Spacing		0.25	in	6	mm
Headloss Thru Bars @ 30% Blinding		2.7	in	69	mm
Deflection Headloss @ 30% Blinding		2.6	in	66	mm
Total Headloss @ 30% Blinding		5.3	in	135	mm
Through-Bar Slot Velocity @ 30% Blinding		2.54	ft/s	0.77	m/s
Channel Approach Velocity @ 30% Blinding		0.92	ft/s	0.28	m/s
Submerged Open Area		4.76	ft ²	0.44	m ²
<i>Submerged Open Area (Standard Multi-Rake @ 75°) for Comparison Only</i>		2.52	ft ²	0.23	m ²

Screen Dimensions

		Imperial		Metric	
Overall Discharge Height above Channel Invert	H1	33.59	ft	10239	mm
Overall Screen Height	H2	37.19	ft	11336	mm
Min. Overflow Weir Height (if Applicable)	[-]	37.00	in	940	mm
Chamber Opening	[B]	19.69	in	500	mm
Frame Width (Excluding Supports)	[W1]	31.42	in	798	mm
Overall Width (Inside Channel)	[W2]	36.54	in	928	mm
Centerline Screen to Centerline Discharge Chute	[D]	31.70	in	805	mm
Radius of Sieve Bars	[R]	26.54	in	674	mm
Sieve Width (Parallel to Flow)	[A]	19.69	in	500	mm
Depth (Length in Channel Parallel to Flow)	[F]	35.43	in	900	mm
Inclination from Horizontal		90° with 70° Upper Section			

Screen Model	RakeMax-CF® 11519x500x500/6
Quantity	1
Material	304L stainless steel construction; pickled and passivated in acid bath
Screening Bars	Flat; 4/20mm; 316L stainless steel construction
Chains	316L links with ANSI-431 pins & polyamide rollers
Upper Sprocket & Bearing	304L stainless steel, split; greasable flange bearings
Discharge Scraper Plate	Polyethylene blade
Motor Data	BK40 2.0HP, VFD, C1D1, 480VAC, 3 phase, 60Hz, SF 1.0
Anchor Bolts	M12 316 stainless steel
Local Control Station	Included, 3-hole NEMA7
Level Control Device(s)	HydroRanger 200 differential with two (2) transducers (per screen)
Optional Adder(s)	No optional adders included

Screenings Treatment Details

Washer/Compactor Data	Imperial		Metric	
Maximum Screenings Capacity	70	ft ³ /hr	2	m ³ /hr
Wash Water Demand	13	gpm	0.8	l/s
Wash Water Pressure	30-60	psi	2-4	bar
Weight (Empty)	660	lbs	300	kg

Wash/Compactor Model	WAP® 2
Quantity	1
Body Material	304L stainless steel construction; pickled and passivated in acid bath
Screw Auger	Shafted; 304L stainless steel construction with stainless-backed nylon brush in wash & compaction zones
Drain	5mm perforations; latched and sealed with 3.5in NPT drain connection
Inlet Hopper	304L stainless steel construction; inspection hatch included
Discharge Pipe	Tapered, conical pipe flanged connection
Motor Data	5.0HP, C1D1, 480VAC, 3 phase, 60Hz, SF 1.15 (auger)
Water Manifold	Mounted to body; 304L stainless steel construction with two (2) solenoid valves, brass-bodied, C1D1, 120VAC
Local Control Station	Included, 4-hole NEMA7
Optional Adder(s)	No optional adders included

Control Details

One (1) HUBER Standard Control Panel	
Enclosure	NEMA 4X, 304 stainless steel
PLC	Allen Bradley MicroLogix
HMI	Allen Bradley PanelView 4"
Motor Starters	VFD (screen), NEMA reversing (WAP) as required
Components	HUBER standard
Climate control components available upon request and are not included in this proposal	
Pre-programmed and factory tested	

Equipment	Model	Quantity	Pricing
HUBER Multi-Rake Bar Screen	RakeMax-CF® 11519x500x500/6	1	Included
HUBER Wash Press	WAP® 2	1	OPTIONAL +\$43,750
HUBER Control Panel	HUBER Standard	1	Included
Freight and Startup Services	Standard HUBER Start-up Services	1 trip(s), 3 day(s)	Included
TOTAL [Screen Only]:			\$254,450.00

Standard delivery is 22-28 weeks from approval of submittals.

Thank you for your interest in HUBER Technology, Inc. If you have any questions, please do not hesitate to contact our Regional Sales Director or our local sales representative.

This proposal has been reviewed for accuracy and approved for issue by: CD

RakeMax-CF Additional Services	Pricing
Five (5) year warranty on all rotating components [RakeMax CF & WAP]	Included
Service Contract for first five (5) years after installation, including:	Included
- Semi-annual trips per year, including one to two days on site	Included
- All required spare parts over the five-year period	Included
Installation assistance, training, and functional performance testing	Included

Notes and Technical Clarifications

- Equipment specification and drawings are available upon request.
- If there are site-specific hydraulic constraints that must be applied, please consult the manufacturer's representative to ensure compatibility with the proposed system.
- Electrical disconnects required per local NEC code are not included in this proposal.
- All electrical interconnections, wirings, junction boxes, and terminations between the equipment and electrical components are to be provided by installing contractor.
- Huber Technology warrants all components of the system against faulty workmanship and materials for a period of 12 months from date of start-up or 18 months after shipment, whichever occurs first.
- Budget estimate is based on Huber Technology's standard Terms & Conditions and is quoted in US dollars unless otherwise stated.
- Equipment recommendations are based on information provided to Huber Technology. Subsequent information which differs from what has been provided may alter the equipment recommendation.
- Any item not specifically listed is not considered part of this scope of supply. Please contact the HUBER Technology representative listed for further
- Equipment pricing that has been broken out from the Total in the table above are only valid when packaged together.

Screen Blinding Calculation Table

Blinding	Total Headloss		Upstream Head		Flow Velocity Thru Bar		Channel Approach Velocity	
	[%]	[in]	[mm]	[in]	[mm]	[ft/s]	[m/s]	[ft/s]
0	7	182	27	690	1.44	0.44	0.85	0.26
10	7	184	27	692	1.60	0.49	0.85	0.26
20	7	187	27	695	1.79	0.55	0.85	0.26
30	8	193	28	701	2.04	0.62	0.84	0.26
35	8	200	28	708	2.17	0.66	0.83	0.25
40	8	209	28	717	2.33	0.71	0.82	0.25
50	9	221	29	729	2.76	0.84	0.81	0.25



**Xylem Water Solutions USA, Inc.
Flygt Products**

March 11, 2022

90 Horizon Drive
Suwanee, GA 30024
Tel (770) 932-4320
Fax (770) 932-4321

CITY OF DALLAS
129 E MEMORIAL DR
DALLAS GA 30132-4200

Quote # 2022-ATL-0168 Alternate 1, Version 3
Project Name: Dallas-Pumpkinvine Regional
Job Name: NP3312 215HP

A Flygt Preventive Maintenance DISCOUNT is available for this order. Please contact your Xylem Service Center for more information.

NOTES:

1. This is a direct purchase by the end user City of Dallas under the guidance of the design engineer Croy Engineering.
2. Work for this project will be bid to a contractor at a later date after a PO for the pump package is issued to Xylem by the end user.
3. If it is not specifically listed as a line item on this quote or referenced in the notes it is not assumed or implied.
4. The customer shall field-verify the quantities, scope and cable lengths before issuing a PO.
5. The owner, engineer and or authorized agent are responsible for all construction means and methods, supervision of the contractor and verification that the pump station design, construction and installation are per the plans, specifications, approved submittals and latest requirements of the local issuing authority.
6. Any expenses related to additional materials and services required to complete this project are the responsibility of the contractor.
7. All control equipment including but not limited to PLC, MCC, Pilot Panel, VFDs, Motor Protection Relays, SCADA, Telemetry, RTU, Enclosures, Cabinets, Level Instruments and all related controls appurtenances and controls start-up complete, by others.
8. Xylem will supply sensor relay components in the form of MAS-801 for 3 pumps and MiniCASII for 2 mixers.
9. Xylem will coordinate with the Controls Supplier as part of commissioning and start-up..
10. Anchor-bolt calculations by others.
11. Field vibration testing not included.
12. Seismic testing by others.
13. Virtual Witness Testing not included.
14. Dynamics analysis not included.
15. Xylem's Warranty and start-up responsibilities are limited to the items listed in the scope of this quote.

Xylem Water Solutions USA, Inc. is pleased to provide a quote for the following Flygt equipment.

PUMPS

Qty	Part Number	Description
-----	-------------	-------------



Qty	Part Number	Description
3	00ZZZZ0	<p>Flygt NP 3312, 63-670, 460 mm Intended for semi permanent wet installation, guiding claw included other installation components to be ordered individually Hard iron impeller and insert ring Drive Unit: 746 6 pole, 215 hp, 460 V, Std motor Approval: FM Ex Closed-Loop Cooling jacket Glycol Large connection housing Insulated support bearing Material Shaft: AISI 431 Stainless steel Supervision FLS, leakage detector, in junction box FLS, leakage detector, in stator housing PT-100 in one stator winding PT-100 in 2nd and 3rd stator windings PT-100 in lower bearing PT-100 in upper bearing 3-Axis Vibration MAS-801 Amps Current Frequency</p>
3	00ZZZZ0	5 YEAR WARRANTY = 1.5 YEAR STANDARD WARRANTY + 3.5 YEAR EXTENDED WARRANTY

CABLES

Qty	Part Number	Description
		NOTE: 2 CABLES PER PUMP X 3 PUMPS X 100' PER CABLE LENGTH = 600' TOTAL CABLE LENGTH
600	94 19 96	CABLE,SUBCAB S3X50+3X25/3+ S(4X0.5) 39MM
12	83 57 26	GRIP,CABLE SS 37-49MM

CURRENT TRANSFORMER

Qty	Part Number	Description
3	14-40 41 15	TRANSFORMER,CURRENT 600:1

MAS 801

Qty	Part Number	Description
1	822 48 00	PANEL,OPERATOR 402 7"
1	823 07 00	MONITOR,PUMP MAS800 CU
3	823 06 00	MONITOR,PUMP MAS800 BU811

PUMP ACCESSORIES

Qty	Part Number	Description
3	373 92 05	CONNECTION,DISCH 12X12" CI



Qty	Part Number	Description
3	14-58 91 10	HOOK,SAFETY ASSEMBLY
12	14-48 82 10	BOLT,ANCHOR HD 1 X 12IN
6	255 47 01	SLEEVE,NBR
9	14-59 00 00	KIT,HARDWARE 3/8IN SS (2X)
3	661 54 01	BRACKET,GUIDE BAR U. 3" 316SS
3	14-58 44 05	@BRACKET,INT GB 3 X 12" STEEL+ FOR STEEL PIPE 3306,3312
300	14-49 01 01	TS3163 FEET 3"GUIDE RAIL 316SS
2	14-48 94 00	HOLDER,CABLE HEAVY DUTY 316SS
150	14-48 71 06	CHAIN,1/2" HI-TEST GALVANIZED
3	14-58 72 07	KIT,CHAIN FITTINGS FSWL 7150#

SPARES

Qty	Part Number	Description
1	00ZZZZ0	IMPELLER UNIT, N 460MM HC 3312
1	559 80 30	SEAL,MECHANICAL WCCR/WCCR
1	585 26 01	SEAL,MECHANICAL WCCR/WCCR
1	83 34 65	BEARING,ROLLER CYL SNGL ROW 160X75X37,28X28, NU315ECPVLO24
1	83 57 64	BEARING,ROLLER CYL SNGL ROW 200X110X38,28X28MM, NU222ECP6
1	571 45 00	WASHER,SUPPORTING STEEL
1	84 23 28	BEARING,BALL ANG CONT SNGL ROW 240X110X100MM, 7322BECB

PUMP SERVICES

Qty	Part Number	Description
3	14-69 00 11A	START UP,FLYGT,NO TAX 3-TP MODELS: 3000,7000,8000
3	14-69 94 94	TEST FAL 2.2 3001-5570-7000 + DEFAULT PLOTTED FAL 15-900006
3	14-69 95 76	TEST FAL 2.8 VIBRATN 3001-7000 FAL 15-900015
1	00ZZZZ0	DESIGN-BUILD SUPPORT, CONTROLS REVIEW AND COORDINATION
1	14-69 98 98	SUBMITTALS
1	electronic_Sub	Electronic Copy of Submittals in PDF (Portable Document Format) complete with Bookmarks and an Indexed Table Of Contents.
1	14-69 98 96	PARTS LISTS AND MANUALS
1	electronic_OM	Electronic Copy of Operations & Maintenance Manual in PDF (Portable Document Format) with Bookmarks and Indexed Table Of Contents.

MIXER

Qty	Part Number	Description
2	4620.490-YYYY	Flygt Model SR-4620 Submersible Mixer460 Volt / 3 phase / 60 Hz 2.3 HP 1685 RPM motor, Prop 15° with Jet ring, 100 Ft. length of SUBCAB 4G2,5+2x1,5 submersible cable, C/W FLS leakage detector, Explosion proof
2	00ZZZZ0	5 YEAR WARRANTY = 1.5 YEAR STANDARD + 3.5 YEAR EXTENDED

MIXER SENSOR RELAY

Qty	Part Number	Description
2	14-40 71 29	MINI-CASII/FUS 120/24VAC,24VDC
2	14-40 70 97	SOCKET,11 PIN OCTAL DIN MOUNT



MIXER ACCESSORIES

Qty	Part Number	Description
2	00ZZZZ0	KIT,SYSTEM IV-2" FLOOR MOUNT + 60'CABLE, 2 SUPPORTS 14-589230
2	14-58 79 17	HOIST,PORTABLE ASSEMBLY S.S.
2	14-58 79 19	SOCKET,WALL ASSEMBLY 316 SS

MIXER SERVICES

Qty	Part Number	Description
2	14-69 00 09A	START UP,FLYGT,NO TAX 1-TP MODELS: 3000,7000,8000
2	14-69 94 94	TEST FAL 2.2 3001-5570-7000 + DEFAULT PLOTTED FAL 15-900006
1	14-69 98 98	SUBMITTALS
1	electronic_Sub	Electronic Copy of Submittals in PDF (Portable Document Format) complete with Bookmarks and an Indexed Table Of Contents.
1	14-69 98 96	PARTS LISTS AND MANUALS
1	electronic_OM	Electronic Copy of Operations & Maintenance Manual in PDF (Portable Document Format) with Bookmarks and Indexed Table Of Contents.

Total Price \$ 805,193.93

Freight Charge \$ 40,272.00

Total Price \$ 845,465.93

Terms & Conditions

This order is subject to the Standard Terms and Conditions of Sale – Xylem Americas effective on the date the order is accepted which terms are available at <http://www.xyleminc.com/en-us/Pages/terms-conditions-of-sale.aspx> and incorporated herein by reference and made a part of the agreement between the parties.

Purchase Orders: Please make purchase orders out to: Xylem Water Solutions USA, Inc.

Freight Terms: 3 DAP - Delivered At Place 08 - Jobsite (per IncoTerms 2020)

See Freight Payment (Delivery Terms) below.

Taxes: State, local and other applicable taxes are not included in this quotation.

Back Charges: Buyer shall not make purchases nor shall Buyer incur any labor that would result in a back charge to Seller without prior written consent of an authorized employee of Seller.

Shortages: Xylem will not be responsible for apparent shipment shortages or damages incurred in shipment that are not reported within two weeks from delivery to the jobsite. Damages should be noted on the receiving slip and the truck driver advised of the damages. Please contact our office as soon as possible to report damages or shortages so that replacement items can be shipped and the appropriate claims made.

Terms of Delivery: PP/Add Order Position



Validity: This Quote is valid until September 31, 2022 based on a March 11, 2022 issue date. A 5% price increase will be applied on September 31, 2022 and quarterly thereafter if 100% of the order is not released for production by this date. Xylem reserves the right to adjust the cost and validity if the scope changes.

Terms of Payment: 90% N60 after invoice date; 10% NTE 120 after initial invoice date. Xylem's payment shall not be dependent upon Purchaser being paid by any third party unless Owner denies payment due to reasons solely attributable to items related to the equipment being provided by FLYGT.

Schedule: Delivery lead times are XX weeks after receipt of submittal approval and order acceptance.

Submittals: 6-8 weeks after receipt of order.

Pumps: 16-20 weeks after receipt of signed submittals and approved contract.

Controls: 12-16 weeks after receipt of signed submittals and approved contract.

Accessories: 9-12 weeks after receipt of signed submittals and approved contract

COVID 19: Our current delivery lead-times are forecasted estimates only due to the outbreak of the COVID-19 virus pandemic and its global effects on commerce, supply chain, and logistics. Xylem will, however, use all commercially reasonable efforts to minimize any delivery delay impacts.

Sincerely,

Chris Miller, P.E.
Sales Representative

Cell: (678)381-3878 <Best
chris.miller@xylem.com





Customer Acceptance

This order is subject to the Standard Terms and Conditions of Sale – Xylem Americas effective on the date the order is accepted which terms are available at <http://www.xyleminc.com/en-us/Pages/terms-conditions-of-sale.aspx> and incorporated herein by reference and made a part of the agreement between the parties.

A signed copy of this Quote is acceptable as a binding contract.

Purchase Orders: Please make purchase orders out to: Xylem Water Solutions USA, Inc.

Quote #: 2022-ATL-0168 Alternate 1, Version 3
Customer Name: CITY OF DALLAS
Job Name: NP3312 215HP
Total Amount: \$ 805,193.93
(excluding freight)

Signature: _____ Name: _____
(PLEASE PRINT)

Company/Utility: _____ PO: _____

Address: _____ Date: _____

_____ Phone: _____

_____ Email: _____

_____ Fax: _____



NP 3312/746 3~ 670

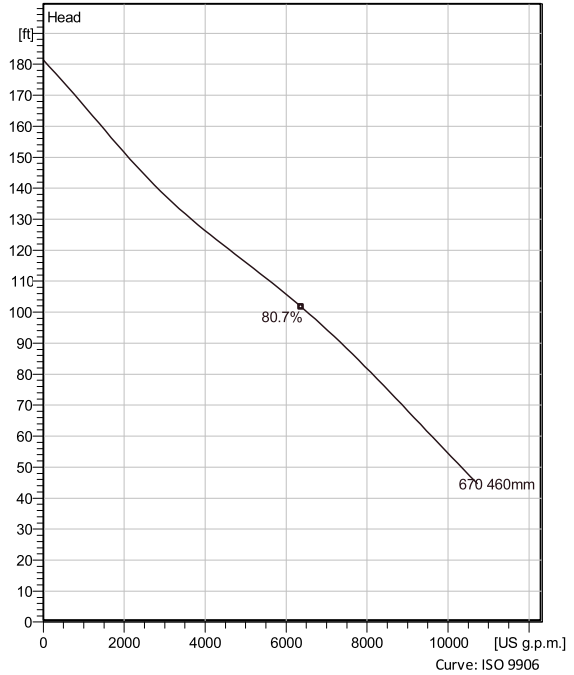
Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Modular based design with high adaptation grade.



Technical specification



Curves according to: Water, pure Water, pure [100%], 39.2 °F, 62.42 lb/ft³, 1.6891E-5 ft²/s



Configuration

Motor number N0746.000 43-44-61D-W IE3 215hp	Installation type P - Semi permanent, Wet
Impeller diameter 460 mm	Discharge diameter 12 inch

Pump information

Impeller diameter 460 mm
Discharge diameter 12 inch
Inlet diameter 350 mm
Maximum operating speed 1185 rpm
Number of blades 3
Max. fluid temperature 40 °C

Materials

Impeller Hard-Iron™

Project	Created by Jim Vukich
Block	Created on 3/7/2022 Last update 3/7/2022

NP 3312/746 3~ 670

Technical specification



Motor - General

Motor number N0746.000 43-44-6ID-W IE3 215hp	Phases 3~	Rated speed 1185 rpm	Rated power 215 hp
ATEX approved FM	Number of poles 6	Rated current 254 A	Stator variant 1
Frequency 60 Hz	Rated voltage 460 V	Insulation class H	Type of Duty
Version code 000			

Motor - Technical

Power factor - 1/1 Load 0.83	Motor efficiency - 1/1 Load 95.8 %	Total moment of inertia 88.9 lb ft ²	Starts per hour max. 0
Power factor - 3/4 Load 0.78	Motor efficiency - 3/4 Load 96.4 %	Starting current, direct starting 1540 A	
Power factor - 1/2 Load 0.67	Motor efficiency - 1/2 Load 96.6 %	Starting current, star-delta 515 A	

Project
Block

Created by Jim Vukich
Created on 3/7/2022 **Last update** 3/7/2022

NP 3312/746 3~ 670

Performance curve

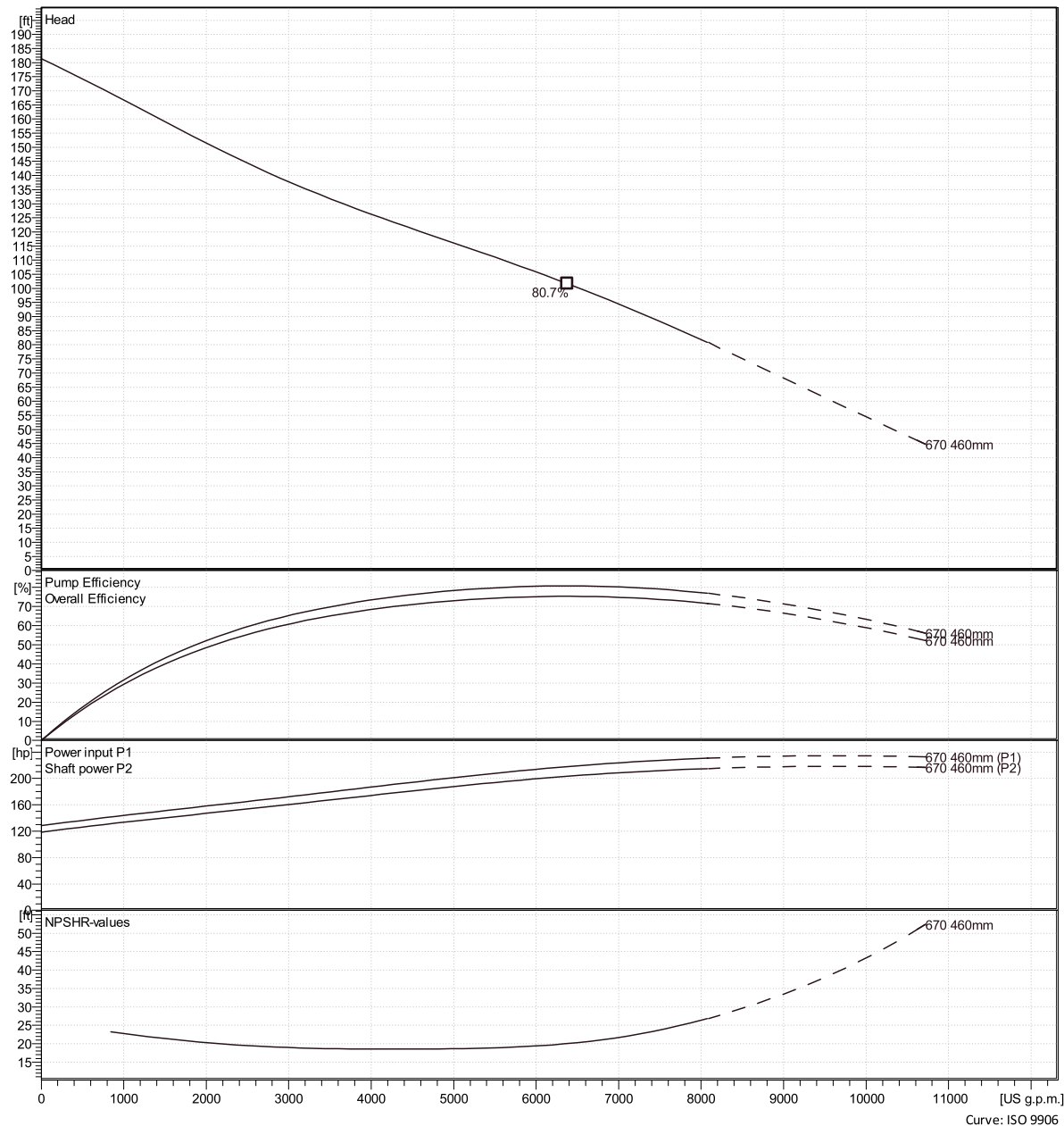


Duty point

Flow

Head

Curves according to: Water, pure Water, pure [100%], 39.2 °F, 62.42 lb/ft³, 1.6891E-5 ft²/s



Curve: ISO 9906

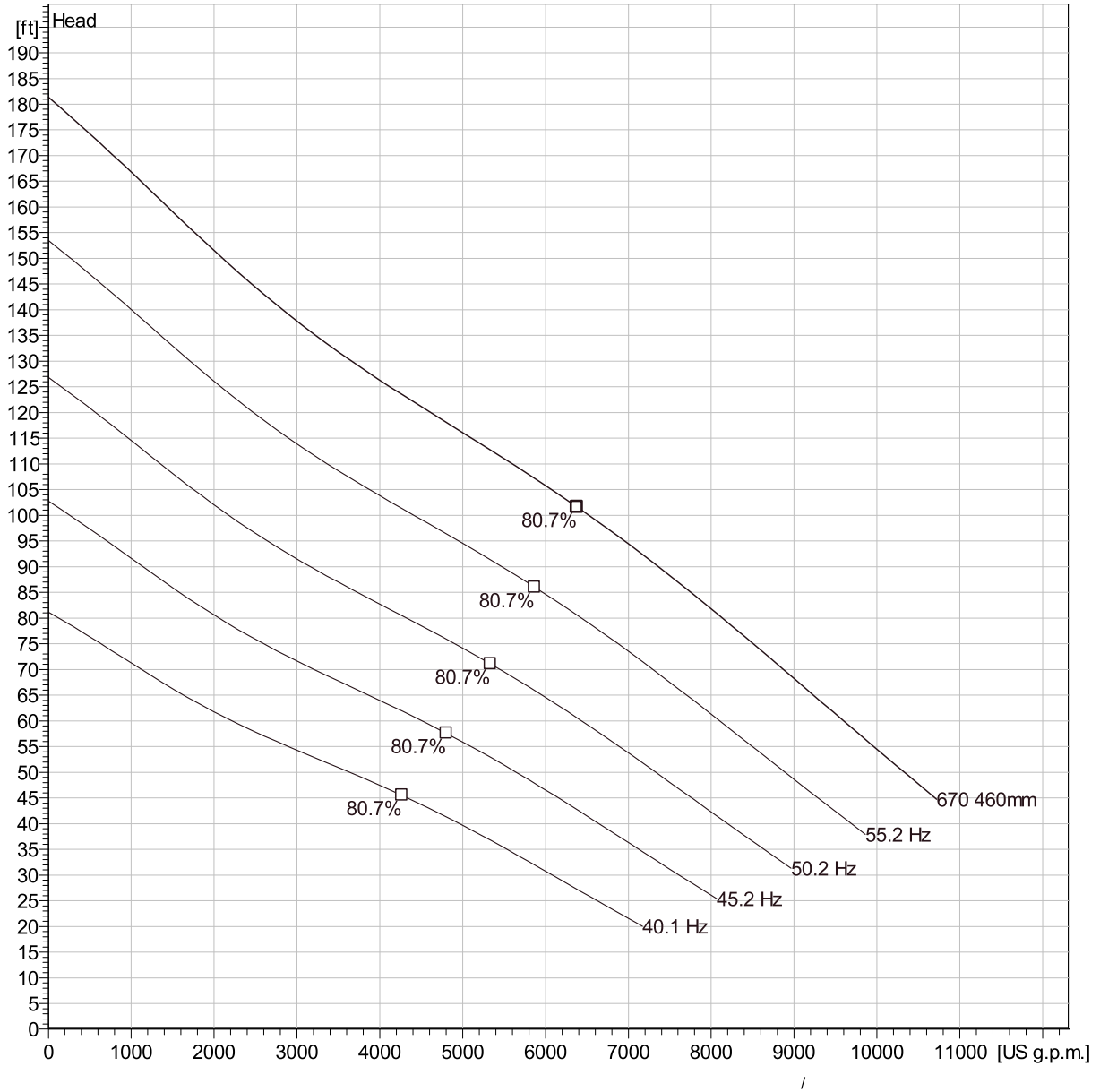
Jim Vukich			
Created on	3/7/2022	Last update	3/7/2022

NP 3312/746 3~ 670

Duty Analysis



Curves according to: Water, pure [100%]; 39.2°F; 62.42lb/ft³; 1.6891E-5ft²/s



Operating characteristics

Pumps / Systems	Flow US g.p.m.	Head ft	Shaft power hp	Flow US g.p.m.	Head ft	Shaft power hp	Hydr.eff.	Spec. Energy kWh/US MG	NPSHre ft
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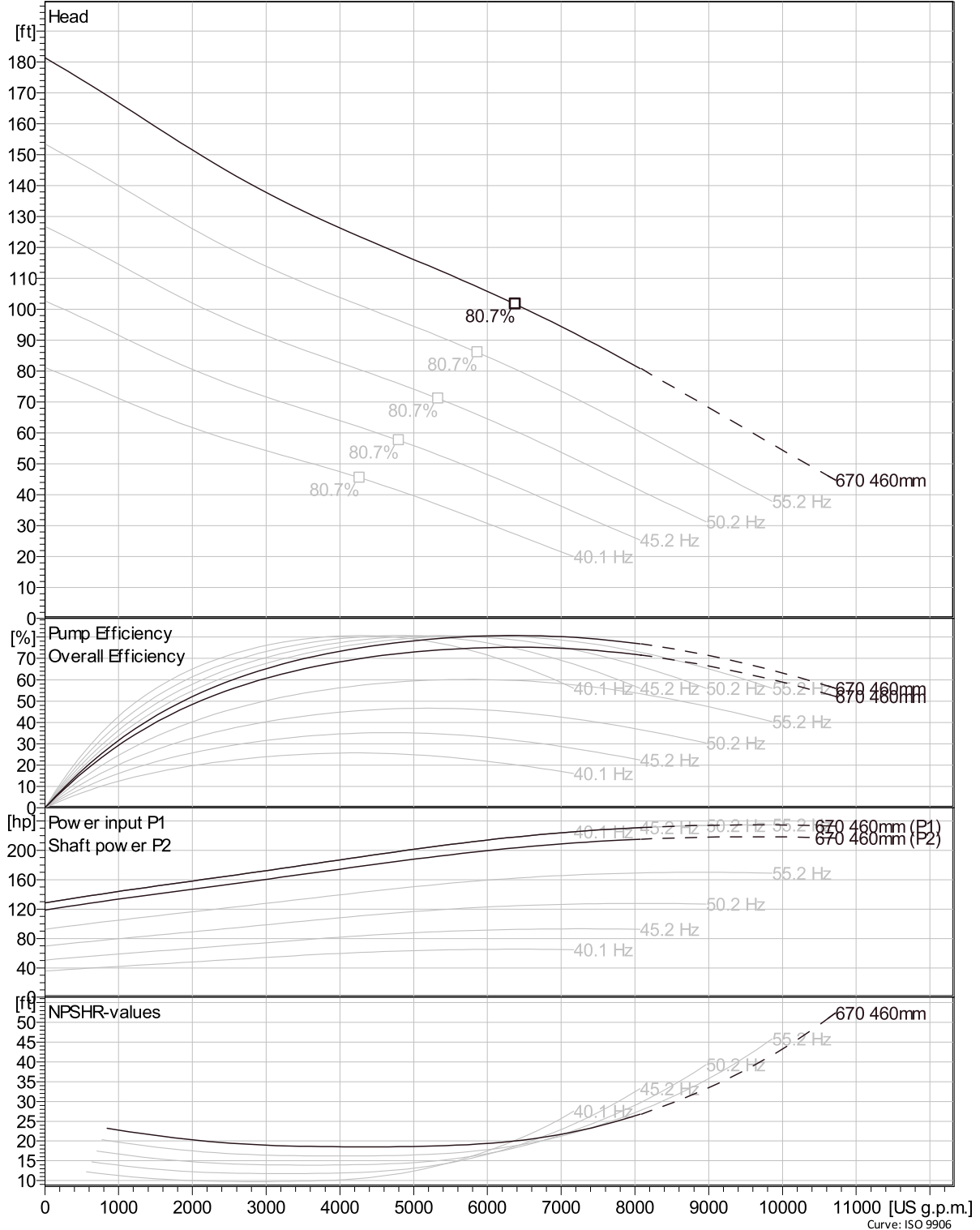
Project	Created by	Jim Vukich
Block	Created on	3/7/2022
	Last update	3/7/2022

NP 3312/746 3~ 670

VFD Curve



Curves according to: Water, pure, 39.2 °F, 62.42 lb/ft³, 1.6891E-5 ft²/s



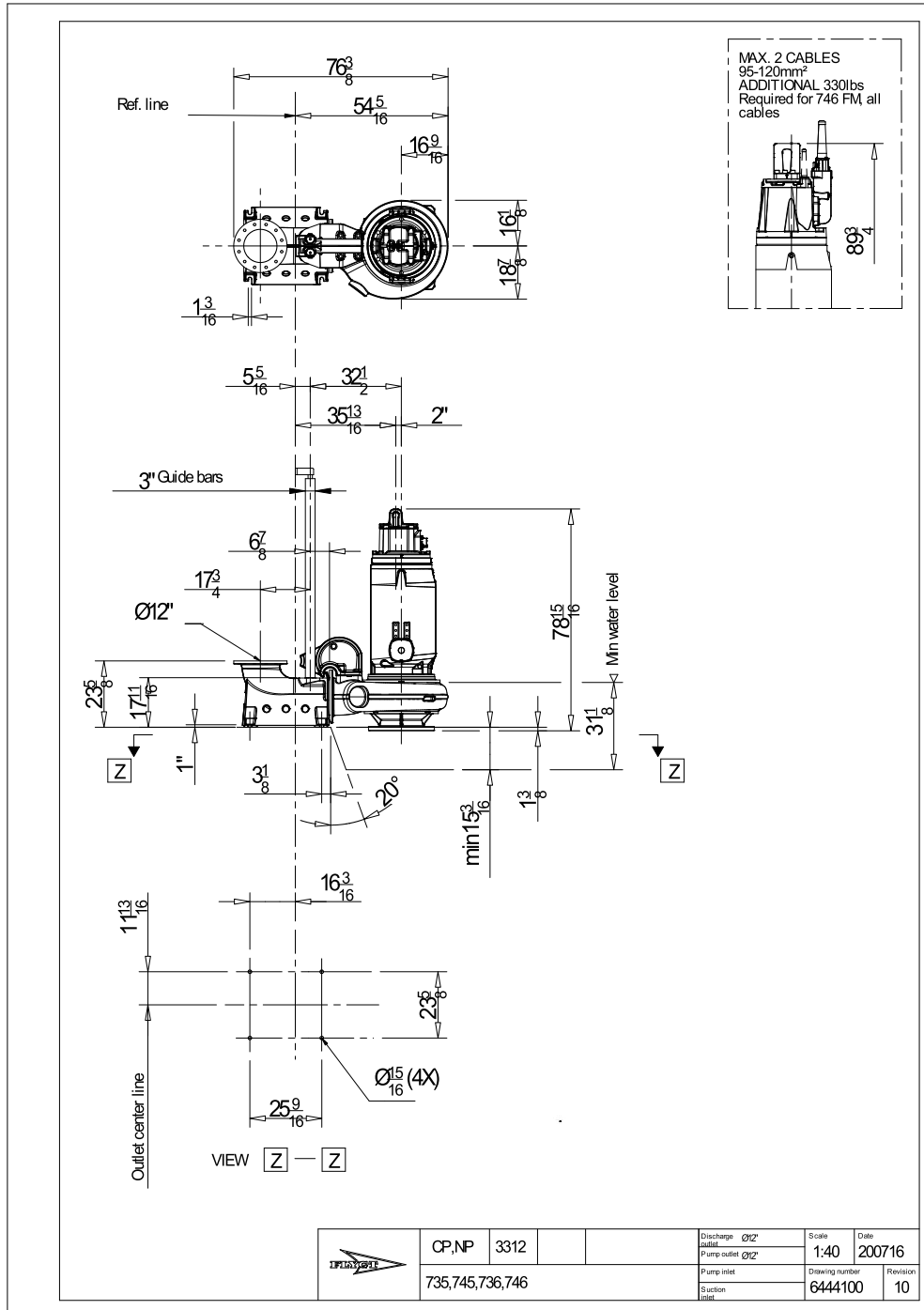
Project
Block

Created by Jim Vukich
Created on 3/7/2022 Last update 3/7/2022

Curve: ISO 9906

NP 3312/746 3~ 670

Dimensional drawing



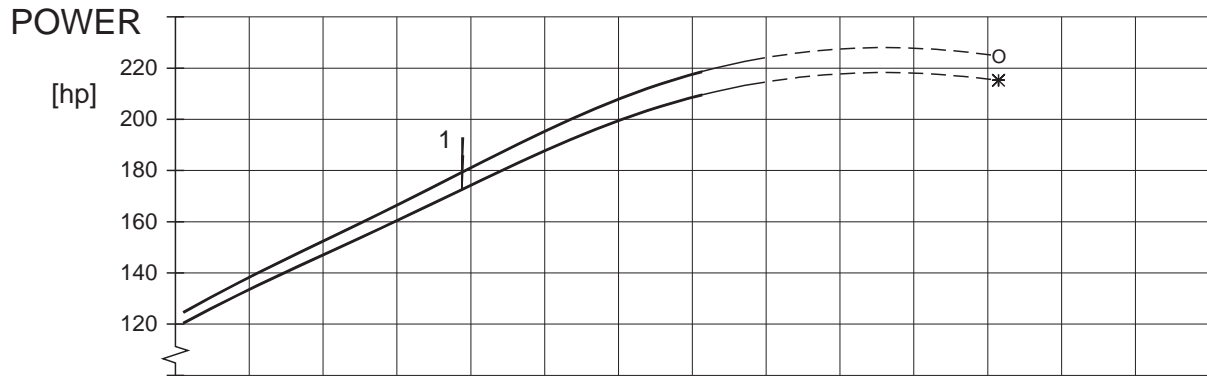
Project
Block

Created by Jim Vukich
Created on 3/7/2022 Last update 3/7/2022



PERFORMANCE CURVE

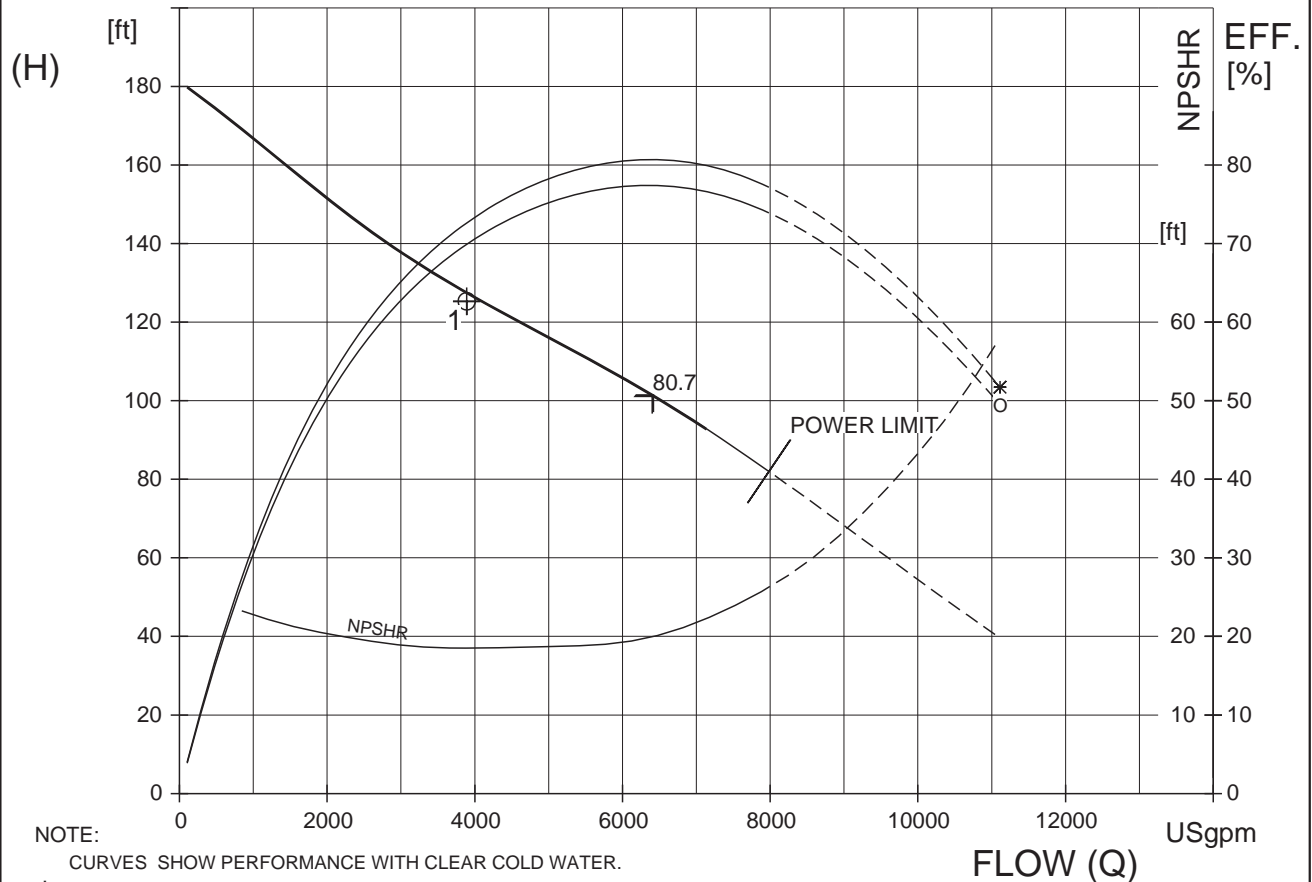
DATE 2022-03-07	PROJECT:			ISSUE 80	PROD N3312/746 FM
NO. OF BLADES..... 3	TOT.MOM.OF INERTIA..... 3.74 KGM²	POLES 6	FREQ. 60 HZ	CURVE NO 63-670	
	RATED SPEED..... 1185 RPM	VOLTAGE..... 460 V	MOTOR SHAFT POWER..... 215 hp	IMPELLER DIAMETER 460 mm	
		STARTING TORQUE..... 1625 NM	MAX TORQUE..... 3573 NM	MOTOR TYPE 43-44-6ID /01 (12)	
MOTOR COS PHI 0.83	1/1-LOAD 0.83	3/4-LOAD 0.78	1/2-LOAD 0.67	RATED CURRENT..... 254 A	GEAR TYPE
MOTOR EFFICIENCY 95.8%	95.8%	96.4%	96.6%	STARTING CURRENT..... 1545 A	RATIO
GEAR EFFICIENCY					



DUTY POINTs: FLOW[USgpm] HEAD[ft] POWER [hp] EFF. [%] NPSHR[ft] GUARANTEE) -> No guarantee

3890 125.3 (< 186) (<179) 70.2 (72.9) 18.9 HI grade 2B eff. (ANSI/HI 11.6:2012)

HEAD



NOTE:

CURVES SHOW PERFORMANCE WITH CLEAR COLD WATER.

* : PUMP EFFICIENCY / SHAFT POWER

O : OVERALL EFFICIENCY / INPUT POWER

NPSHR = NPSH3 + min. operational margin

unix AUTHOR: fus306 PECU rev:21.14/CUPC

USA

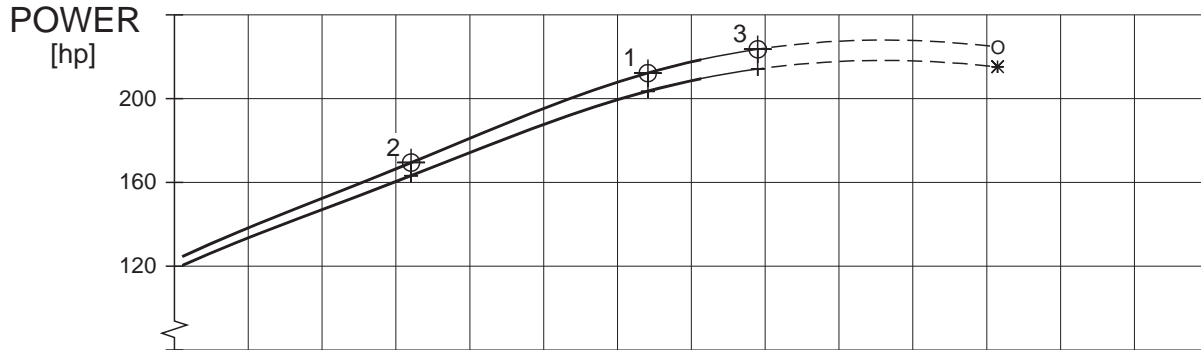


PERFORMANCE CURVE

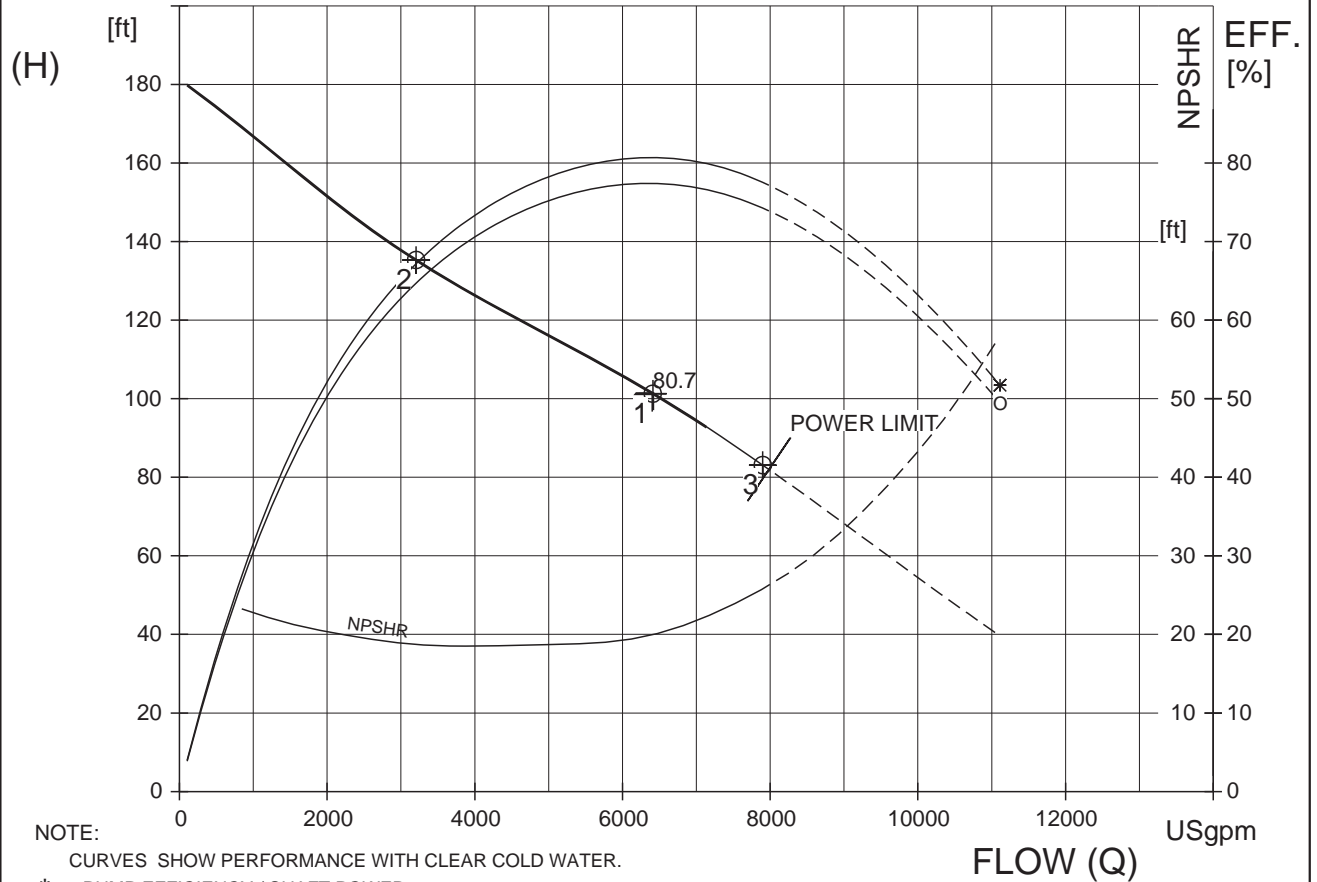


PERFORMANCE CURVE

DATE 2022-03-07	PROJECT:		ISSUE 80	PROD N3312/746 FM
NO. OF BLADES..... 3	TOT.MOM.OF INERTIA..... 3.74 KGM²	POLES 6	FREQ. 60 HZ	CURVE NO 63-670
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		STARTING TORQUE..... 1625 NM	MAX TORQUE..... 3573 NM	MOTOR TYPE 43-44-6ID /01 (12)
MOTOR COS PHI 0.83	1/1-LOAD 0.83	3/4-LOAD 0.78	1/2-LOAD 0.67	GEAR TYPE
MOTOR EFFICIENCY 95.8%	95.8%	96.4%	96.6%	RATIO
GEAR EFFICIENCY				
			STARTING CURRENT..... 1545 A	



HEAD



USA unix AUTHOR: fus306 PECU rev:21.14/CUPC



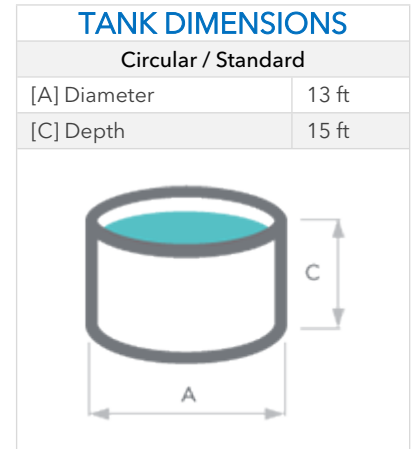
PERFORMANCE CURVE

MIXING SELECTION REPORT

Quote Number: 3556-210825-002 (Rev. 0)
 Project:
 Position: Dallas Westside - Initial

INPUT DATA	
Wastewater Treatment > Biological Treatment Mixing	
Biological Treatment	Anox or Anaerobe or Deox - No Aeration
Type of pre-treatment	No screening or screen > ½ inch
Outlet location in tank	Top
Recommended average velocity	1.05 ft/s
Accept recommended avg. velocity	Yes

PRODUCT DATA	
Mixer type	4620 without Jetring
Number of mixers	1
Thrust produced/mixer	297 N
Total thrust produced	297 N
Total thrust required	177 N
Power uptake / mixer	1.8 kW (22 % margin to input power)
Total power uptake	1.8 kW
Propeller diameter	8.31 in
Propeller speed	1675 RPM
Number of blades	2
Rec. min Submergence	2.3ft
Hub design	2
Propeller material	Stainless steel
Propeller code	042113SF



MOTOR DATA	
Rated Shaft Power	2.3 Hp
Mains frequency	60 Hz
Number Of Phases	3
Rated voltage	460 V Y
Number Of Poles	4
Max Input Power	2.3 kW
Approval	STD
Rated Temperature	40 °C / 104 °F

ISO 21630 VALUES	
Nominal thrust	305 N
ISO Input Power	1.95 kW
Efficiency	156 N/kW

Mixer performance data are based on the configuration 400 V Y for 50 Hz and 460 V Y for 60 Hz, for other configurations the data may be different. For mixer performance tolerances, refer to the mixer data chart. Xylem guarantees that the proposed mixer selection will perform the specified duty when all mixers are operating positioned according to Xylem's recommendation. The selection is a function of the input data and the supplier of the data is fully responsible for its correctness.

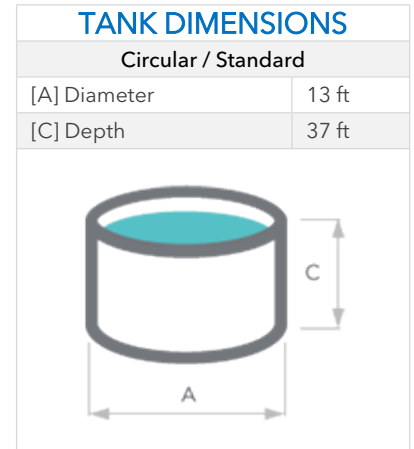


MIXING SELECTION REPORT

Quote Number: 3556-210825-002 (Rev. 0)
 Project:
 Position: Dallas Westside - Future

INPUT DATA	
Wastewater Treatment > Biological Treatment Mixing	
Biological Treatment	Anox or Anaerobe or Deox - No Aeration
Type of pre-treatment	No screening or screen > ½ inch
Outlet location in tank	Top
Recommended average velocity	1.05 ft/s
Accept recommended avg. velocity	Yes

PRODUCT DATA	
Mixer type	4620 without Jetring
Number of mixers	2
Thrust produced/mixer	297 N
Total thrust produced	595 N
Total thrust required	467 N
Power uptake / mixer	1.8 kW (22 % margin to input power)
Total power uptake	3.6 kW
Propeller diameter	8.31 in
Propeller speed	1675 RPM
Number of blades	2
Rec. min Submergence	2.3ft
Hub design	2
Propeller material	Stainless steel
Propeller code	042113SF



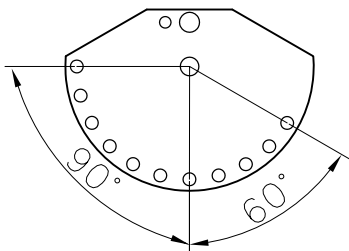
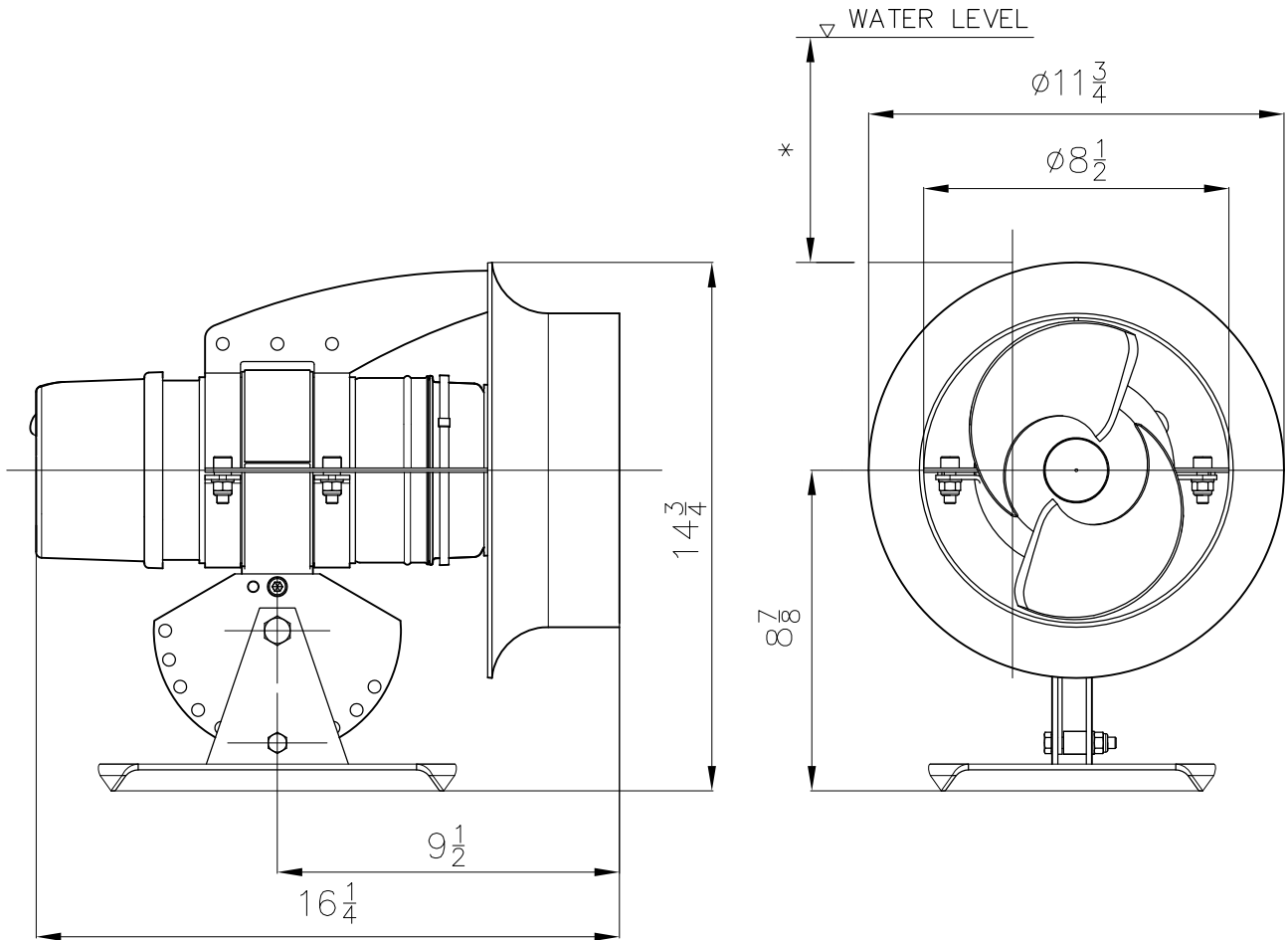
MOTOR DATA	
Rated Shaft Power	2.3 Hp
Mains frequency	60 Hz
Number Of Phases	3
Rated voltage	460 V Y
Number Of Poles	4
Max Input Power	2.3 kW
Approval	STD
Rated Temperature	40 °C / 104 °F

ISO 21630 VALUES	
Nominal thrust	305 N
ISO Input Power	1.95 kW
Efficiency	156 N/kW

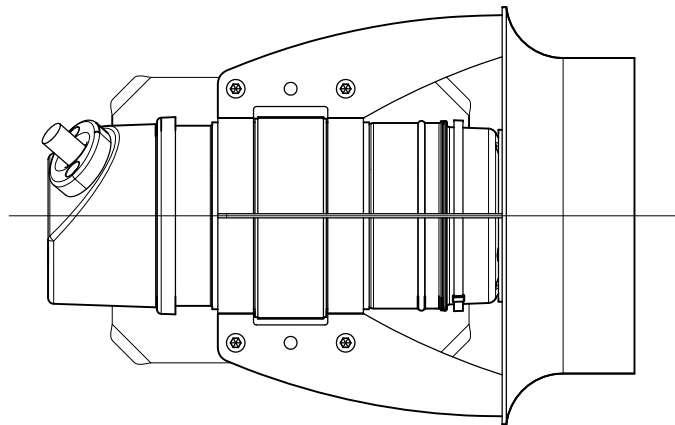
Mixer performance data are based on the configuration 400 V Y for 50 Hz and 460 V Y for 60 Hz, for other configurations the data may be different. For mixer performance tolerances, refer to the mixer data chart. Xylem guarantees that the proposed mixer selection will perform the specified duty when all mixers are operating positioned according to Xylem's recommendation. The selection is a function of the input data and the supplier of the data is fully responsible for its correctness.



* 29"MIN, WITH VORTEX 12"MIN



NOTE:
MIXER CAN BE ANGLED ABOUT ITS CENTERLINE
TO 11 POSITIONS, INCREMENTS ARE 15°.



Weight (lbs)	
Mixer	
50 MAX	

 AUTOCAD DRAWING	Denomination	Drawn by NK	Checked by Fre	Date 100301
	Dimensional drwg	Scale	Reg no	
	SR 4620.410,490	7287500		2
	Bottom Bracket, Jetring			



Powering Business Worldwide

Pumpkinvine Creek Regional LS (West Dallas)

Submittal for Approval

Negotiation Number

AT900208X2K1

Volume 1 of 1

Equipment:

Adjustable Frequency Drives

Enclosed Control (NEMA)



Powering Business Worldwide

Main Table of Contents

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2.2 Drawings	46
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Powering Business Worldwide

Adjustable Frequency Drives



Powering Business Worldwide

Bill of Material



Detail Bill of Material

Project Name:	Pumpkinvine Creek Regional LS (West Dallas)	Negotiation No:	AT900208X2K1
General Order No:		Alternate No:	0000

Item No.	Qty	Product	Description
	3	Drives - Enclosed	EGF Passive Filtered Enclosed Drive w/ 5% Dual DC Link Choke, 250 HP (187 KW) Low Overload (IL) Rated, 480VAC Three Phase Input, NEMA 1 Enclosure

Catalog No EGF3024A130DA10000*
Designation PASSIVE FLTR 250HP VFD

Catalog No	Qty	List of Materials
Isolation Fuses	1	Isolation Fuses
Circuit Breaker	1	Circuit Breaker
Engineered Options	1	Engineered Options
--->100KAIC Rated	1	--->100KAIC Rated
DV/DT Filter	1	DV/DT Filter
Filter Isolation Contactor	1	Filter Isolation Contactor
HOA Switch	1	22mm HOA Switch - M22 Series
Light Kit	1	22mm Power On (White), Drive Run (Green), & Drive Fault (Red) Light Kit - M22 Series
Control Relay	2	Control Relay
Standard Enclosure	1	EX Enclosure
Varnished Boards (Standard)	1	Varnished Boards (Standard)

Eaton Selling Policy 25-000 applies.

All orders must be released for manufacture within 90 days of date of order entry. If approval drawings are required, drawings must be returned approved for release within 60 days of mailing. If drawings are not returned accordingly, and/or if shipment is delayed for any reason, the price of the order will increase by 1.0% per month or fraction thereof for the time the shipment is delayed.

Seller shall not be responsible for any failure to perform, or delay in performance of, its obligations resulting from the COVID-19 pandemic or any future epidemic, and Buyer shall not be entitled to any damages resulting thereof.



Powering Business Worldwide

Drawings

General Information: Drives - Enclosed

Drive Schedule

Item	Qty	Equipment ID	Catalog Number	Output HP	Output Amps	Output Voltage
	3	PASSIVE FLTR 250HP VFD	EGF3024A130DA1 0000*	250	302	480VAC Three Phase

Item Information

Design Series:	Enclosed Passive Filtered DG1 Drive
Output Power:	250 HP (187 KW)
Rated Output Current (Amps):	302
Input Voltage:	480VAC Three Phase
Input Frequency:	45 to 66 Hz
Output Voltage:	480VAC Three Phase
Output Frequency:	0 to 320 Hz
Branch Protection:	
Short Circuit Current Rating:	100KAIC
Enclosure NEMA Rating:	NEMA 1
Enclosure Size:	EX
Drive Frame Size:	FR6
Onboard Comms:	BACnet MS/TP, Ethernet/IP, Modbus, & Modbus TCP
Optional Comms:	None

Enclosure Information

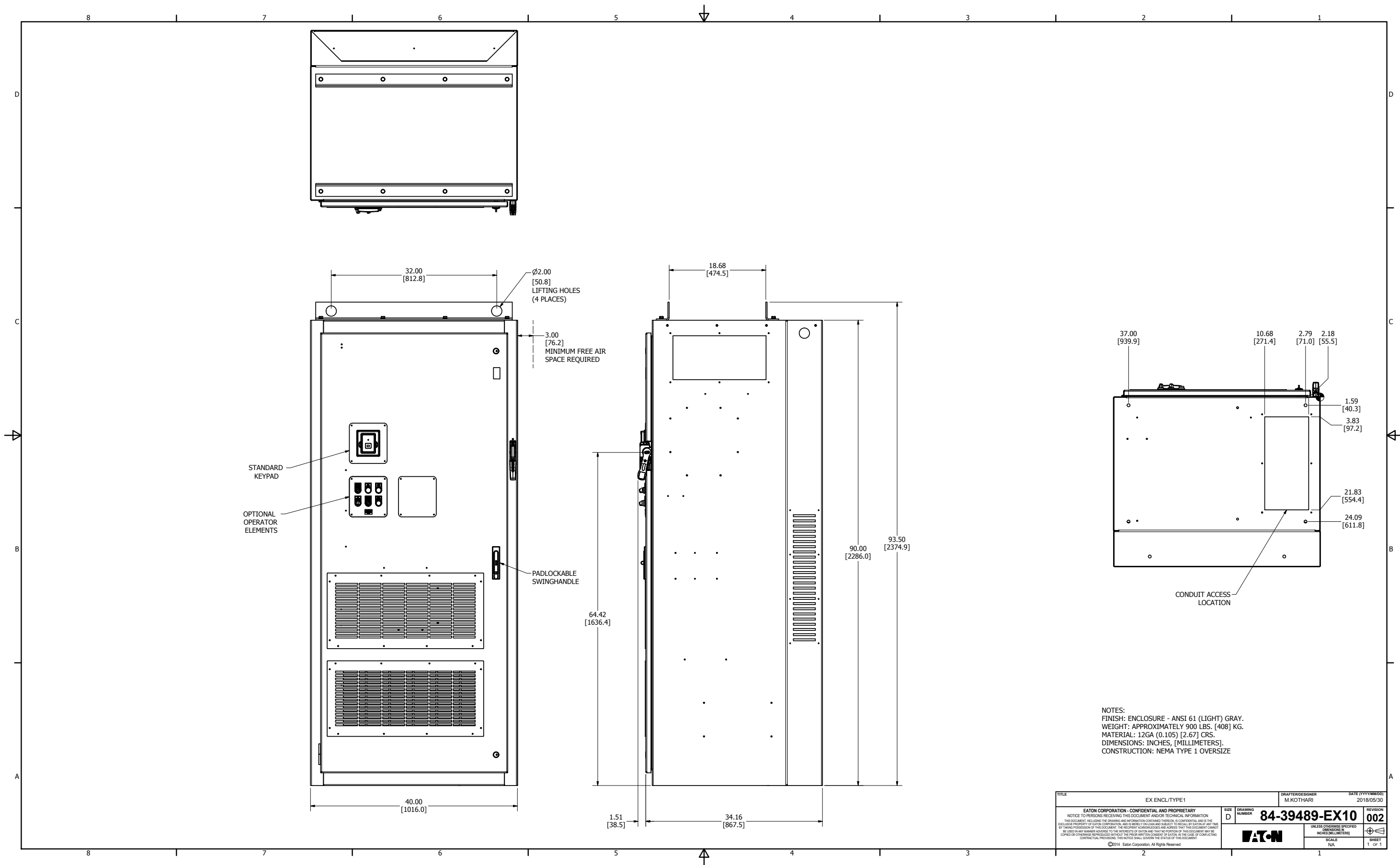
NEMA Rating:	NEMA 1
Height (in):	93.5
Width (in):	40
Depth (in):	35.67
Weight (lbs):	2000

Circuit Protection

KDC3400
3TA400K
3/0-250 (2)
400

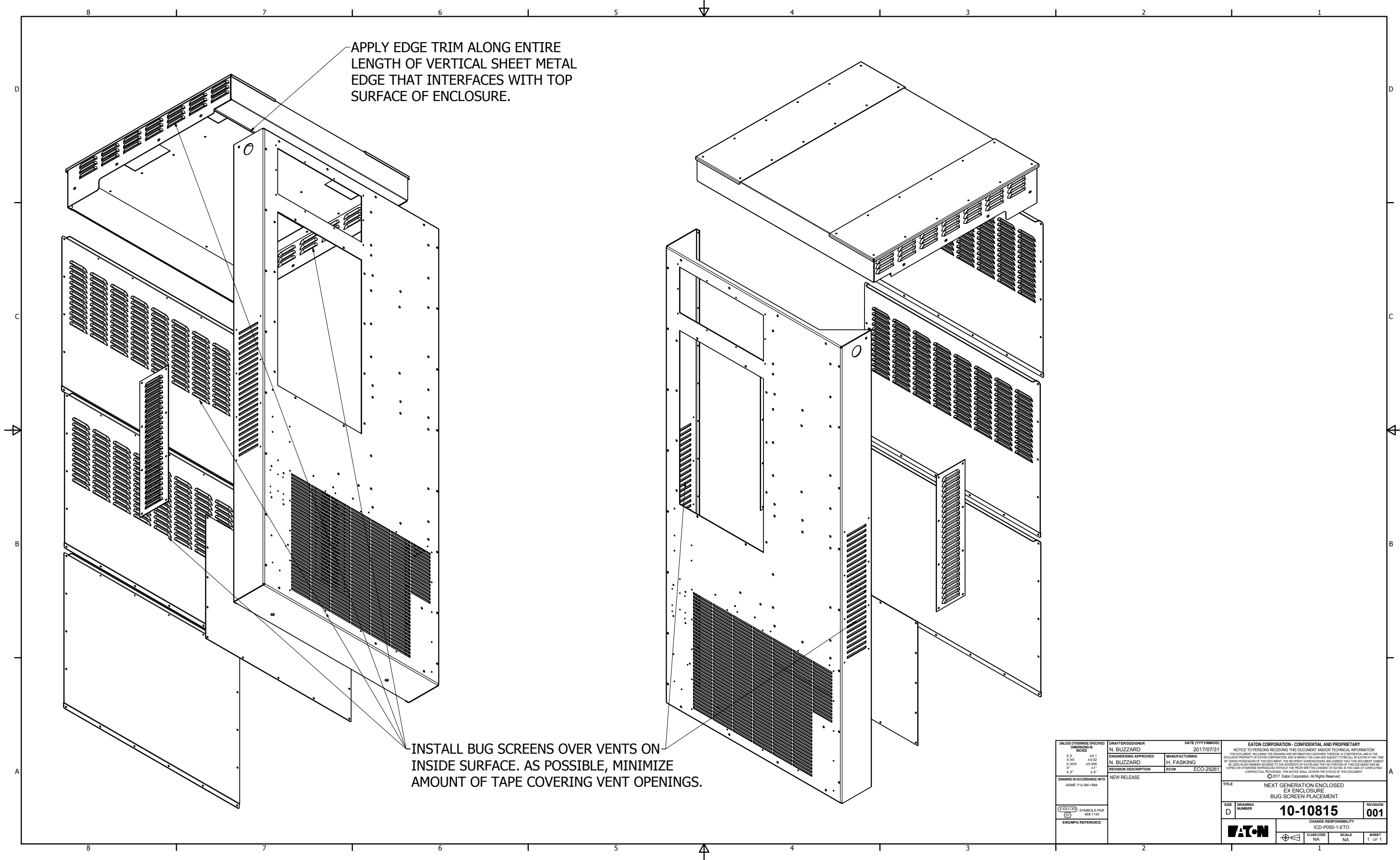
400

The information on this document is created by Eaton Corporation. It is disclosed in confidence and it is only to be used for the purpose in which it is supplied.	PREPARED BY	DATE	Eaton			
	Kyle Molnar	3/9/2022				
	APPROVED BY	DATE	JOB NAME	Pumpkinvine Creek Regional LS (West Dallas)		
			DESIGNATION	PASSIVE FLTR 250HP VFD		
	VERSION	TYPE	DRAWING TYPE			
	10.0.11.0	Drives - Enclosed	Customer Appr.			
NEG-ALT Number	REVISION	DWG SIZE	G.O.	ITEM	SHEET	
AT900208X2K1-0000	0	A			1 of 1	



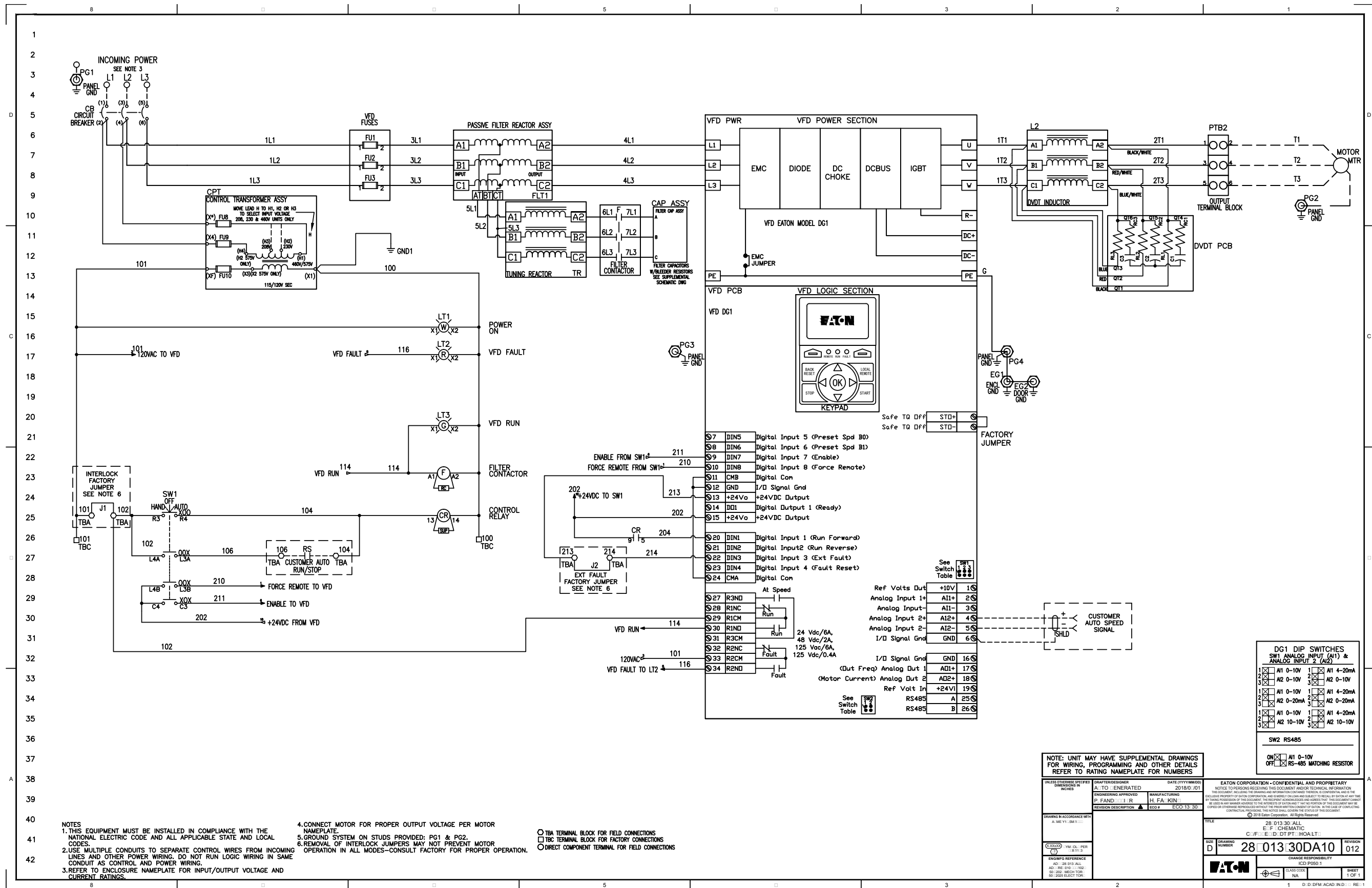
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UNLESS OTHERWISE SPECIFIED			SCALE NA		
SHEET			SHEET		
1 OF 1			1 OF 1		

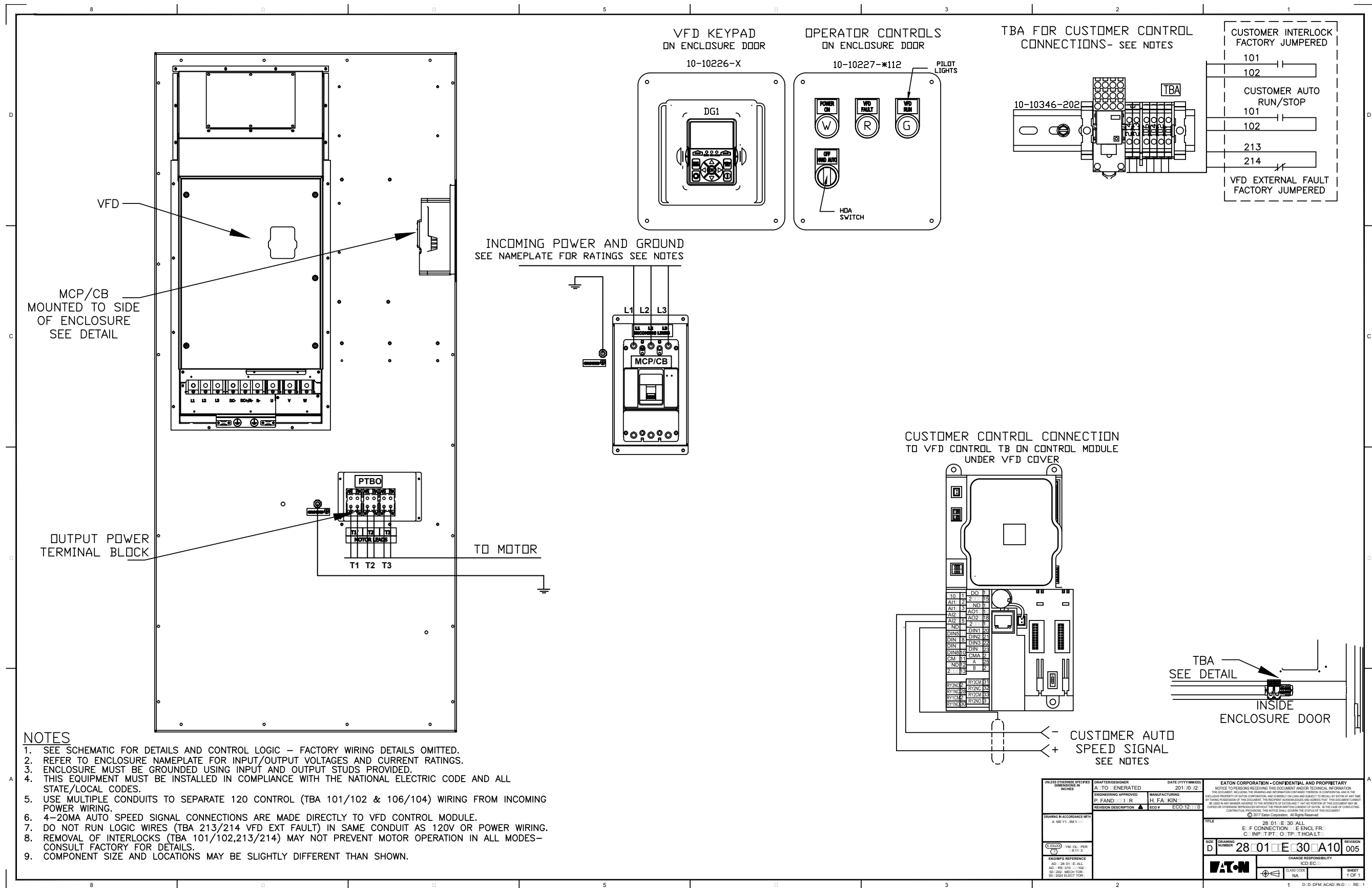
GO/NEG-Alt-Date:	AT900208X2K1-0000-3/9/2022	Job Name:	Pumpkinvine Creek Regional LS (West Dallas)
Item Number:	Catalog Number: EGF3024A130DA10000*	Designation:	PASSIVE FLTR 250HP VFD



UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES	DRAFTER/DESIGNER N. BUZZARD		DATE (YYYYMMDD) 2017/07/31	EATON CORPORATION - CONFIDENTIAL AND PROPRIETARY NOTICE TO PERSONS RECEIVING THIS DOCUMENT AND/OR TECHNICAL INFORMATION THIS DOCUMENT INCLUDING THE DRAWING AND INFORMATION CONTAINED HEREIN IS CONFIDENTIAL AND IS THE EXCLUSIVE PROPERTY OF EATON CORPORATION AND IS HEREBY ON LOAN AND SUBJECT TO RECALL BY EATON AT ANY TIME. BY TAKING POSSESSION OF THIS DOCUMENT THE RECIPIENT ACKNOWLEDGES AND AGREES THAT THIS DOCUMENT CANNOT BE USED IN ANY MANNER ADVERSE TO THE INTERESTS OF EATON AND THAT NO PORTION OF THIS DOCUMENT MAY BE COPIED OR OTHERWISE REPRODUCED WITHOUT THE PRIOR WRITTEN CONSENT OF EATON IN THE CASE OF CONTRACTING CONTRACTUAL PROVISIONS, THE NOTICE SHALL GOVERN THE STATUS OF THIS DOCUMENT. © 2017 Eaton Corporation. All Rights Reserved.
	X.X .001	ENGINEERING APPROVED N. BUZZARD	MANUFACTURING H. FASKING	
X.XXX .0005	REVISION DESCRIPTION ECCM		ECCO-29281	
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X.X" .1"	NEW RELEASE			
0" .1"	TITLE NEXT GENERATION ENCLOSED EX ENCLOSURE BUG SCREEN PLACEMENT			
0" .1"	SIZE D		REVISION 001	
0" .1"	CHANGE RESPONSIBILITY ICD-P050-1-ETG			
0" .1"	CLASS CODE NA	SCALE NA	SHEET 1 OF 1	

GO/NEG-Alt-Date: AT900208X2K1-0000-3/9/2022	Job Name: Pumpkinvine Creek Regional LS (West Dallas)
Item Number:	Catalog Number: EGF3024A130DA10000*
	Designation: PASSIVE FLTR 250HP VFD





- NOTES**
- SEE SCHEMATIC FOR DETAILS AND CONTROL LOGIC - FACTORY WIRING DETAILS OMITTED.
 - REFER TO ENCLOSURE NAMEPLATE FOR INPUT/OUTPUT VOLTAGES AND CURRENT RATINGS.
 - ENCLOSURE MUST BE GROUNDED USING INPUT AND OUTPUT STUDS PROVIDED.
 - THIS EQUIPMENT MUST BE INSTALLED IN COMPLIANCE WITH THE NATIONAL ELECTRIC CODE AND ALL STATE/LOCAL CODES.
 - USE MULTIPLE CONDUITS TO SEPARATE 120 CONTROL (TBA 101/102 & 106/104) WIRING FROM INCOMING POWER WIRING.
 - 4-20MA AUTO SPEED SIGNAL CONNECTIONS ARE MADE DIRECTLY TO VFD CONTROL MODULE.
 - DO NOT RUN LOGIC WIRES (TBA 213/214 VFD EXT FAULT) IN SAME CONDUIT AS 120V OR POWER WIRING.
 - REMOVAL OF INTERLOCKS (TBA 101/102,213/214) MAY NOT PREVENT MOTOR OPERATION IN ALL MODES- CONSULT FACTORY FOR DETAILS.
 - COMPONENT SIZE AND LOCATIONS MAY BE SLIGHTLY DIFFERENT THAN SHOWN.

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DRAWING IN ACCORDANCE WITH A. ME Y1-SM 1111	ENGINEERING APPROVED P. FAND - J. R.	MANUFACTURING H. FA - K.N.	TITLE 28.01 E.30 ALL E. F CONNECTION - E ENCL FR: C. IND. T. PT. Q. TP. T. HOA. L. T.
ENGINING REFERENCE AD - 28.01 E. ALL AD - ME. 010 - 1102 80 - 202 MECH TOR: 60 - 202 ELECT TOR:	REVISION DESCRIPTION ECO # ECO T2 1 1	ECO # ECO T2 1 1	SIZE D 28.01 E.30 A10 005
	CHANGE RESPONSIBILITY CD EC		CLASS CODE NA
			SHEET 1 OF 1

GO/NEG-Alt-Date: AT900208X2K1-0000-3/9/2022	Job Name: Pumpkinvine Creek Regional LS (West Dallas)
Item Number:	Catalog Number: EGF3024A130DA10000*
	Designation: PASSIVE FLTR 250HP VFD



Powering Business Worldwide

Technical Documents

EGF Enclosed Drives



EGF Enclosed Drives

Product Description

Eaton's Enclosed EGF Drives combine harmonic distortion reduction and true power factor performance with the latest in Eaton adjustable frequency drive technology to deliver an industry-leading solution. This pre-engineered passive filtered solution prevents transformer overheating and overloading of breakers and feeders, which enables the application of adjustable frequency drives on generators and other high impedance power systems.

Features and Benefits

- Tuned passive filter
- Delivers 5–8% THD
- Generator compatible
- Uses the same DG1, SVX or SPX drive that is stocked in the warehouse
- Simple to retrofit
- Provides a low-impedance path to ground for the harmonic frequencies
- Meets IEEE 519-2014
- Excellent cost for performance
- Small footprint, compact enclosure design
- Insensitive to voltage imbalance
- Customizable cover control options
- Padlockable disconnect
- The PowerXL DG1 comes standard with the following communication protocols:
 - EtherNet/IP
 - Modbus/TCP
 - Modbus RTU
 - BACnet MS/TP

Standards and Certifications

- UL 508C



Contents

Description

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Wiring Diagram	V6-T2-313
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CFX Enclosed Drives	V6-T2-325
Enclosed 12-Pulse Drives	V6-T2-351
Enclosed 18-Pulse Drives	V6-T2-355
Enclosed Regenerative Drives	V6-T2-379

Communication Options

- PROFIBUS-DP
- LonWorks
- CANopen
- DeviceNet

Enclosure Ratings

- NEMA Type 1
- NEMA Type 12
- NEMA Type 3R

Mounting

- Wall mount
- Floor mount: 12-inch legs
- Floor mount: 22-inch legs

Product Range

- 480 V: 1–250 hp

2.11

Adjustable Frequency Drives

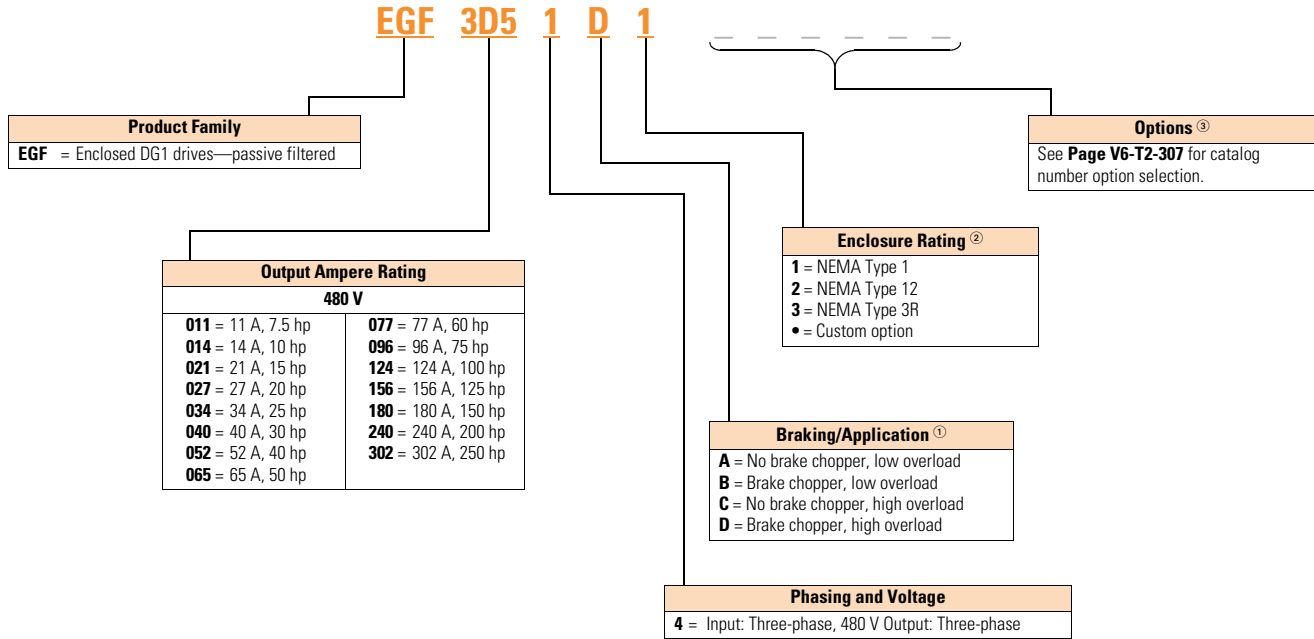
Clean Power Drives

Catalog Number Selection

Catalog Number Selection is for reference only. Not all option combinations may be available.

2

EGF Enclosed—Base Catalog Number



Notes

- ① Brake chopper is a factory-installed option only. Braking resistors sold separately. See DG1 drives starting on **Page V6-T2-59** for selection.
- ② Additional enclosure options including NEMA 4 and 4X are available. Please contact the factory for configuration and pricing.
- ③ Part number configuration continued on the following page.

Catalog Number Selection is for reference only. Not all option combinations may be available.

EGF Enclosed—Catalog Number Options

EGF 3D5 1 D 1

Base Catalog Number Example

See **Page V6-T2-306** for base catalog number selection.

Power Disconnect Options

- 0 = None
- 1 = MCP disconnect ^①
- 2 = Circuit breaker
- 3 = Circuit breaker/isolation fusing
- 5 = Circuit breaker/isolation fusing/SPD
- 8 = Circuit breaker/SPD
- A = Fused disconnect
- B = Fused disconnect/SPD
- E = Isolation fuses
- G = Isolation fuses/SPD
- = Custom option ^②

Bypass Options ^③

- 0 = None
- 1 = Manual HOA bypass
- 2 = Manual HOA bypass/isolation fusing
- 4 = Manual HOA bypass/isolation fusing/SPD
- 7 = Manual HOA bypass/SPD
- H = Manual HOA RVSS bypass
- J = Manual HOA RVSS bypass/isolation fusing
- L = Manual HOA RVSS bypass/isolation fusing/SPD
- P = Manual HOA RVSS bypass/SPD
- = Custom option ^②

Output Power Options ^④

- 0 = None
- A = Output contactor
- B = 3% Output reactor
- D = dV/dt filter
- E = 3% Output Reactor/output contactor
- G = dV/dt/output contactor
- = Custom option ^②

Control Options ^⑤

- 0 = None
- 1 = Speed pot
- 2 = Start-stop pushbutton
- 3 = Start-stop pushbutton with speed pot
- A = HOA switch
- B = Start-stop pushbutton with speed pot & HOA switch
- C = Start-stop pushbutton with HOA switch
- D = HOA switch with speed pot
- = Custom option ^②

2 0 0 B 1 0 0 0 0

Option Boards 2

Same options and codes as Option Boards 1

Option Boards 1

- 0 = No option
- 1 = 3 x DI, 3 x DO, 1 Thermistor, 24 Vdc/EXT
- 2 = 1 x AI, 2 x AO (isolated to control board)
- 3 = 3 x relay dry contact (2NO + 1NO/NC)
- 4 = 3 x PT100 RTD thermistor input
- 5 = 6 DI 240 Vac input
- = Custom option ^②

Communication Options

- 0 = No option
- 1 = PROFIBUS-DP
- 3 = CANopen (slave)
- 4 = DeviceNet
- 5 = PROFIBUS-DP (D9 connector)
- D = SmartWire-DT
- = Custom option ^②

Enclosure Options

- 0 = None
- 1 = Floor stand—12 inches
- 2 = Floor stand—22 inches
- A = Space heater
- B = Space heater & 12-inch floor stands
- C = Space heater & 22-inch floor stands
- = Custom option ^②

Light Options ^⑤

- 0 = None
- 1 = Non-bypass light kit—Power On, Run, Fault
- 2 = Bypass light kit—On, VFD Run, Fault, Bypass Run
- = Custom option ^②

Notes

- ① HMCP disconnect option required and only available when bypass is selected.
- ② More options are available as Engineered to Order through the Bid Manager tool.
- ③ All bypass options include third contactor for drive isolation when in bypass mode.
- ④ Output contactor not available with bypass. Bypass comes standard with output contactor.
- ⑤ Pilot devices are 22 mm standard. 30 mm options are available as engineered to order through the Bid Manager tool.

Production Selection

2

EGF Enclosed Drive

480 V Drives—Constant Torque (CT)/High Overload (H) Enclosed Drives



hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number ^①	NEMA Type 12 Base Catalog Number ^①	NEMA Type 3R Base Catalog Number ^①
7.5	11	2	EGF0114D1	EGF0114D2	EGF0114D3
10	14	2	EGF0144D1	EGF0144D2	EGF0144D3
15	21	2	EGF0214D1	EGF0214D2	EGF0214D3
20	27	3	EGF0274D1	EGF0274D2	EGF0274D3
25	34	3	EGF0344D1	EGF0344D2	EGF0344D3
30	40	3	EGF0404D1	EGF0404D2	EGF0404D3
40	52	4	EGF0524C1	EGF0524C2	EGF0524C3
50	65	4	EGF0654C1	EGF0654C2	EGF0654C3
60	77	4	EGF0774C1	EGF0774C2	EGF0774C3
75	96	5	EGF0964C1	EGF0964C2	EGF0964C3
100	124	5	EGF1244C1	EGF1244C2	EGF1244C3
125	156	5	EGF1564C1	EGF1564C2	EGF1564C3
150 ^②	180	6	EGF1804C1 ^②	EGF1804C2 ^②	EGF1804C3 ^②
200 ^②	240	6	EGF2404C1 ^②	EGF2404C2 ^②	EGF2404C3 ^②

EGF Enclosed Drive

480 V Drives—Variable Torque (VT)/Low Overload (L) Enclosed Drives



hp	Current (A)	Drive Frame Size	NEMA Type 1 Base Catalog Number ^①	NEMA Type 12 Base Catalog Number ^①	NEMA Type 3R Base Catalog Number ^①
7.5	11	1	EGF0114B1	EGF0114B2	EGF0114B3
10	14	2	EGF0144B1	EGF0144B2	EGF0144B3
15	21	2	EGF0214B1	EGF0214B2	EGF0214B3
20	27	2	EGF0274B1	EGF0274B2	EGF0274B3
25	34	3	EGF0344B1	EGF0344B2	EGF0344B3
30	40	3	EGF0404B1	EGF0404B2	EGF0404B3
40	52	3	EGF0524B1	EGF0524B2	EGF0524B3
50	65	4	EGF0654A1	EGF0654A2	EGF0654A3
60	77	4	EGF0774A1	EGF0774A2	EGF0774A3
75	96	4	EGF0964A1	EGF0964A2	EGF0964A3
100	124	5	EGF1244A1	EGF1244A2	EGF1244A3
125	156	5	EGF1564A1	EGF1564A2	EGF1564A3
150	180	5	EGF1804A1	EGF1804A2	EGF1804A3
200 ^②	240	6	EGF2404A1 ^②	EGF2404A2 ^②	EGF2404A3 ^②
250 ^②	302	6	EGF3024A1 ^②	EGF3024A2 ^②	EGF3024A3 ^②

Notes

^① Table is for base catalog number reference only. For complete catalog number selection, see **Page V6-T2-306**.

^② Available in 2017.

Enclosure Selection

EGF Enclosed Drives

Enclosure selection charts are based on physical space limitations only and only to be used as a reference. For actual enclosure sizing, refer to Bid Manager.

Note: Filtered enclosure sizing includes dedicated space for passive filter, input fuses, circuit breaker or fusible disconnect, CPT, SPD, heater/thermostat, control relay and terminal blocks.

Filtered Enclosure X-Space

Enclosure Size	Frame 1	Frame 2	Frame 3	Frame 4	Frame 5
AX	—	—	—	—	—
BX	0	0	—	—	—
CX	3	3	2	2	—
DX	14	14	13	13	10

Filtered Power Options X-Space

Power Options	Frame 1	Frame 2	Frame 3	Frame 4	Frame 5
3% Output reactor	1	1	3	5	6
dV/dt filter	3	3	3	5	6
Output contactor	1	1	1	1	1

Accessories

The PowerXL Series—DG1 drives can accommodate a wide selection of expander and adapter option boards to customize the drive for your application needs. The drive's control unit is designed to accept a total of two additional option boards.

The PowerXL Series—DG1 drives come with a factory-installed standard board configuration including the following:

- Standard I/O:
 - 8DI, 1DO
 - 2AI, 2AO
 - 2FC, 1FA relays
- Standard communications:
 - EtherNet/IP, Modbus TCP
 - RS-485: Modbus RTU, BACnet MS/TP

Note: Filtered bypass enclosure sizing includes dedicated space for a passive filter, input fuses, MCP, CPT, input contactor, output bypass contactors, overload relay, SPD, heater/thermostat, control relay and terminal blocks.

Filtered Bypass Enclosure X-Space

Enclosure Size	Frame 1	Frame 2	Frame 3	Frame 4	Frame 5
AX	—	—	—	—	—
BX	—	—	—	—	—
CX	2	1	0	—	—
DX	13	12	11	10	6

Filtered Bypass Power Options X-Space

Power Options	Frame 1	Frame 2	Frame 3	Frame 4	Frame 5
RVSS Bypass	1	1	3	5	6
3% Output reactor	2	2	2	3	4
dV/dt filter	3	3	3	5	6

PowerXL Series—DG1 I/O Card Kits

Description	Catalog Number
3 x DI, 3 x DO, 1 x thermistor, 24 Vdc/EXT option card	DXG-EXT-3DI3DO1T
1 x AI, 2 x AO (isolated to control board) option card	DXG-EXT-1AI2AO
3 x relay dry contact (2NO + 1NO/NC) option card	DXG-EXT-3RO
3 x PT100 RTD thermistor input option card	DXG-EXT-THER1
6 x DI 240 Vac input option card	DXG-EXT-6DI

PowerXL Series—DG1 Communication Card Kits

Description	Catalog Number
PROFIBUS-DP communication card	DXG-NET-PROFB
CANopen communication card	DXG-NET-CANOPEN
DeviceNet communication card	DXG-NET-DEVICENET
PROFIBUS DB9 to 5-pin adapter card	DXG-NET-PROAD
SmartWire communication card and module	DXG-NET-SWD ^①

Note

^① Available January 2017.

Options

2

Input Power Options

Option	Description
HMCP Disconnect	The HMCP motor protection circuit breaker uses an electronic trip unit to provide typical motor overload relay functionality and short-circuit protection against potential phase-to-phase or phase-to-ground faults.
Circuit Breaker	Utilizes a circuit breaker to provide a means of short-circuit protection for the power cables between it and the drive, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the drive from the line, and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.
Isolation Fusing	Provides high-level fault protection of the drive input power circuit from the load side of the fuses to the input side of the power transistors. This option consists of three 200 kA fuses that are factory mounted in the enclosure.
3% Input Reactor	The input reactor is a three-phase series inductance on the line side of an AFD. It is used to provide a reduction in voltage and current harmonics. It also provides increased input protection for AFD and its semiconductors from line transients.
SPD	Provides a UL 1449 surge protection device (SPD) rated for 40 kA/ph that is connected to the line side terminals.
Fused Disconnect	Utilizes fusing to provide a means of short-circuit protection for the power cables between it and the drive, and protection from high-level ground faults on the power cable. Allows a convenient means of disconnecting the drive from the line, and the operating mechanism can be padlocked in the OFF position. This is factory mounted in the enclosure.

Bypass Options

Option	Description
Manual HOA Bypass	Provides a three-position selector switch that allows the user to select either a HAND or AUTO mode of operation. HAND mode is defaulted keypad operation, and AUTO mode is defaulted to control from an external terminal source. These modes of operation can be configured via programming to allow for alternate combinations of start and speed sources. Start and speed sources include keypad, I/O and fieldbus.
Manual HOA RVSS Bypass	This option adds a reduced voltage soft starter to bypass assembly for soft starting in bypass mode.

Output Power Options

Option	Description
Output Contactor	Provides a means for positive disconnection of the drive output from the motor terminals. The contactor coil is controlled by the drive's run or permissive logic. NC and NO auxiliary contacts rated at 10 A, 600 Vac are provided for customer use. This option includes a low VA 115 Vac fused control power transformer and is factory mounted in the enclosure.
3% Output Reactor	The output reactor is a three-phase series inductance on the load side of a VFD. It is used to reduce transient voltage (dv/dt) and peak voltages at the motor terminals. A 3% output filter is recommended for motor cable lengths up to 300 ft (10 m).
dV/dt Filter	Used to reduce the transient voltage (dV/dt) at the motor terminals. Recommended for motor cable lengths over 300 ft (10 m) and up to 1000 ft (304.8 m). This option is mounted in the enclosure.

Control Options

Option	Description
Speed Pot	Provides the ability to adjust the frequency reference using a door-mounted potentiometer. This option uses the 10 Vdc reference to generate a 0–10 V signal at the analog voltage input signal terminal. When the HOA bypass option is added, the speed is controlled when the HOA switch is in the HAND position. Without the HOA bypass option, a two-position switch (labeled local/remote) is provided on the keypad to select speed reference from the speed potentiometer or a remote speed signal.
HOA Switch	Provides a three-position selector switch that allows the user to select either a HAND or AUTO mode of operation. HAND mode is defaulted to keypad operation, and AUTO mode is defaulted to control from an external terminal source. These modes of operation can be configured via drive programming to allow for alternate combinations of start and speed sources. Start and speed sources include Keypad, I/O and fieldbus.
Start-Stop Pushbutton	Provides door-mounted START and STOP pushbuttons for either bypass or non-bypass configurations.

Light Options

Option	Description
Non-Bypass Light Kit—Power On, Run, Fault	Provides a white POWER ON light that indicates power to the enclosed cabinet, a green RUN light that indicates the drive is running and a red FAULT light that indicates a drive fault has occurred.
Bypass Light Kit—On, VFD Run, Fault, Bypass Run	Provides a white POWER ON light that indicates power to the enclosed cabinet, a green RUN light that indicates the drive is running, a red FAULT light that indicates a drive fault has occurred and an amber light that indicates when the motor is running in Bypass mode.

Enclosure Options

Option	Description
Floor Stand 12 in	Converts a normally wall-mounted enclosure to a floor-standing enclosure with a height of 12 in (304.8 mm).
Floor Stand 22 in	Converts a normally wall-mounted enclosure to a floor-standing enclosure with a height of 22 in (558.8 mm).

Technical Data and Specifications

PowerXL Series—DG1 Technical Data and Specifications

Attribute	Description	Specification	
Input ratings	Input voltage U_{in}	208 V, 230 V, 480 V, 575 V, –15 to 10%	
	Input frequency	50 Hz to 60 Hz (variation up to 45 Hz to 66 Hz)	
	Connection to power	Once per minute or less	
	Starting delay	3 s (FR1 to FR2), 4 s (FR3), 5 s (FR4), 6 s (FR5 and FR6)	
	Short-circuit withstand rating	100 kAIC (fuses and circuit breakers)	
Output ratings	Output voltage	0 to U_{in}	
	Output current	I_L : ambient temperature maximum 40 °C, up to 60 °C with derating, overload 1.1 x I_L (1 min./10 min.) I_H : ambient temperature maximum 50 °C, up to 60 °C with derating, overload 1.5 x I_H (1 min./10 min.)	
	Initial output current	200% (2 s / 20 s)	
	Output frequency	0–400 Hz (standard)	
	Frequency resolution	0.01 Hz	
Control characteristics	Control methods	Frequency control Speed control Open-loop speed control Open-loop torque control	
	Switching frequency	230 V / 480 V range: FR1–3: 1 kHz to 12 kHz FR4–6: 1 kHz to 10 kHz 230 V / 480 V defaults: FR1–3: 4 kHz FR4–5: 3.6 kHz FR6: 2 kHz 575 V range: FR1–6: 1 kHz to 6 kHz 575 V defaults: FR1–4: 3 kHz FR5–6: 2 kHz Automatic switching frequency derating in case of overload.	
	Frequency reference	Analog input: resolution 0.1% (10-bit), accuracy +1% Analog output: resolution 0.1% (10-bit), accuracy +1% Panel reference: resolution 0.01 Hz	
	Field weakening point	20 Hz to 400 Hz	
	Acceleration time	0.1 s to 3000 s	
	Deceleration time	0.1 s to 3000 s	
	Braking torque	DC brake: 30% x Motor Rated Torque (T_n) (without brake chopper) Dynamic braking (with optional brake chopper using an external brake resistor): 100% continuous maximum rating	
	Ambient conditions	Ambient operating temperature	–10 °C (no frost) to +40 °C
		Storage temperature	–40 °C to +70 °C
		Relative humidity	0–95% RH, noncondensing, non-corrosive
Air quality: • Chemical vapors • Mechanical particles		Tested according to IEC 60068-2-60 Test Key: Flowing mixed gas corrosion test, Method 1 (H ₂ S [hydrogen sulfide] and SO ₂ [sulfur dioxide]) Designed according to: IEC 60721-3-3, unit in operation, class 3C2 IEC 60721-3-3, unit in operation, class 3S2	
Altitude		100% load capacity (no derating) up to 3280 ft (1000 m); 1% derating for each 328 ft (100 m) above 3280 ft (1000 m); max. 9842 ft (3000 m) (2000 m for corner grounded earth main systems) For 575 V product, maximum altitude is 6561 ft (2000 m) regardless of main system	

PowerXL Series—DG1 Technical Data and Specifications, continued

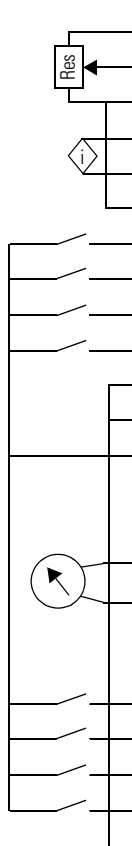
Attribute	Description	Specification
2 Ambient conditions, continued	Overvoltage	Overvoltage Category III
	Pollution degree	Pollution Degree 2
	Enclosure class	NEMA Type 1, 12, 3R
	Immunity	Fulfills EN 61800-3 (2004), first and second environment
Standards	Safety	UL 508C, EN 61800-5-1
	Approvals	UL and cUL
Fieldbus connections		Onboard: EtherNet/IP, Modbus [®] TCP, Modbus RTU, BACnet
Safety/protections	Overvoltage protection	Yes
	Overvoltage trip limit	230 V drives: 456 V 480 V drives: 911 V 575 V drives: 1100 V
	Undervoltage protection	Yes
	Undervoltage trip limit	230 V drives: 211 V 480 V drives: 370 V 575 V drives: 550 V
	Earth fault protection	Yes Default: 15% motor FLA Minimum: 0% motor FLA Maximum: 30% motor FLA
	Input phase supervision	Yes
	Motor phase supervision	Yes
	Overcurrent protection	Yes
	Unit overtemperature protection	Yes
	Motor overload protection	Yes
	Motor stall protection	Yes
	Motor underload protection	Yes
	DC bus overvoltage control	Yes
	Short-circuit protection of 24 V reference voltages	Yes
	Surge protection	Yes (differential mode 2 kV; common mode 4 kV 230 V drives: 275 Vac, 10,000 A 480 V drives: 320 Vac, 8000 A 575 V drives: 385 Vac, 10,000 A
	Common coated boards	Yes (prevents corrosion)
Efficiency	Drive efficiency ratings ^①	480 V: FR1 = 97.7% FR2 = 97.9% FR3 = 97.7% FR4 = 98.0% FR5 = 98.2%
		230 V: FR1 = 96.7% FR2 = 97.4% FR3 = 97.2% FR4 = 97.4% FR5 = 97.7%

Note

^① Based on DG1 efficiency ratings in an enclosure with no options.

Wiring Diagram

PowerXL Series—DG1 Control Wiring Diagram



Pin	Signal Name	Signal	Default Setting	Description
1	+10 V	Ref. Output Voltage	—	10 Vdc Supply Source
2	AI1+	Analog Input 1	0–10 V	Voltage Speed Reference (Programmable to 4 mA to 20 mA)
3	AI1–	Analog Input 1 Ground	—	Analog Input 1 Common (Ground)
4	AI2+	Analog Input 2	4 mA to 20 mA	Current Speed Reference (Programmable to 0–10 V)
5	AI2–	Analog Input 2 Ground	—	Analog Input 2 Common (Ground)
6	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
7	DIN5	Digital Input 5	Preset Speed B0	Sets frequency output to Preset Speed 1
8	DIN6	Digital Input 6	Preset Speed B1	Sets frequency output to Preset Speed 2
9	DIN7	Digital Input 7	Emergency Stop (TI–)	Input forces VFD output to shut off
10	DIN8	Digital Input 8	Force Remote (TI+)	Input takes VFD from Local to Remote
11	CMB	DI5 to DI8 Common	Grounded	Allows source input
12	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
13	24 V	+24 Vdc Output	—	Control voltage output (100 mA max.)
14	DO1	Digital Output 1	Ready	Shows the drive is ready to run
15	24 Vo	+24 Vdc Output	—	Control voltage output (100 mA max.)
16	GND	I/O Signal Ground	—	I/O Ground for Reference and Control
17	AO1+	Analog Output 1	Output Frequency	Shows Output frequency to motor 0–60 Hz (4 mA to 20 mA)
18	AO2+	Analog Output 2	Motor Current	Shows Motor current of motor 0–FLA (4 mA to 20 mA)
19	24 Vi	+24 Vdc Input	—	External control voltage input
20	DIN1	Digital Input 1	Run Forward	Input starts drive in forward direction (start enable)
21	DIN2	Digital Input 2	Run Reverse	Input starts drive in reverse direction (start enable)
22	DIN3	Digital Input 3	External Fault	Input causes drive to fault
23	DIN4	Digital Input 4	Fault Reset	Input resets active faults
24	CMA	DI1 to DI4 Common	Grounded	Allows source input
25	A	RS-485 Signal A	—	Fieldbus Communication (Modbus, BACnet)
26	B	RS-485 Signal B	—	Fieldbus Communication (Modbus, BACnet)
27	R3NO	Relay 3 Normally Open	At Speed	Relay output 3 shows VFD is at Ref. Frequency
28	R1NC	Relay 1 Normally Closed	Run	Relay output 1 shows VFD is in a run state
29	R1CM	Relay 1 Common		
30	R1NO	Relay 1 Normally Open		
31	R3CM	Relay 3 Common	At Speed	Relay output 3 shows VFD is at Ref. Frequency
32	R2NC	Relay 2 Normally Closed	Fault	Relay output 2 shows VFD is in a fault state
33	R2CM	Relay 2 Common		
34	R2NO	Relay 2 Normally Open		

2.11

Adjustable Frequency Drives

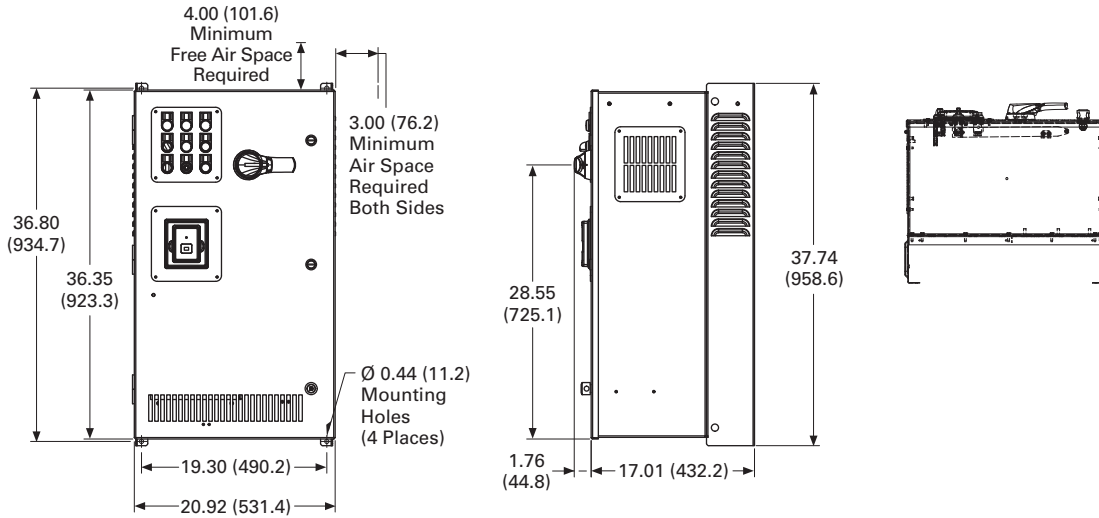
Clean Power Drives

Dimensions

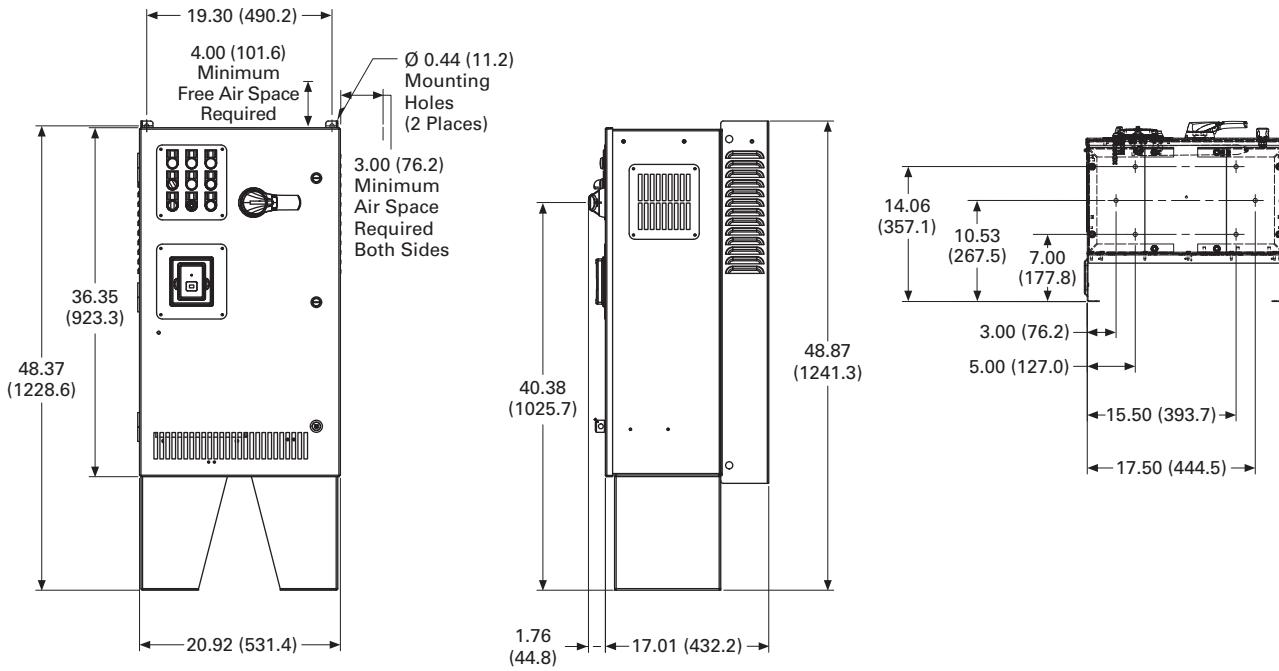
Approximate Dimensions in Inches (mm)

2

BX Box Type 1

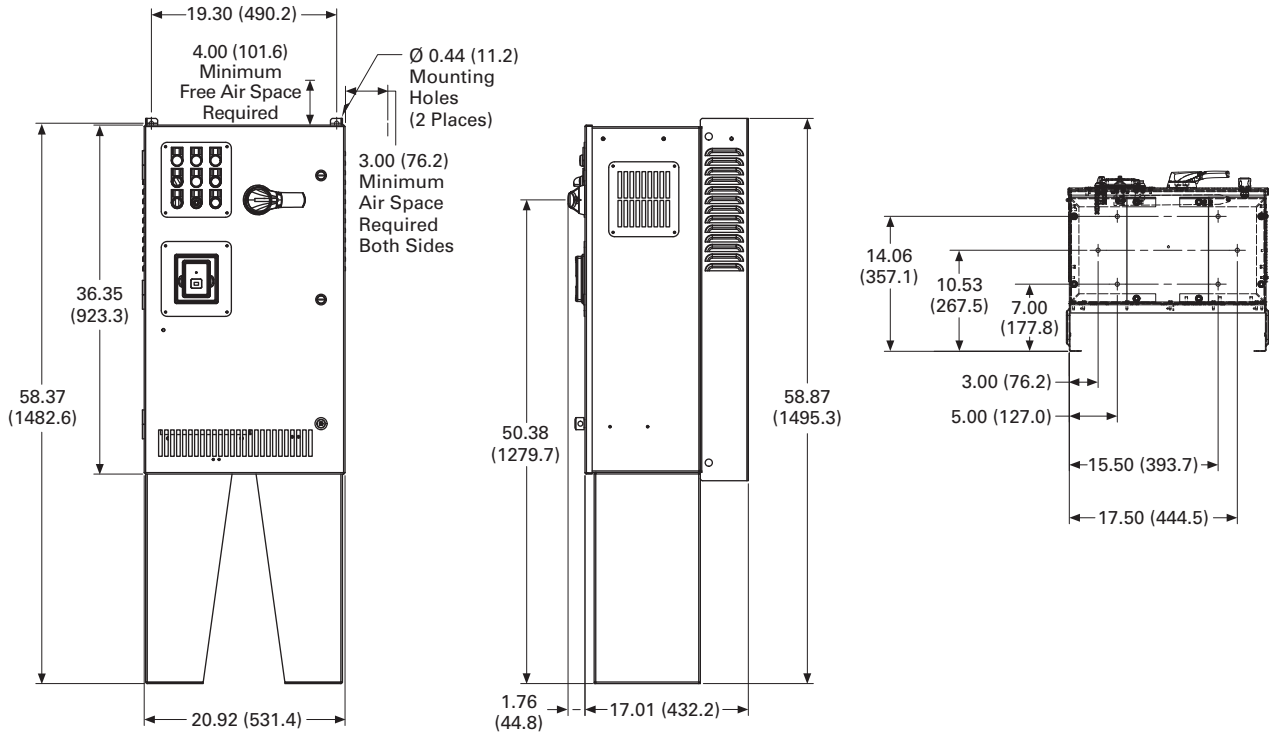


BX Box Type 1—12 Inch Floor Stands

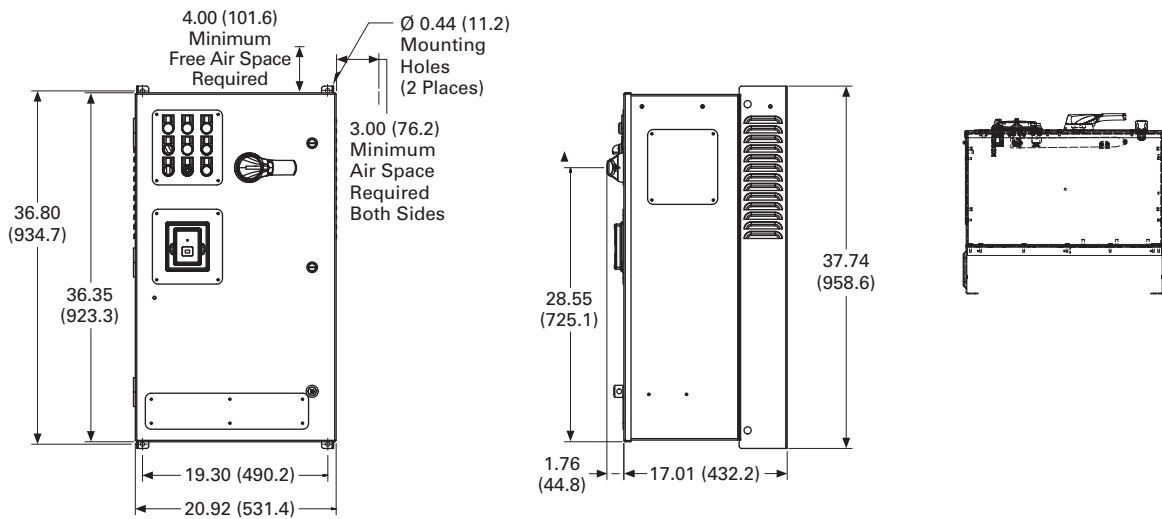


Approximate Dimensions in Inches (mm)

BX Box Type 1—22 Inch Floor Stands



BX Box Type 12



2.11

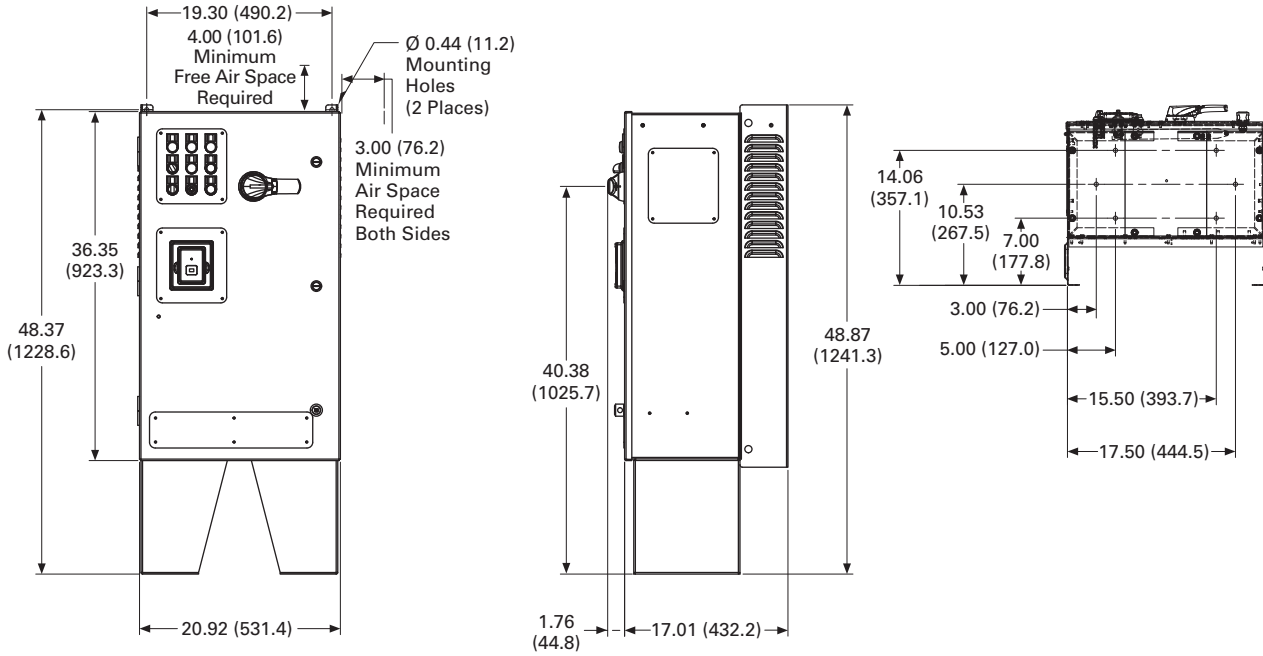
Adjustable Frequency Drives

Clean Power Drives

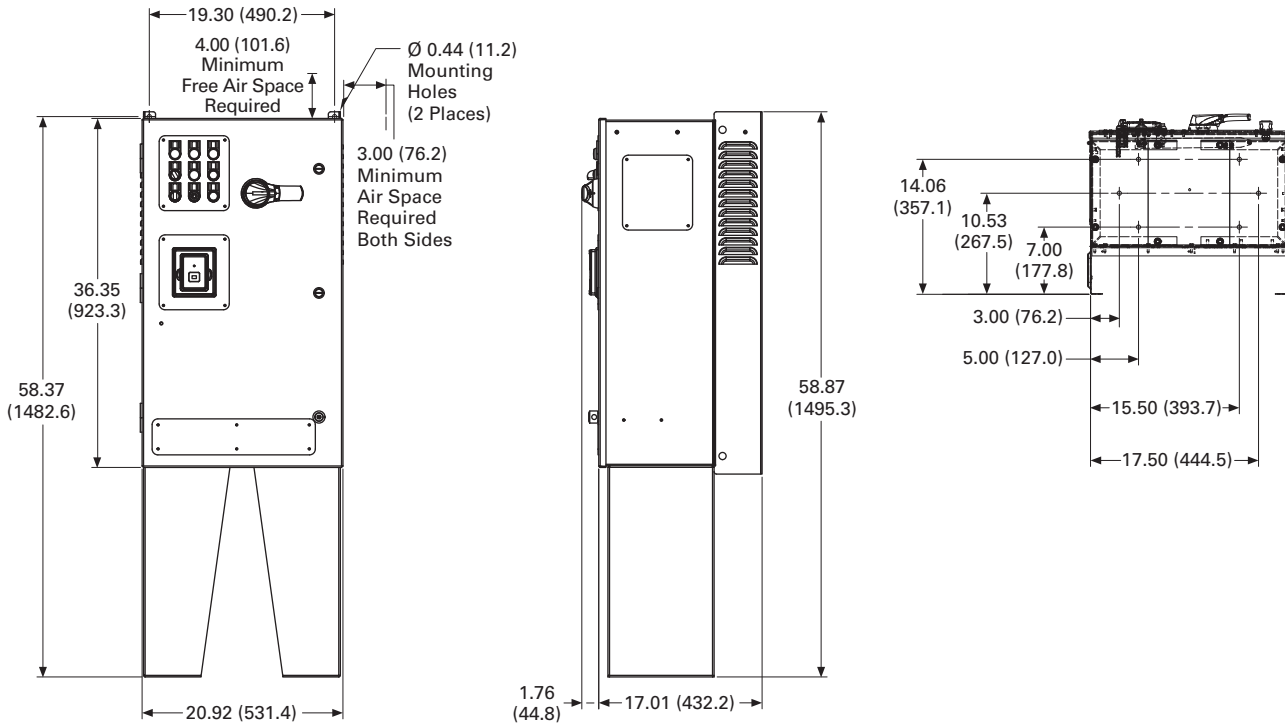
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2

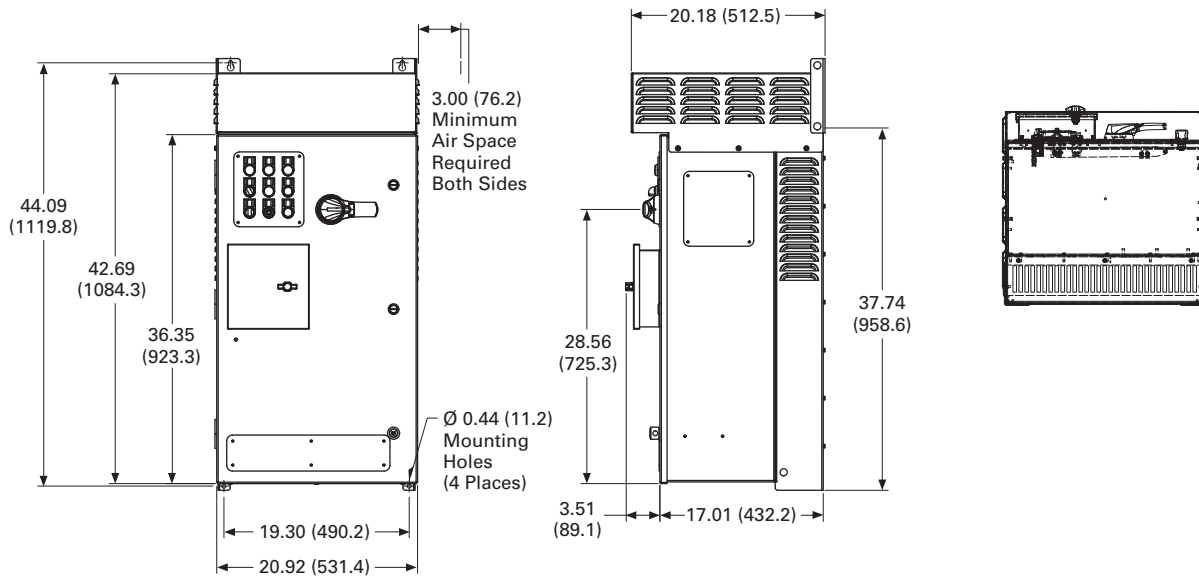
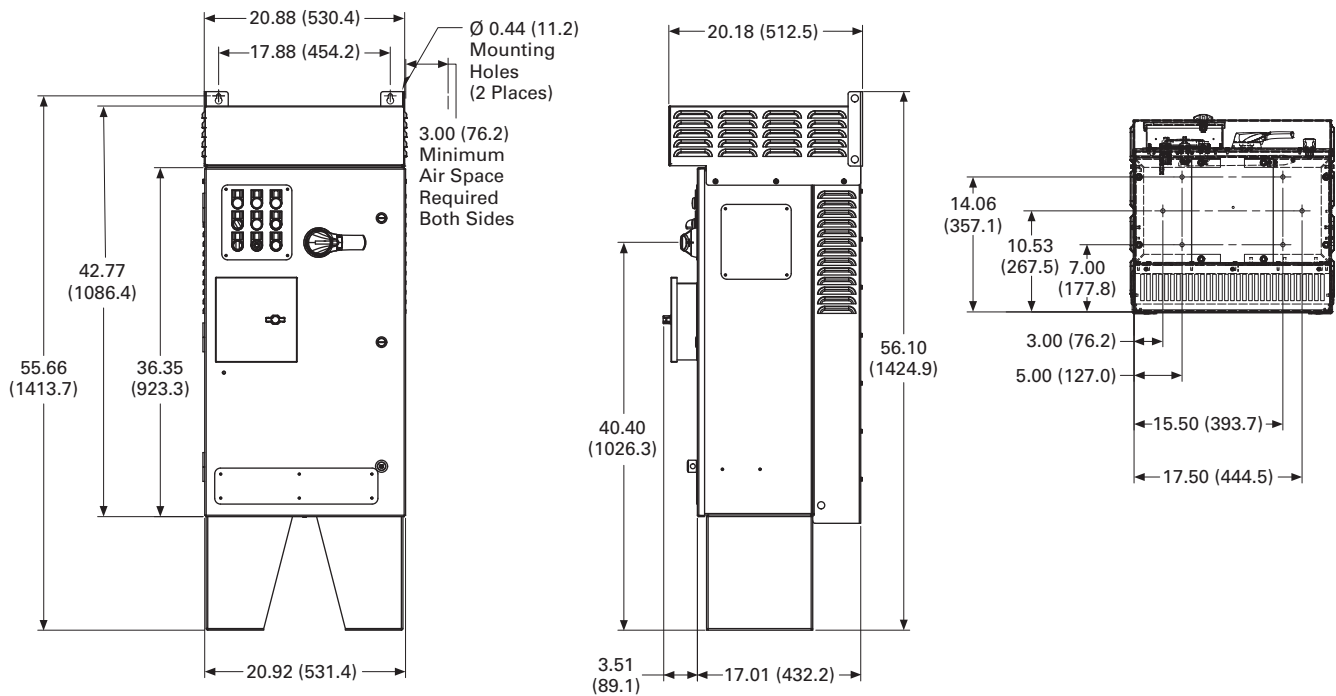
BX Box Type 12—12 Inch Floor Stands



BX Box Type 12—22 Inch Floor Stands



Approximate Dimensions in Inches (mm)

BX Box Type 3R**BX Box Type 3R—12 Inch Floor Stands**

2.11

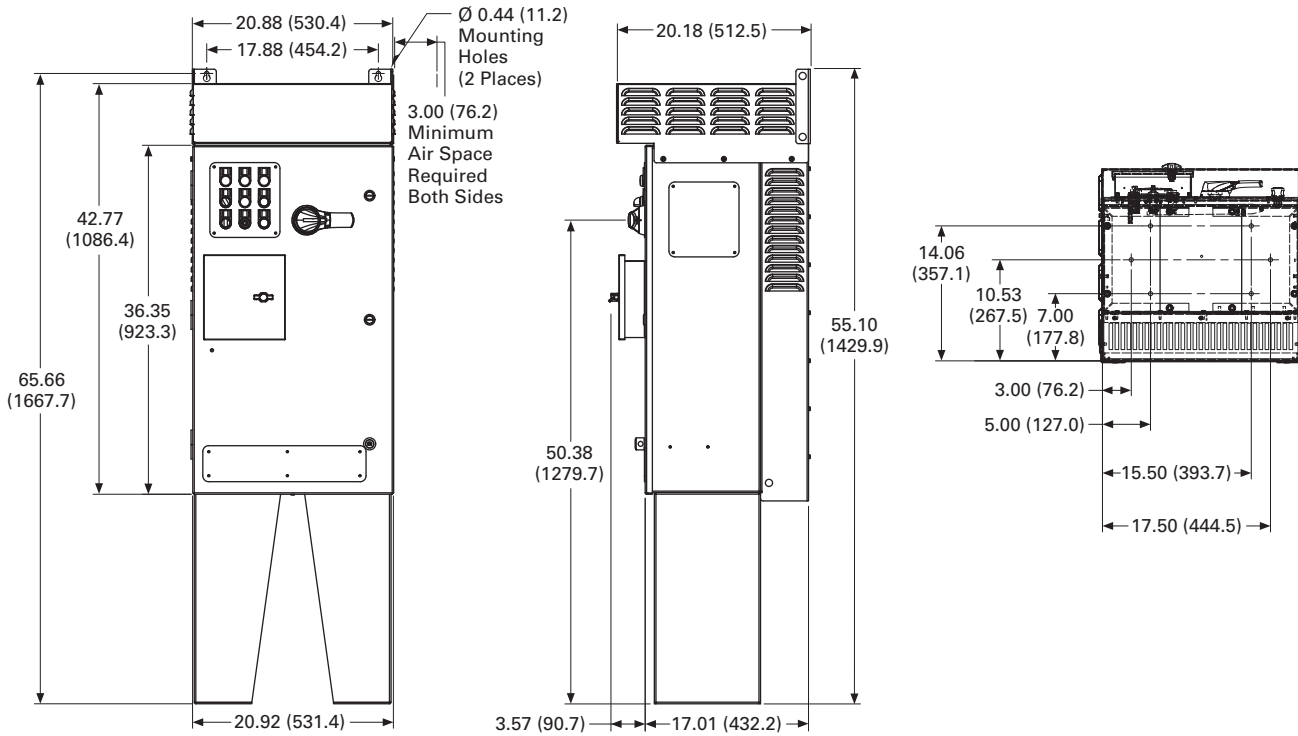
Adjustable Frequency Drives

Clean Power Drives

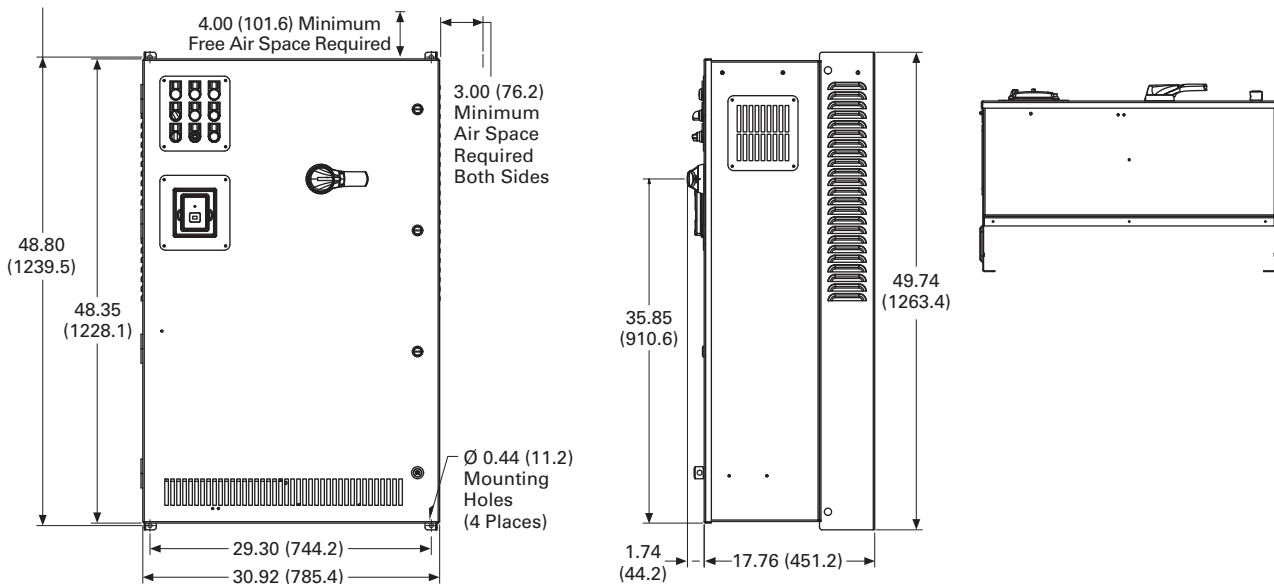
Approximate Dimensions in Inches (mm)

BX Box Type 3R—22 Inch Floor Stands

2

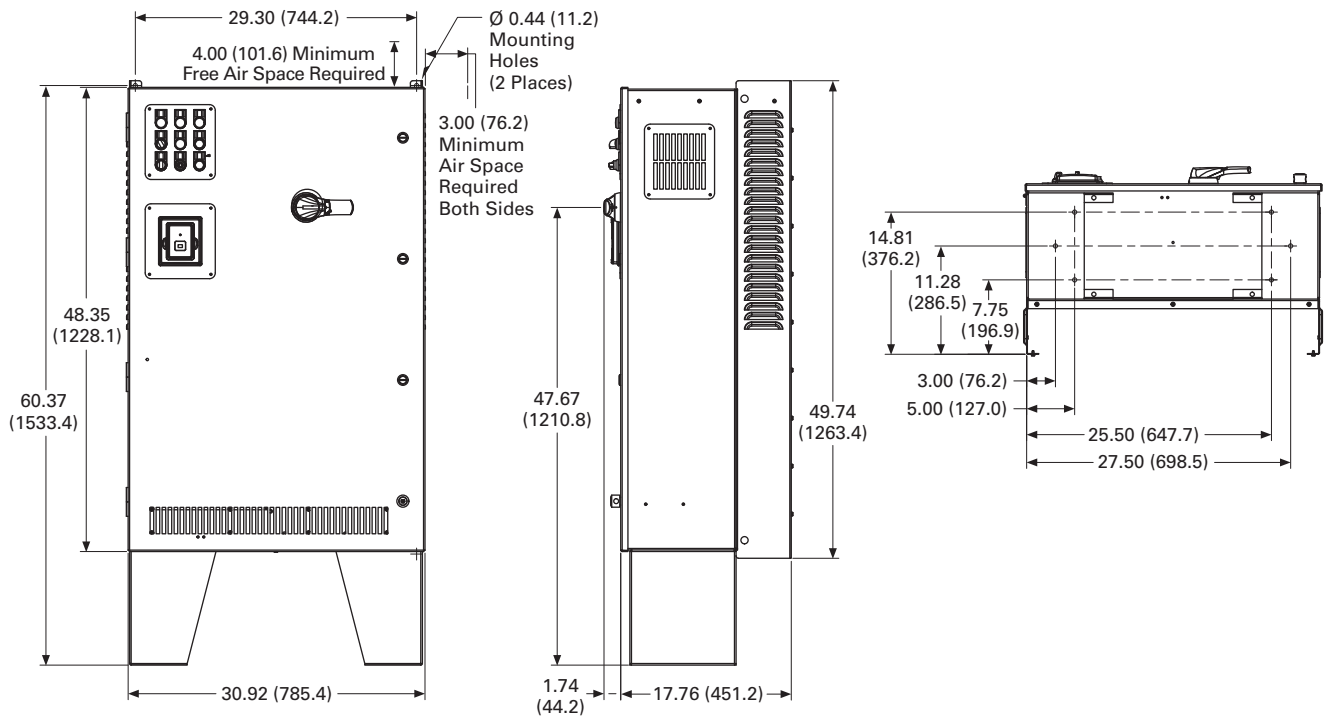


CX Box Type 1

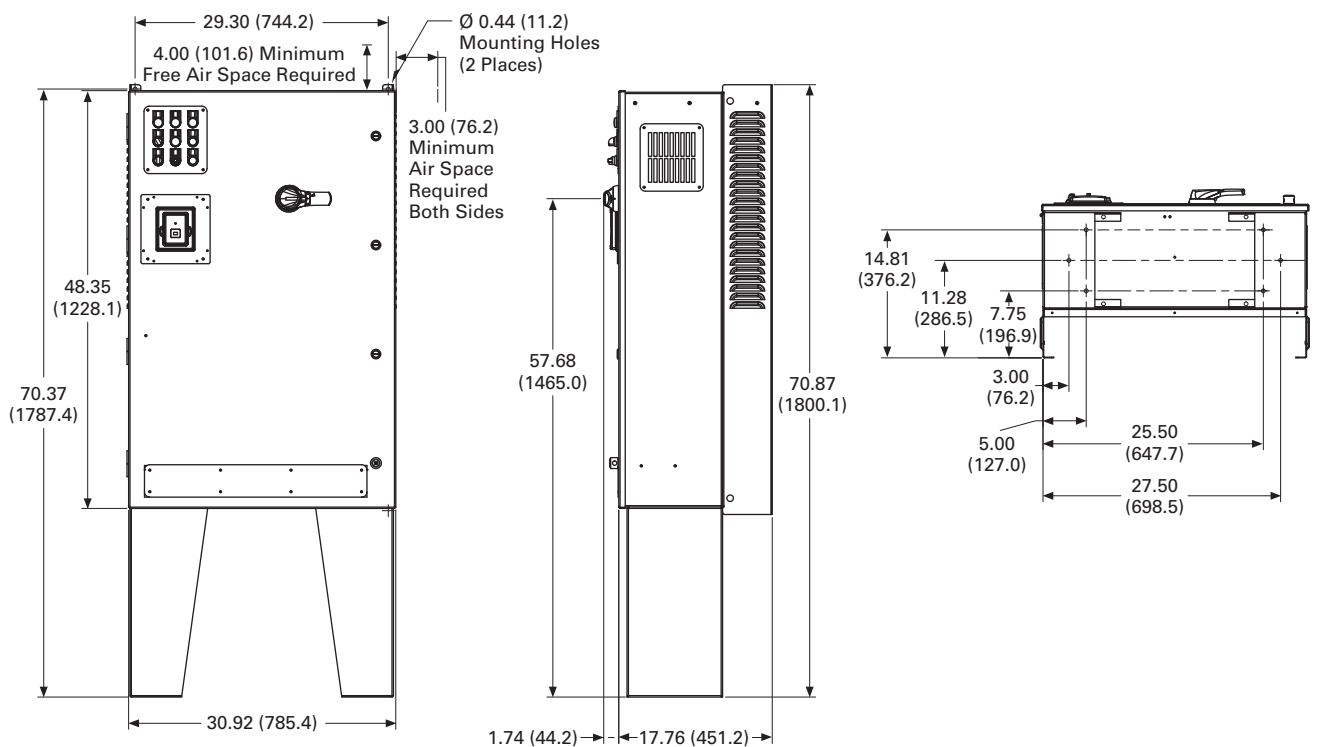


Approximate Dimensions in Inches (mm)

CX Box Type 1—12 Inch Floor Stands



CX Box Type 1—22 Inch Floor Stands



2.11

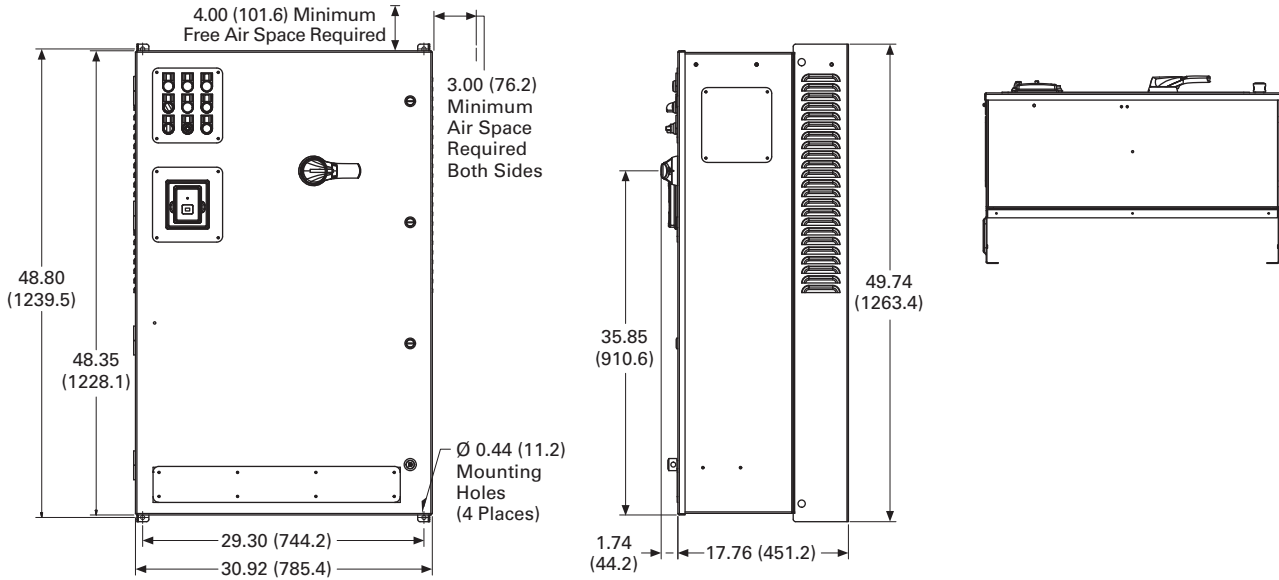
Adjustable Frequency Drives

Clean Power Drives

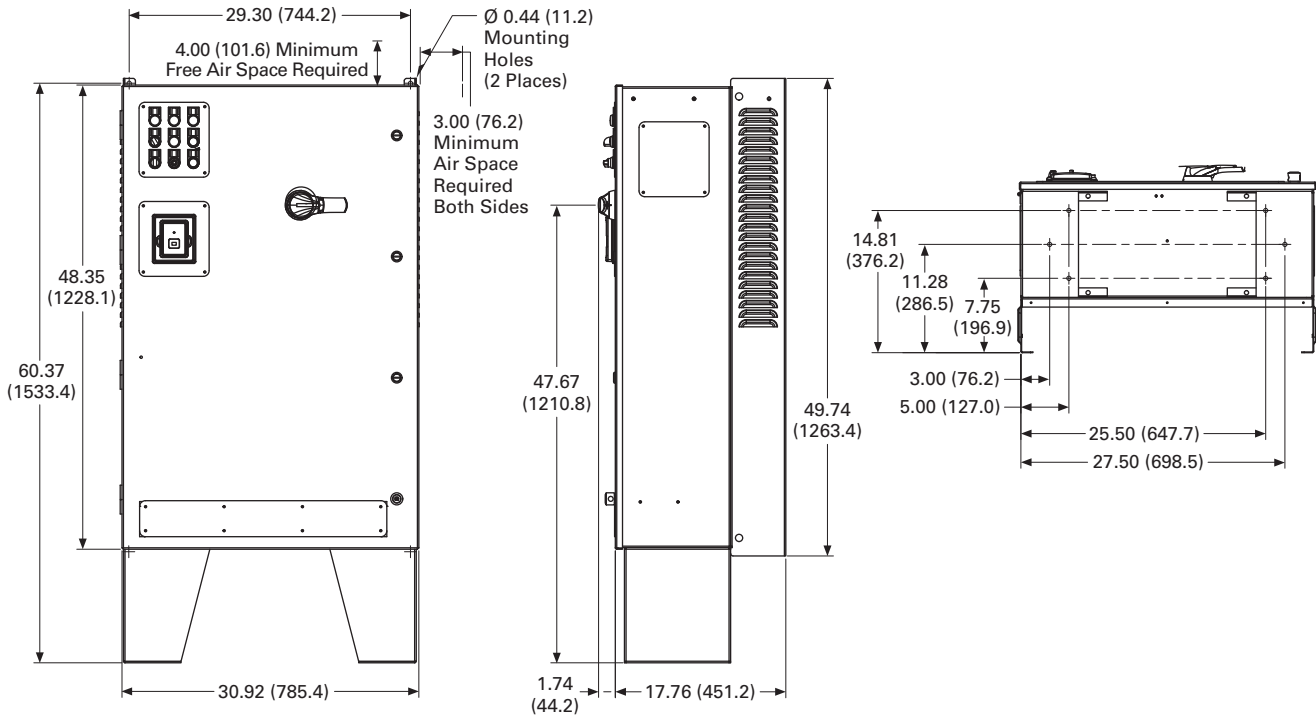
Approximate Dimensions in Inches (mm)

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CX Box Type 12

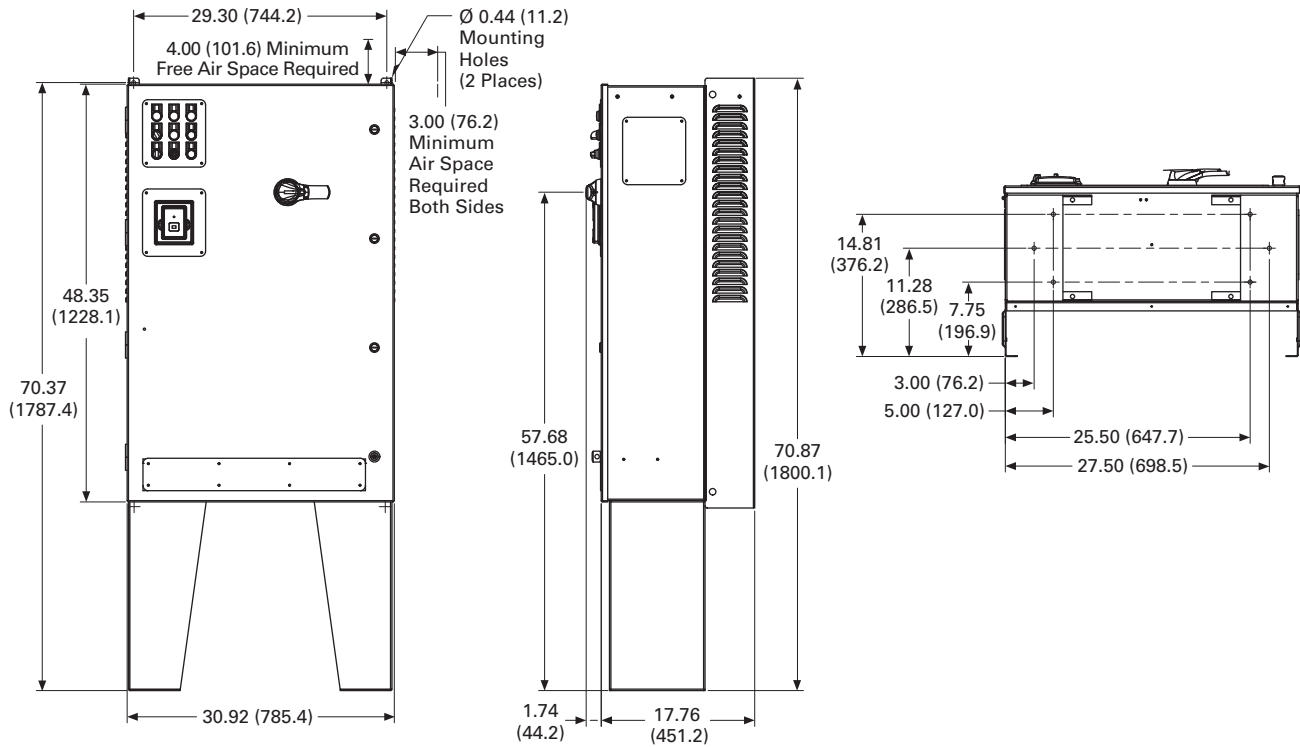


CX Box Type 12—12 Inch Floor Stands

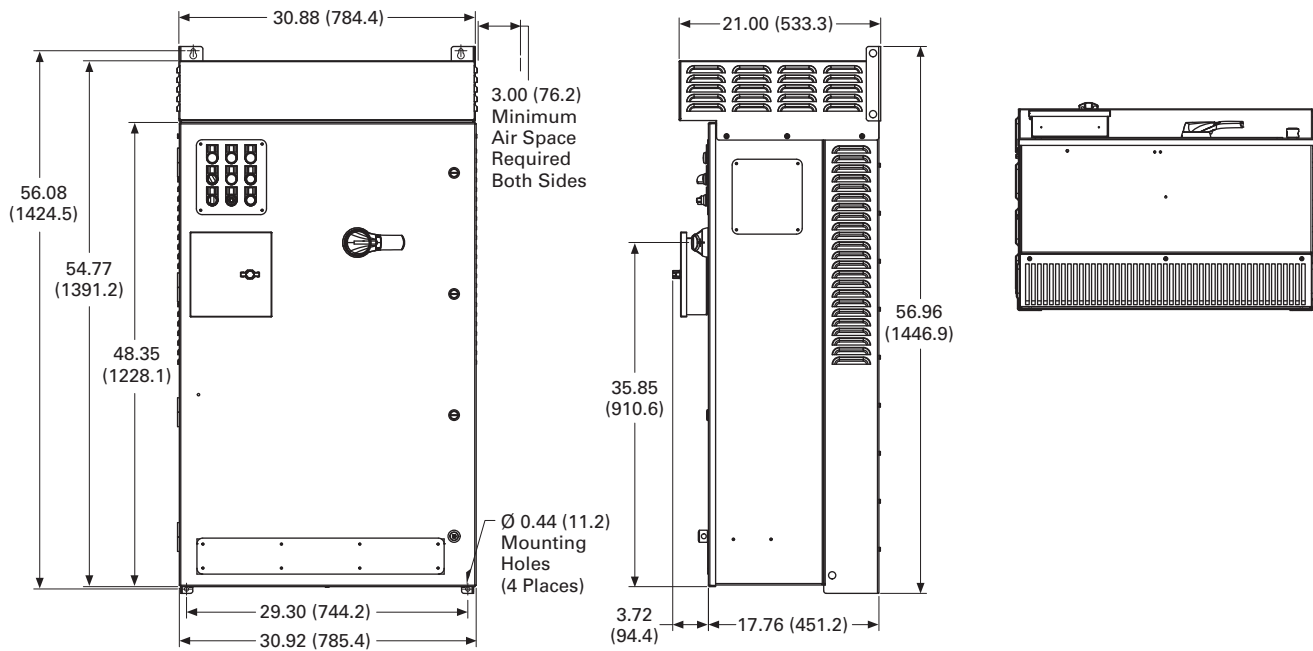


Approximate Dimensions in Inches (mm)

CX Box Type 12—22 Inch Floor Stands



CX Box Type 3R



2.11

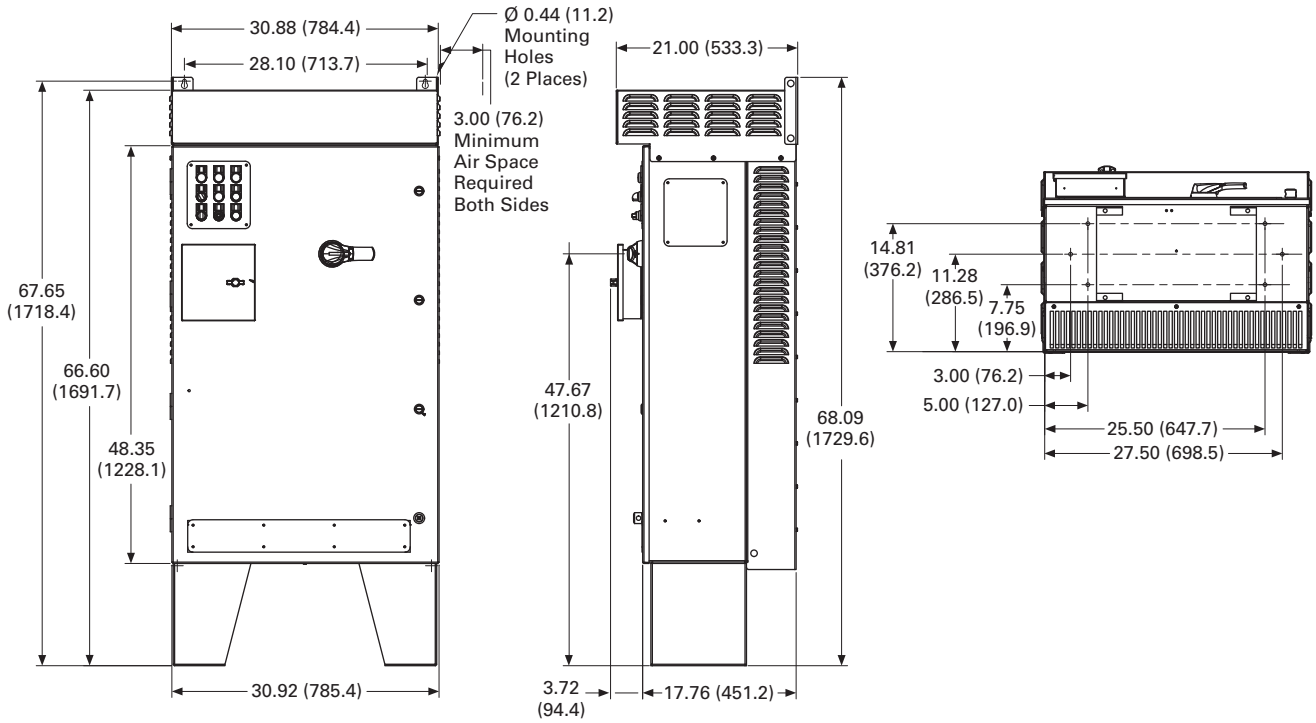
Adjustable Frequency Drives

Clean Power Drives

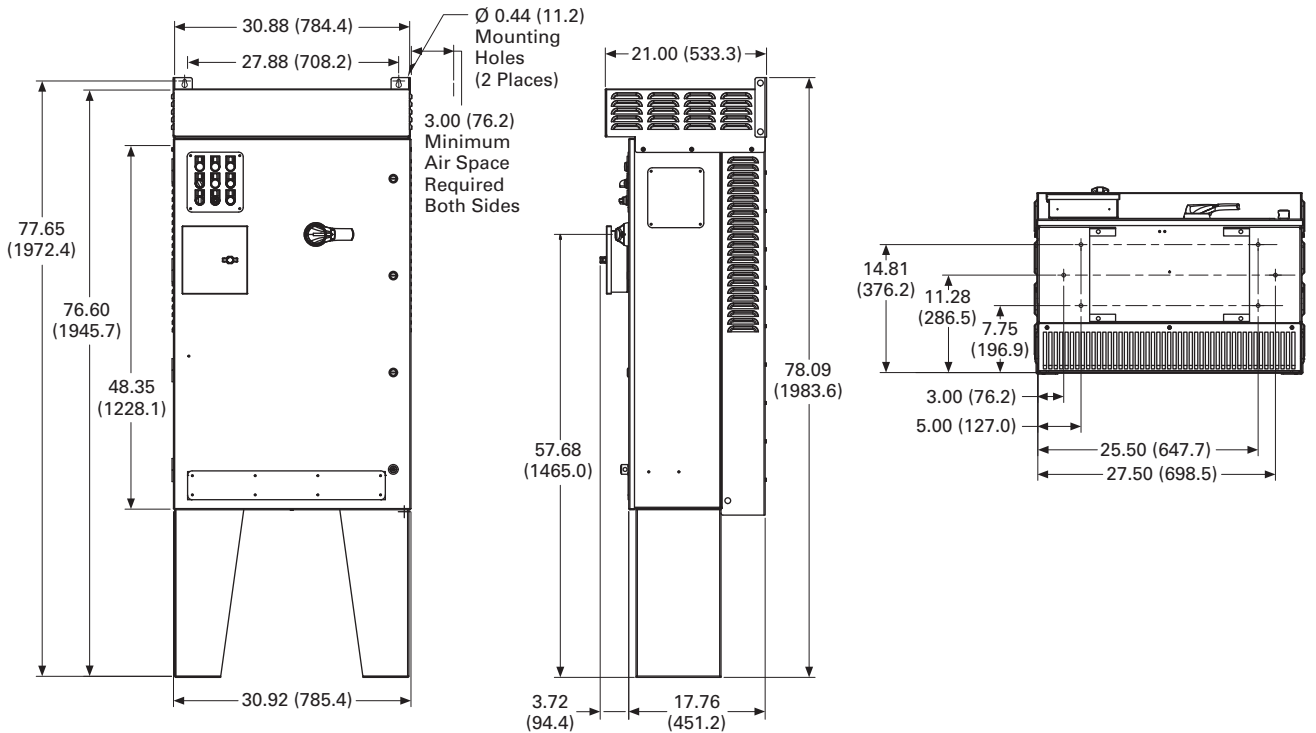
Approximate Dimensions in Inches (mm)

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CX Box Type 3R—12 Inch Floor Stands

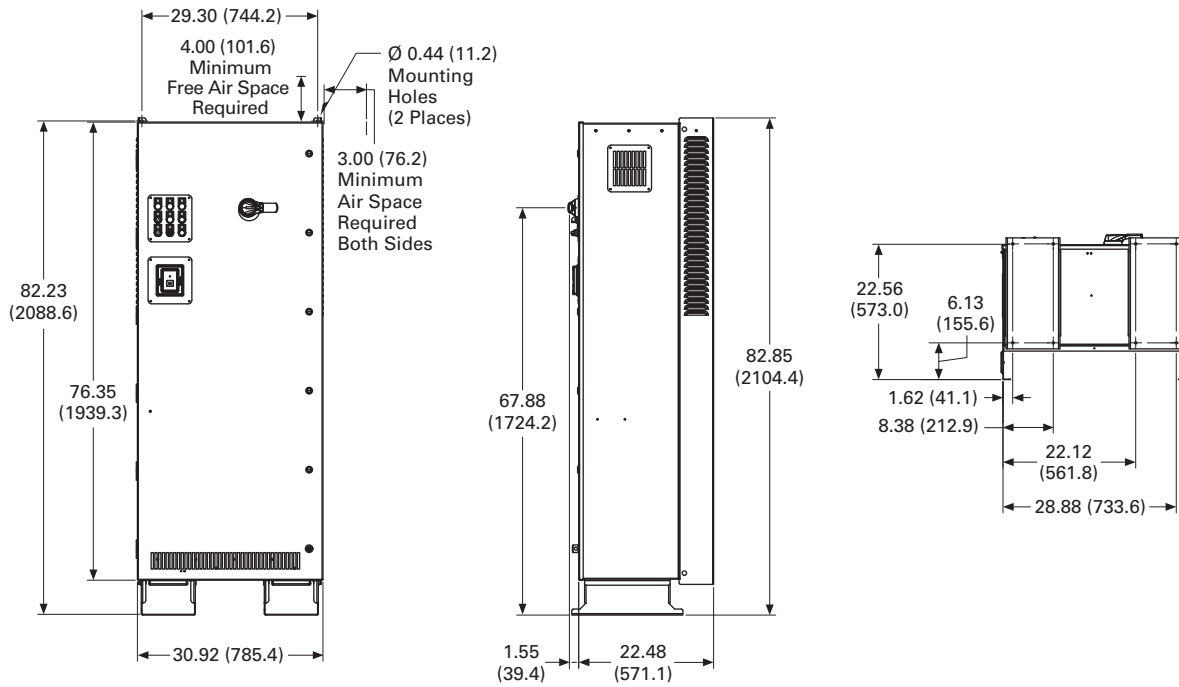


CX Box Type 3R—22 Inch Floor Stands

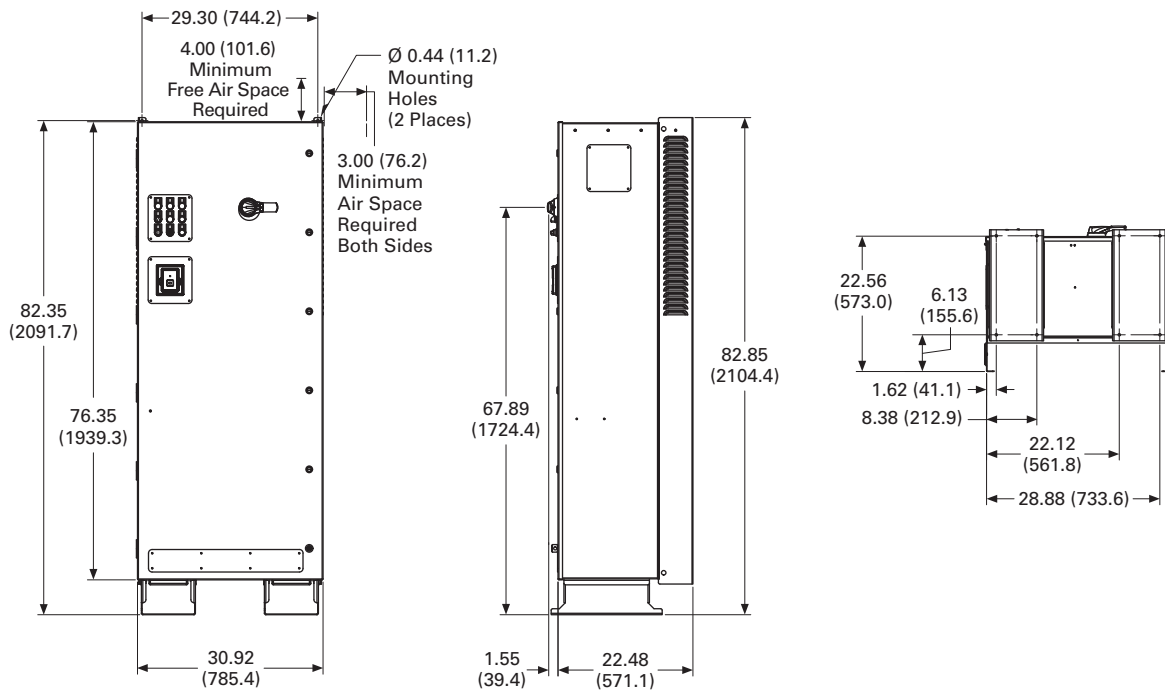


Approximate Dimensions in Inches (mm)

DX Box Type 1



DX Box Type 12



2.11

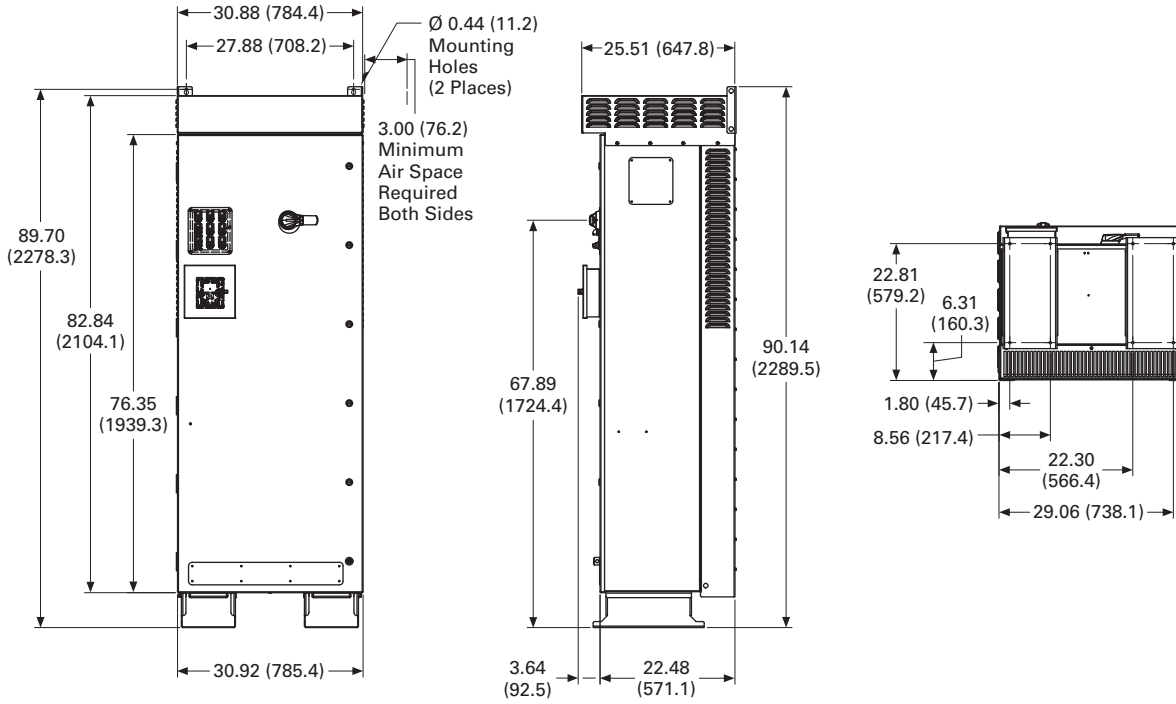
Adjustable Frequency Drives

Clean Power Drives

Approximate Dimensions in Inches (mm)

DX Box Type 3R

2





Powering Business Worldwide

Eaton Drives Warranty & Commercial Exchange Policy - Supplement to Selling Policy 25-000

Eaton warrants to Buyer, subject to the limitations and conditions stated herein, that all new products shall be free from defects in material and workmanship and shall deliver their rated output as indicated on the nameplates.

Drive Product Warranty

Drive Family	1 Year	2 Year	3 Year	4 Year	5 Year	6 Year
Micro Drives (DE1, DC1, DA1, MMX)	Standard	Standard	Not Available	Not Available	Not Available	Not Available
HVAC Drives (DH1 / HMX)	Standard	Standard	Certified 3	Extended 4	Extended 5	Consult Factory
Industrial Drives (DG1, SVX, SPX, LCX, RGX, EFG, EGS, CFX, CPX)	Standard	Standard	Certified 3	Extended 4	Extended 5	Consult Factory

Standard Warranty

- 24 months from date of shipment from Eaton warehouse (open drives) or enclosed drive plant
- Covers parts or replacement drive after factory approval
- Labor and travel costs are not included
- Replacement parts or replacement drive carry 90 days or the remainder of the original warranty period
- Due to the special nature of the SVX, SPX Frame 10 and larger, this warranty shall not be applicable to these products unless start-up is performed by an Eaton Authorized Commissioning Agent. (**See Certified 3, Extended 4 and Extended 5 warranties**)
- This warranty policy does not cover failure or damage due to the following:
 - Storage, installation, operation, maintenance, or repaired or altered outside of the Eaton factory or by anyone other than an Eaton Certified Technician not in conformance with Eaton's recommendations (Reference Troubleshooting and Maintenance Document from After-market Web Site- www.Eaton.com/Drives) and industry standard practice
 - Due to accident, misuse, abuse or negligence.
 - If damage occurred by the shipping company contact Eatoncargoclaims@expeditors.com or call 1-800-706-5640
- See below for Eaton Warranty Claim Process

Certified 3 – Extended 3 Year Warranty

- Reference the **Drive Product Warranty & Standard Warranty** above with the following additions:
 - Startup must be performed by an Eaton authorized commissioner (charges may apply)
 - To find an Eaton Authorized commissioner visit www.Eaton.com/VFDAftermarket
 - This warranty is no charge including parts, labor and travel (within the contiguous US)

Extended 4 – Extended 4 Year Warranty

- This warranty includes the **Certified 3** Warranty with the following addition:
 - The Certified 4 has a net cost of 5% of the net price of the drive

Extended 5 – Extended 5 Year Warranty

- This warranty includes the **Certified 3** Warranty with the following addition:
 - The Certified 5 has a net cost of 15% of the net price of the drive

Warranty Claim Process

1. Required information prior to calling Drives TRC (Technical Resource Center):
 - a. Original Eaton GO# (general order number)
 - b. Catalog number
 - c. Serial number (For enclosed packages, the serial & general order numbers are on enclosure door)
 - d. Customer job site location
 - e. Job site contact information
 - f. Detailed description of the issue

2. Before warranty status can be confirmed, and parts and/or service provided, it is required to contact the Drives TRC for troubleshooting assistance, in order to determine if the problem is in the VFD, and eliminate possible external causes.
 - a. Call the TRC at 877.ETN.CARE (877.386.2273) Option 2, Option 6, Option 4. Please have the above information available during the call.
 - b. Send pictures and documentation if needed to: TRCDrivesTechSupport@Eaton.com

3. The TRC will help determine warranty status, and if parts, replacements, and/or service is needed, and will provide you with a SR (Service Request) Number.
 - a. Be sure to write down the TRC SR Number.

4. Warranty Claim Processing:
 - a. Parts Only: contact CORE (Center of Returns Excellence) at 800.410.2910 (or CORE@eaton.com)
 - Return replaced components per the instructions provided on the return paperwork.
 - Parts are shipped standard freight. If expedited shipping is required please request.
 - b. Onsite Service Required: a CQM (Customer Quality Management) form must be filled out on "JOE" (for Eaton employees), or contact EatonCare at 877.ETN.CARE (386.2273) Option 4, Option 2, for CQM assistance.
 - See attached file "CQM FORM Rev. 10_22_2013.pdf" for the information which will be required. Be sure to include the TRC SR Number in the CQM form.
 - When entering a CQM in Joe (for Eaton employees) assign the CQM to "Watertown Warranty" (TRCDrivesTechSupport@eaton.com). For non-Eaton employees, this will be taken care of by EatonCare as they assist you with the CQM process.
 - Upon receipt of the CQM, the Drives TRC / Aftermarket team will supply replacement material and authorize an EWARF to the local Eaton Services team (EESS) or ISP (Independent Service Provider) who will schedule the service work.

5. Returned parts will be evaluated by the Product Integrity Center (PIC) in Watertown, WI for warranty validation.

Product Return Policy

- Returns must be coordinated through the original point of purchase.
- Return freight charges are at the customer's expense.
- No products shall be returned to Eaton's plant except in accordance with Eaton's prior written instructions.
- Items returned to Eaton without prior authorization, or without proper paperwork to identify the Returned material as an authorized return, will be returned to the Buyer at Buyer expense.
- Buyer shall return defective product or make available such defective product for Eaton's inspection at Buyer's place of business.
- Buyer is to return the defective item to Eaton within 30 days after the claim is authorized. If the defective item is not returned to Eaton within 30 days, if an exchange was shipped at no charge Buyer will be invoiced for the price of the replacement item at current purchase price levels.

- If it is determined that the returned item failed for reasons not covered by warranty (above in **Standard Warranty**) , the Buyer will be invoiced for the replacement item at current purchase price levels.
- To remedy a product defect, Eaton may, at its option, elect to repair, rebuild or replace the defective product using new or reconditioned parts or product. In this case, the repaired, rebuilt or replaced product shall be warranted hereunder for the unexpired portion of the original warranty period or 90 days from shipment of replacement product, whichever is longer.
- If the item returned is determined to be a non-warranty failure, the Buyer will be notified of the repair or replace options available.
- Returned product evaluation time frame
 - Goal of 10 days from date received
 - Repair timeframe is 2-8 weeks depending on parts availability
 - Non warranty returns will be shipped at distributors expense
 - Tracking information can be found in VISTA by using the repair/replacement GO number
 - If the claim is found to be non-warranty, the contact person has 30 days to provide additional information for review
 - If there is no response to the claim after 30 days on hold the part/drive will be returned as is, at the distributors expense and additional charges may apply

Warranty Limitations

The foregoing warranty is exclusive except for warranties of title and against patent infringement. Eaton disclaims all other warranties including any implied warranties of merchantability and fitness for a particular purpose. Corrections on non-conformities in the manner and for the period of time provided above shall constitute Eaton's sole liability and Buyer's exclusive remedy for failure of Eaton to meet its warranty obligations, whether claims of the Buyer are based in contract, in tort (including negligence or strict liability) or otherwise.

Limitation of Liability

The remedies of the Buyer set forth herein are exclusive and are its sole remedies for any failure of Eaton to comply with its obligations hereunder. In no event shall Eaton be liable in contract, in tort, (including negligence or strict liability) or otherwise for damage to property or equipment other than products sold hereunder, loss of profit or revenue, loss of use of products, cost of capital, claims of Eaton drives.

Commercial Exchange Policy

Warranty Claim Types:

CE - Commercial Exchange

CA - Corrective Action, Eaton mistake

RE - Return

 Type E – Exchange

 Type N – Non-warranty repair

 Type W- Warranty repair

WC – Warranty Credit

A commercial exchange (CE) return is for registered, stocked products with a valid Product ID. A CE return is product in inventory that needs to be returned for credit, which may include stock rotation, customer errors and overstock. For defective products that fall within the warranty eligibility period, a warranty claim (WC) return should be used.

For Open Drives to be eligible for a commercial return, they must be returned within 18 months of the original manufacturing date code as found on the packaging label. For Enclosed Drives, they must be returned within 12 months from shipment from Eaton as found on the General Order (GO) number. Product returned outside of this period will not be given credit and will be scrapped. See Table 1 for the level of credit that will be provided if returned in good working condition and in the original packaging.

Table 1 – Condition Code / Credit Level:

Condition Code	Description	% of Credit
N	Standard warehoused current product (part of stock rotation) *typically stocked open drive as found in Vista with status W	100%
O	Standard warehoused current product (not part of stock rotation) *typically stocked open drive as found in Vista with status W	90%
R	Standard non-warehoused current product *typically non-stocked open drive as found in Vista with status FP	80%
F	Non-standard product *typically enclosed drive assembly	20%
G	Damaged or used product	10%
M	Prearranged agreement	Prearranged
P	Standard warehoused current product requiring repacking *20% of invoiced price or \$50, whichever is less	

Enter the CE return:

- Use Vistaline on the Web (VOTW) to enter a return. Required fields are Quantity, Product ID and Invoice Price for each item.
- Determine the condition of the products to be returned. The condition will determine the amount of credit to be given. See Table 1 for condition codes and definitions. Use Vista to confirm if a product is a stocked item or not. A stocked item in vista will have a W status.
- Determine if the return qualifies as a stock rotation return. This return waives the 10% restocking fee on standard products. If returning one or two items, you may want to include them in your next stock rotation return to optimize credit.

Receive confirmation and authorization via email or fax:

- Prior to packaging any product, check confirmation and authorization of the return, sent via email or fax after a return is entered via VOTW.
- Be aware that multiple return locations are possible. Shipping product to an incorrect return location will result in delays. Do not deduct any amount until the returned product is shipped, received by return location and evaluated, and the authorized credit memo is received.

Prepare material for return shipment:

- Prepare product for shipment per packing guidelines shown on this page. Include one packing slip per shippable unit (1 per box or pallet), ensuring that product is returned to the correct location.
- Remove all labels, stickers or markings not found on original packaging to optimize the credit. If the returned product requires repackaging, a 20% fee will be assessed with a maximum amount of \$50 per unit, whichever is smaller.
- Check returned product from customers for evidence of use or installation.
- For maximum credit, take photos of larger returns (>\$10,000) and send to W34ReturnCoreCustomerService@eaton.com with the Claim ID in the subject line. Alternatively, work with your Eaton Distributor Sales Representatives prior to shipping.
- Affix authorization paperwork with the Claim ID to each shippable unit, making copies as necessary.

Receive credit memo and deduct:

- An evaluation report will be emailed or faxed, indicating credit amount for the return within two weeks of shipping a return material if the process above is followed correctly.
- Once an evaluation report is sent, a credit memo will be issued within two to four business days in the amount shown on the evaluation report. A distributor is now able to deduct the authorized amount, referencing the credit memo number.

Packing guidelines for return product:

- Each shipment must include a packing list per each shippable unit (package or pallet).
- Affix authorization paperwork with Claim ID to each shippable unit, making copies as necessary; ensure that product is returned to the correct facility.
- If a shipment is greater than one pallet or carton, it must include a consolidated packing list (master list) on the last shippable unit. Maximum pallet load height (including pallet) of 38 inches (pallet shipments and bulk packs). Target pallet load weight of 1500 pounds with maximum weight limit of 2000 pounds.
- Pallet shipments to be stretch-wrapped or banded. Heavy product to be placed in bottom of carton and pallets. Lighter product to be placed on top of the heavier products.
- All loose items must be packaged with bubble wrap. All parcel cartons must use two layers of bubble wrap on the inside bottom of the carton to protect products from breakage.
- Do not use padded envelopes as a parts shipping container. Cardboard sheets should be used between pallet layers where applicable.
- Consolidate like styles and separate mixed styles to help facilitate breakdown and reduce errors
- Ranpak paper or other appropriate packaging material to be used for void fill and block-and-brace techniques where needed on pallets. Balance the weight evenly on the pallet to avoid excessive weight on one end. Never use damaged pallets with broken/missing boards or protruding nails that could cause a safety hazard.

Drives Aftermarket Contacts

Technical Resource Center (TRC)

- Contact TRC for trouble shooting issues prior to return
- Phone 800-322-4986,
- Email TRCDrivesTechSupport@Eaton.com

Center of Return Excellence (CORE)

- Claim Creation
- Email CORE@Eaton.com

Aftermarket Support

- Customer support for Drives regarding Claim updates, status, etc.
- Email VFDAftermarketeg@eaton.com
- TRC call is warranty consideration only; the unit still needs to be returned for evaluation of final warranty determination.
- Case/Call Log number must be referenced on the claim
- Regarding warranty claims, the GO number and the item number must be referenced
- Contact person on claim will receive any quotes and additional information
- Non Warranty Test and evaluation fees can be obtained by Contacting CORE or Aftermarket

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Powering Business Worldwide

PowerXL DA1 and DC1 micro drive product families update

PowerXL DA1 and DC1 drives were launched in January 2014 and provide a fuller portfolio and unique solutions for MOEM applications. These micro drives have the capability and product positioning to be competitive with all drive manufacturers in the micro drive market.

APPLICATIONS/INSTALLATIONS

- Conveyor motor control
- Pump control and protection
- Fan or air handling systems control
- Permanent magnet motor control
- Standard low horsepower motor frequency control

MARKETS

- | | |
|-------------------------------------------------------|------------------------------------------------------------------|
| <input type="checkbox"/> Alternative energy | <input checked="" type="checkbox"/> Industrial and manufacturing |
| <input type="checkbox"/> Commercial construction | <input type="checkbox"/> Infrastructure |
| <input type="checkbox"/> Data centers | <input checked="" type="checkbox"/> Machine building |
| <input type="checkbox"/> Education | <input type="checkbox"/> Mineral and mining |
| <input type="checkbox"/> Electric utilities | <input type="checkbox"/> Oil and gas |
| <input type="checkbox"/> Electronics | <input checked="" type="checkbox"/> Pulp and paper |
| <input checked="" type="checkbox"/> Food and beverage | <input type="checkbox"/> Residential construction |
| <input type="checkbox"/> Government | <input type="checkbox"/> Transportation |
| <input type="checkbox"/> Health care | <input checked="" type="checkbox"/> Water/wastewater |

TYPICAL CUSTOMERS

- | | |
|------------------------------------------|--------------------------------------------------------------------|
| • Conveyor integrators and manufacturers | • Corrugated and paper system manufacturers |
| • Panel builders and integrators | • Any customer who requires speed controls of a motor, pump or fan |
| • Fan, pump and compressor OEMs | |

TARGET REGIONS AND COUNTRIES

Regions

- Americas
- EMEA
- APAC

Countries

- United States, Canada, Mexico, Brazil, Colombia
- Germany, UK, Netherlands, others

Key features and benefits

Feature	Benefit
SmartWire-DT™ connectivity	All SmartWire-DT benefits, including reduction of panel space and wiring, installation and troubleshooting times
Easy menu navigation	Easy-to-navigate parameters allow for quick configuration and diagnostics
drivesConnect PC Tool	Unique Bluetooth module simplifies commissioning and diagnostics using the data logger and monitoring functionality with the PC Tool
STO SIL 2 function	Safe Torque Off allows the device to be used in SIL 2 rated safety applications
PM motor capability	Provides higher efficiency corresponding to the permanent magnet motor
Single-phase motor capability	Unique applications that require speed control of single-phase motors
IP66 option	Reduces material and labor costs for mounting a separate enclosure, disconnect, keypad and potentiometer



HOW TO FIND BUSINESS

What to look for

- Belt conveyor systems OEMs looking for a drive with small side clearances
- Integrators needing remotely mounted drives with local controls and means of disconnect
- Applications using permanent magnet (PM) motors requiring rated devices with special software parameters
- MOEMs looking to replace an across-the-line starter with a simplified frequency controller

How we address key business challenges

- RJ45 daisy-chain feature allows for one remote mount keypad that views/controls multiple drives
- Programmable digital and analog inputs allow for I/O count changes due to application tweaks
- The Copy/Paste Bluetooth module saves startup time by allowing the customer to program similar drive parameters
- An IP66 rated drive with integrated disconnect and control can save the customer money, time and space compared to mounting these required devices separately

Customer reaction

Reaction	Reply
Are the DC1 and DA1 rated for constant or variable torque?	They are rated for constant torque, but they can be de-rated for variable torque application with a few parameter settings to optimize performance.
Do these drives have a PID loop?	The DA1 has PID loop while the DC1 only has PI loop.
What does IP66 correlate to in NEMA ratings?	IP66 = NEMA 4: protection from dust, oil and non-corrosive materials and protection from water, even powerful jets.
Can I expand the communications on the DC1?	No, if the applications require anything more than Modbus RTU and CANopen, it will require the DA1.

Important questions

- What are the current and voltage ratings of your application and how many input and output phases?
- Are you using a permanent magnet motor?
- What kind of communication protocol is required?
- Do you require an RFI filter for incoming line noise?
- How is the motor, pump, fan, etc. being controlled currently? Where is it mounted?

Key selling points

- The PowerXL drives have Modbus® RTU and CANopen native as standard. The DA1 has options for EtherNet/IP, EtherCAT, DeviceNet,™ PROFIBUS, ProfiNET, Modbus TCP and BACnet
- The DA1 includes an integrated RFI filter as standard and the DC1 has this as an option
- Easy menu navigation with 14 basic parameters allows for speedy startup
- Small size footprint and side-by-side mounting allow for small cabinets while still maintaining efficient heat dissipation

Competitive summary

Company	Equivalent product	Comparison
Rockwell	PowerFlex 40, PowerFlex 525	DC1 is comparable to PowerFlex 40. DA1 is comparable to PowerFlex 525. PowerFlex 525 has EtherNet/IP on board, but DC1 is competitive on size and price.
ABB	ACS55, ACS150, ACS355	DC1 is equivalent to ACS55 and ACS150 in size, pricing and capabilities. ACS355 can control single-phase motors, has a PM motor and is IP66 rated, but DA1 can handle hard torque ratings.
Schneider	ATV12, ATV312, ATV32	DC1 is comparable to ATV12 but smaller with higher capabilities. ATV312 and ATV32 have capabilities in-between the DC1 and DA1 and include optional communication modules, but do not include a PM motor offering and are not IP66 rated.

COMPLEMENTARY PRODUCTS

- SmartWire-DT
- M22 line of products
- Safety relay (ES4P)
- E-stop (M22 or 10250T)
- FAZ circuit breakers
- Series C® circuit breakers
- Series G® circuit breakers

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ADDITIONAL SALES RESOURCES

- PA040003EN: PowerXL DC1 Product Aid
- PA039001EN: PowerXL DA1 Product Aid
- CC039002EN: Competitive Comparison
- BR040002EN: Eaton Variable Frequency Drive Product Overview
- drivesConnect: Software downloadable on Eaton DC1 and DA1 webpages

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Powering Business Worldwide

Enclosed Control (NEMA)



Powering Business Worldwide

Bill of Material



Detail Bill of Material

Project Name: Pumpkinvine Creek Regional LS
(West Dallas)

Negotiation No: AT900208X2K1

General Order No:

Alternate No: 0000

Item No.	Qty	Product	Description
	3	Enclosed Controls	ECN2411CBD-R63/CA21A30C3P3S3, NEMA - Freedom, NEMA 1 - General Purpose, 5 HP, 460V, Size 1, 120V/60 110V/50 Coil, Circuit Breaker - 15 amp, Drawing Number: 84-28780, LIST OF MATERIAL.; ECN2411CBD - FVNR Combo Starter, HMCPE or Mag. Trip, STD-SSOL OLR, w/CPT

Catalog No ECN2411CBD-R63/CA21A30C3P

Catalog No	Qty	List of Materials
R63/C	1	R63/C-Solid State Overload, FLA 4-20
C3	1	C3-With 100 VA extra capacity CPT, 120V/60HZ, 110V 50HZ secondary w/2 primary & 1 secondary fuse
A21	1	A21-3NC extra AUX CONT (Unwired without diagram)
A30	1	A30-2NO extra AUX CONT (Unwired without diagram)
P3	1	P3-Combo of P1 & P2 above
P7	1	P7-PB START/STOP
S3	1	S3-HAND-OFF-AUTO Selector Switch

Eaton Selling Policy 25-000 applies.

All orders must be released for manufacture within 90 days of date of order entry. If approval drawings are required, drawings must be returned approved for release within 60 days of mailing. If drawings are not returned accordingly, and/or if shipment is delayed for any reason, the price of the order will increase by 1.0% per month or fraction thereof for the time the shipment is delayed.

Seller shall not be responsible for any failure to perform, or delay in performance of, its obligations resulting from the COVID-19 pandemic or any future epidemic, and Buyer shall not be entitled to any damages resulting thereof.



Powering Business Worldwide

Drawings

General Information: ENCLOSC

Description
Value

 =====
PRODUCT INFORMATION

CATALOG NUMBER:	ECN2411CBD-R63/CA21A30C3P3S3
COUNTRY:	USA Enclosed Control
LEAD TIME CODE:	D
LEAD TIME (BUSSINESS DAYS):	3-4 Weeks
QTY:	3

 =====
ENCLOSED CONTROL

STARTER DESIGN:	NEMA - Freedom
STARTER/CONTACTOR TYPE:	Full Voltage Non-Rev.

 =====
STARTER CONFIGURATION


MOTOR/LOAD VOLTAGE:	460V
COIL VOLTAGE:	120V/60 110V/50
CPT SELECTION:	C3 - With 100 VA extra capacity CPT, 120V/60HZ, 110V 50HZ sec
MAX HORSEPOWER RATING:	5
NOMINAL MOTOR / LOAD AMPS:	7.6 Amps
RESULTANT SIZE:	1
OVERLOAD TYPE:	SSOL - C440
OVERLOAD RANGE (AMPS, ONLY FOR SOLID STATE O/L):	4-20

 =====
ENCLOSURE

DISCONNECT:	Circuit Breaker
DISCONNECT RATING (FURE CLIP OR CIRCUIT BREAKER):	15 amp
ENCLOSURE TYPE:	NEMA 1 - General Purpose

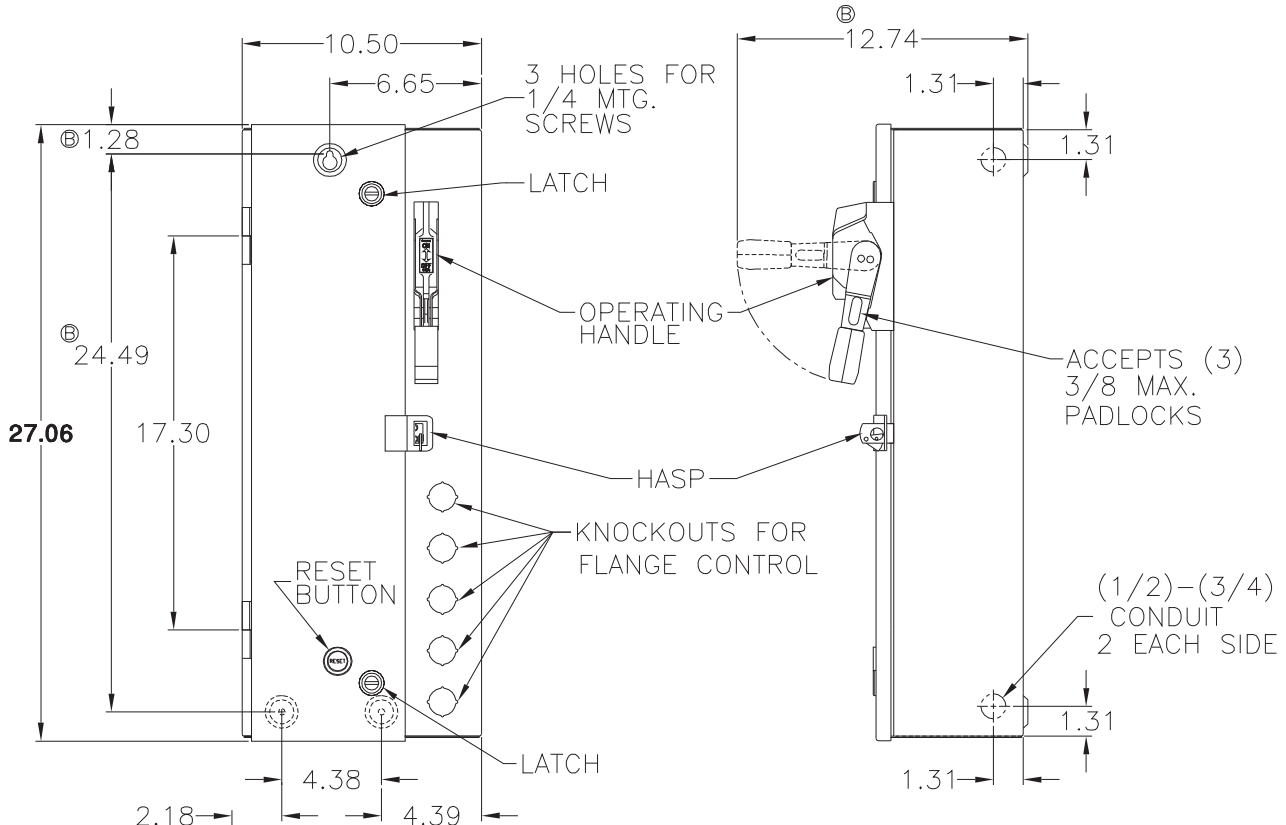
 =====
LABELING

 =====
NOTES

The information on this document is created by Eaton Corporation. It is disclosed in confidence and it is only to be used for the purpose in which it is supplied.	PREPARED BY Kyle Molnar	DATE 3/9/2022	 <i>Powering Business Worldwide</i>		
	APPROVED BY	DATE	JOB NAME Pumpkinvine Creek Regional LS (West Dallas)		
	VERSION 1.0.4.0	TYPE ENCLOSC	DRAWING TYPE Customer Appr.		
NEG-ALT Number AT900208X2K1-0000	REVISION 0	DWG SIZE A	G.O.	ITEM	SHEET 1 of 1

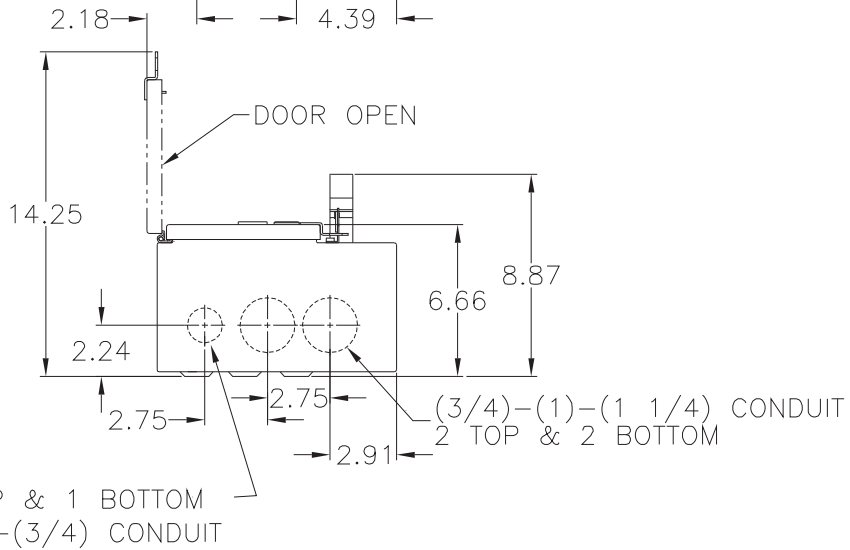
B

B



A

A



Dimensions shown in inches

REV. 2		SIZE A	FILENAME 84-28780.DWG	DWG. NO. 84-28780
EAD_ACAD_FRMA1 REV. 05/13/08		SUBTITLE BOX A NEMA 1		SHEET NO. 1 OF 1

GO/NEG-Alt-Date: AT900208X2K1-0000-3/9/2022		Job Name: Pumpkinvine Creek Regional LS (West Dallas)	
Item Number:	Catalog Number: ECN2411CBD-R63/CA21A30C3P	Designation:	



Powering Business Worldwide

Technical Documents

Freedom Full Voltage Controls

2



Product Description

Eaton's Freedom Series™ starters and contactors feature a compact, space-saving design, high strength, impact and temperature resistant insulating materials.

Features

- C440 solid-state electronic overload providing reliable, accurate and value-driven protection, including communication capabilities, while reducing inventory carrying costs with wide FLA adjustment (5:1) and selectable trip class
- Adjustable bimetallic ambient compensated overload relays with interchangeable heater packs—available in three basic sizes, covering applications up to 900 hp
- Fixed heater overloads optional
- A full line of snap-on accessories—top and side mounted auxiliary contacts, solid-state and pneumatic timers, and so on
- Straight-through wiring—line lugs at top, load lugs at bottom
- Horizontal or vertical mounting on upright panel for application freedom
- Screw type power terminals have captive, backed-out self-lifting pressure plates with ± screws—reduced wiring time
- Accessible terminals for easy wiring. Optional fingerproof shields available to prevent electrical shock
- Top located coil terminals convenient and readily accessible. 45 mm contactor magnet coils have three terminals, permitting either top or diagonal wiring—easy to replace European or U.S. style starters or contactors without changing wiring layout
- Encapsulated dual voltage/frequency magnet coils—permanently marked with voltage, frequency and part number
- Designed to meet or exceed UL, CSA®, IEC, VDE, BS and other international standards and listings

Standards and Certifications

Note: See **Tab 17** for additional information on standards and certifications that apply to all enclosed control products.

- UL Listed
- cUL® Listed (indicates appropriate CSA Standard investigation)
- ABS Type Approved
- OSHPD Certified (OSP-0015-10)

Certified Type 2 Coordination

Eaton's Freedom Series NEMA starters are UL Certified to achieve IEC 947 Type 2 coordination against 100,000 A short-circuit fault currents. Any brand of properly selected fuse can be used. Type 2 coordination means that the starter will be suitable for further use following a short-circuit fault.

ISO 9001 Certification

When you turn to Eaton’s products, you turn to quality. The International Standards Organization (ISO®) has established a series of standards acknowledged by 91 industrialized nations to bring harmony to the international quest for quality. The ISO certification process covers 20 quality system elements in design, production and installation that must conform to achieve registration. The enclosed control is manufactured in our Fayetteville, NC plant, and this facility is registered ISO 9001. This commitment to quality results in increased product reliability and total customer satisfaction.

Freedom NEMA contactors and starters are extremely rugged products built for any application. Their long electrical/mechanical life is extended through easy maintainability.

- Meets and exceeds all UL and CSA standards
- Sized based on standard NEMA size classifications
- Designed and built for a variety of demanding applications
- Easy coil change and inspectable/replaceable contacts
- Available open and in Type 1, 3R, 4, 4X, 7/9 and 12 enclosures

Short-Circuit Protection

Fuses and inverse-time circuit breakers may be selected per Article 430, Part D of the National Electrical Code to protect motor branch circuits from fault conditions. If higher ratings or settings are required to start the motor, do **not** exceed the maximum as listed in Exception No. 2, Article 430-52.

Additional Reference

Other Magnet Coils	V10-T2-4
Cover Control	V10-T2-6
Dimensions	Tab 14
Accessories and Modifications	Tab 15
Renewal Parts	Tab 16
Technical Data and Specifications	Tab 17

2.1

NEMA Contactors and Starters

Freedom Full Voltage Controls

Catalog Number Selection

NEMA Freedom Line Enclosed Control

2

EC N 22 2 1 A A F -

Design
N = Freedom NEMA 2 = A200

Class	Page
01 = Non-reversing contactor—three-pole	V10-T2-10
Non-reversing contactor—two-pole	V10-T2-12
Non-reversing contactor—four-pole	V10-T2-14
Non-reversing contactor—five-pole	V10-T2-15
02 = Reversing contactor—three-pole	V10-T2-16
05 = Non-combination non-reversing starter	V10-T2-18
05 = Non-combination single-phase non-reversing starter	V10-T2-20
06 = Non-combination reversing starter	V10-T2-21
07 = Non-combination non-reversing starter with CPT	V10-T2-23
16 = Combination non-reversing starter—fusible disconnect	V10-T2-25
Combination non-reversing starter—non-fusible disconnect	V10-T2-27
Special enclosure combination non-reversing starter—fusible/non-fusible disconnect	V10-T2-29
17 = Combination reversing starter—fusible disconnect	V10-T2-31
Combination reversing starter—non-fusible disconnect	V10-T2-33
18 = Combination non-reversing starter—fusible disconnect with CPT	V10-T2-35
Combination non-reversing starter—non-fusible disconnect with CPT	V10-T2-37
22 = Combination non-reversing starter—circuit breaker	V10-T2-39
Special enclosure combination non-reversing starter—circuit breaker	V10-T2-42
23 = Combination reversing starter—circuit breaker	V10-T2-44
24 = Combination non-reversing starter—circuit breaker with CPT	V10-T2-47

NEMA Size		
A = Size 00	3 = Size 3	7 = Size 7
0 = Size 0	4 = Size 4	8 = Size 8
1 = Size 1	5 = Size 5	9 = Size 9
2 = Size 2	6 = Size 6	

Modification/Overload Codes
All modification codes, see Tab 15 . For solid-state overload codes, Page V10-T2-5

Disconnect Fuse Clip Ratings		
A = None	G = 100 A/600 V R	N = 600 A/600 V R
B = 30 A/250 V R	H = 200 A/250 V R	P = 800 A/600 V L
C = 30 A/600 V R	J = 200 A/600 V R	Q = 1200 A/600 V L
D = 60 A/250 V R	K = 400 A/250 V R	R = 1600 A/600 V L
E = 60 A/600 V R	L = 400 A/600 V R	S = 2000 A/600 V L
F = 100 A/250 V R	M = 600 A/250 V R	T = By description

Circuit Breaker Ratings		
A = None	H = 150 A	R = 3000 A
B = 3 A	J = 250 A	T = By description
C = 7 A	K = 400 A	5 = 3 A ①
D = 15 A	L = 600 A	6 = 7 A ①
E = 30 A	M = 800 A	7 = 15 A ①
F = 50 A	N = 1000 A	8 = 30 A ①
W = 70 A	P = 1200 A	9 = 50 A ①
G = 100 A	Q = 2000 A	I = 100 A ①

Cover Control
Type 1 non-comb. (NEW BOX 1 only), Page V10-T2-6
Type 1 non-comb., Page V10-T2-7
All others, Page V10-T2-8
Contactors
3 = Three poles

Coil Voltage and/or Control Transformers
See code tables below

Enclosure Type
1 = Type 1—General purpose
2 = Type 3R—Rainproof
3 = Type 4—Watertight (painted steel)
4 = Type 4X—Watertight (304-Grade stainless steel)
5 = Type 4X—Corrosion (non-metallic)
6 = Type 7/9—Bolted hazardous location
7 = Type 7/9—Threaded hazardous location
8 = Type 12—Dust-tight
9 = Type 4X—316-Grade stainless steel

Magnetic Coil Codes (System Voltage) ②

Code	Magnet Coil	Code	Magnet Coil	Code	Magnet Coil
A	120/60–110/50	K	240/50	U	24/50
B	240/60–220/50	L	380/50	V	32/50
C	460/60–440/50	M	415/50	W	48/60
D	575/60–550/50	P	12 Vdc	X	104–120/60
E	208/60	Q	24 Vdc	Y	48/50
G	550/50	R	48 Vdc	Z	By description
H	277/60	S	125 Vdc		
J	208–240/60	T	24/60		

Notes

- ① Use for 0–3, HMCP 600 V applications only.
- ② When control power transformer modification codes (**C1–C11**) are used or when starter class includes CPT (that is ECN07, 18) see the table at right for system voltage code.

Control Power Transformer Codes (System Voltage)

Code	Primary	Secondary
B	240/480–220/440 wired for 240 V	120/60–110/50
C	240/480–220/440 wired for 480 V	120/60–110/50
D	600/60–550/50	120/60–110/50
E	208/60	120/60
H	277/60	120/60
L	380/50	110/50
M	415/50	110/50
Q	208/60	24
R	240/480–220/440 wired for 240 V	24
S	240/480–220/440 wired for 480 V	24
T	600/60	24
U	277/60	24
V	380/50	24
W	415/50	24
X	240/480/600 wired for 480 V	120
Y	240/480/600 wired for 480 V	24
Z	By description	—

C440 Solid-State Overload Modifications

Reliability and Improved Uptime

- C440 provides the users with peace of mind knowing that their assets are protected with the highest level of motor protection and communication capability in its class
- Extends the life of plant assets with selectable motor protection features such as trip class, phase unbalance and ground fault
- Protects against unnecessary downtime by discovering changes in your system (line/load) with remote monitoring capabilities
- Status LED provides added assurance that valuable assets are protected by indicating the overload operational status

Flexibility

- Improves return on investment by reducing inventory carrying costs with wide FLA adjustment (5:1) and selectable trip class
- Design incorporates built-in ground fault protection thus eliminating the need for separate CTs and modules
- Flexible communication with optional I/O enables easy integration into plant management systems for remote monitoring and control

Monitoring Capabilities

- Individual phase currents RMS
- Average three-phase current RMS
- Thermal memory
- Fault indication (overload, phase loss, phase unbalance, ground fault)

Safety

- IP20 rated terminal blocks
- Available in Eaton's industry leading FlashGard MCCs
- Tested to the highest industry standards such as UL, CSA, CE and IEC
- RoHS compliant

For solid-state overload enclosed control, add R63 or R64 modification code after the base Catalog Number. (Example, ECN0501AAA-**R63/B**).

Modification	IEC Size	NEMA Size	Full Load Current Adjustment Range (A)	Three-Phase without Ground Fault Auto/Manual Reset Overload Selectable Class 10/20/30	Three-Phase with Ground Fault Auto/Manual Reset Overload Selectable Class 10/20/30
Solid-state electronic overload relay ^①	B and C	00	0.33–1.65 ^②	R63/A	R64/A
			1–5	R63/B	R64/B
			4–20	R63/C	R64/C
	C and D	0 and 1	0.33–1.65 ^②	R63/A	R64/A
			1–5	R63/B	R64/B
			4–20	R63/C	R64/C
			9–45	R63/D	R64/D
	D	2	9–45	R63/D	R64/D
	D, F and G	3	20–100	R63/E	R64/E
G	4	28–140	R63/F	R64/F	
N/A	5	60–300	R63/G	R64/G	
N/A	6	120–600	R63/H	R64/H	

Notes

- ^① Features:
 - Self-powered
 - Phase loss protection
 - Current adjustment knob
 - ±1% repeat accuracy
 - 1NO and 1NC isolated contacts
- ^② Not UL Listed.

2.1

NEMA Contactors and Starters

Freedom Full Voltage Controls

Cover Control

Product Selection

2

Type 1 Non-Combination Cover Control (Box 1 Only)

- Cover control for non-combination starters uses M22 style devices as standard
- Pushbuttons are momentary type
- Field convertible selector switches from momentary to maintained operation and vice versa
- Cover control kits include hardware, M22 pushbuttons, bracket and pre-wired wire harnesses
- See Volume 7, Tab 1, for more details on M22 pushbuttons

Type 1 Non-Combination Cover Control (Box 1 Only)

Box 1 offering includes FVNR contactor sizes 00–2, electronic FVNR starters size 00–2 and bi-metallic FVNR starters size 00–1.



Description	Factory Installed Flange Control Position 9 Cover Control Code	Field Installation Kits Catalog Number
Non-Reversing		
No cover mounted pilot devices	A	—
STOP/START oval pushbuttons	B	C600M1
With red RUN pilot light	C	C600M101_①
With red RUN/green OFF lights	D	C600M102_①
OFF/ON oval pushbuttons	E	C600M2
With red RUN pilot light	F	C600M201_①
With red RUN/green OFF lights	G	C600M202_①
STOP/START selector switch	S	C600M13
With red RUN pilot light	T	C600M131_①
With red RUN/green OFF lights	U	C600M132_①
OFF/ON selector switch	V	C600M14
With red RUN pilot light	W	C600M141_①
With red RUN/green OFF lights	X	C600M142_①
HAND/OFF/AUTO selector switch	H	C600M12
With red RUN pilot light	J	C600M121_①
With red RUN/green OFF lights	K	C600M122_①
Green START pushbutton	L	C600M3
Red STOP pushbutton	Y	C600M7 ①
Green ON pushbutton	M	C600M4
Red OFF pushbutton	N	C600M5
Red RUN pilot light	P	C600M9_①
Green OFF pilot light	Q	C600M10_①
Red RUN/green OFF lights	R	C600M11_①
TEST/OFF/AUTO selector switch	—	C600M8

Note

① Add code letter from the table below to catalog number for voltage. Example: C600M101**A**.

Rating	Code Letter
85–264 Vac	A
480 Vac	C
12–30 Vac/Vdc	T

Type 1 Non-Combination Cover Control (Box 2 and Larger Enclosures Only)

- Cover control for combination starters uses 10250T style devices as standard
- Selector switches are maintained with lever operators
- Pushbuttons are momentary type with extended pushbutton
- The kit includes hardware and connecting wires (where possible)
- For factory installed control devices other than shown below, refer to modification codes, **Tab 15**

Type 1 Cover Control



Type 1 Non-Combination Cover Control (Box 2 and Larger Enclosures Only)

Box 2 and Larger Enclosure offering includes contactors size 3–5, electronic starters size 3–5 and bi-metallic starters size 2–5.

Description	Factory Installed Flange Control ① Position 9 Cover Control Code	Field Installation Kits Catalog Number
Non-Reversing		
No cover mounted pilot devices	A	C400GK0
STOP/START pushbuttons	B	C400GK1
With red RUN pilot light	C	C400GK12 ②
With red RUN/green OFF lights	D	C400GK16 ②
HAND/OFF/AUTO selector switch	H	C400GK3
With red RUN pilot light	J	C400GK32 ②
With red RUN/green OFF lights	K	C400GK36 ②
Red RUN pilot light	P	C400GK42 ②
Green OFF	Q	C400GK41 ②
Red RUN/green OFF pilot lights	R	C400GK46 ②
Reversing		
No cover mounted pilot devices	A	C400GK0
FOR/REV/STOP pushbuttons	B	C400GR1
With two red pilot lights	C	C400GR14 ②
UP/STOP/DOWN pushbuttons	E	C400GR2
With two red pilot lights	F	C400GR24 ②
Two red pilot lights	P	C400GK44 ②
One green pilot light	Q	C400GK41 ②

Notes

- ① For more available factory installed flange control, see **Page V10-T2-8**.
- ② Add code letter from the table below to catalog number for voltage—kits only. Example: C400GK0B.

Rating	Code Letter	Rating	Code Letter	Rating	Code Letter
120 V 60 Hz	A	277 V 60 Hz	H	480 V 60 Hz	C
208 V 60 Hz	E	380 V 50 Hz	L	600 V 60 Hz	D
240 V 60 Hz	B				

2.1

NEMA Contactors and Starters

Freedom Full Voltage Controls

2

Type 1 Combination and All Type 3R, 4X and 12 Cover Control

- Cover control for combination starters uses 10250T style devices as standard
- Selector switches are maintained with lever operators
- Pushbuttons are momentary type with extended pushbutton
- The kit includes hardware and connecting wires (where possible)
- For factory installed control devices other than shown below, refer to modification codes, **Tab 15**

10250T Cover Control Kits



Type 1 Combination and All Type 3R, 4X and 12 Cover Control ^①

Description	Factory Installed Flange Control Position 9 Cover Control Code	Field Installation Kits Catalog Number
Non-Reversing		
No cover mounted pilot devices	A	—
START/STOP pushbuttons	B	C400T1
With red RUN pilot light	C	—
With red RUN/green OFF lights	D	—
ON/OFF pushbuttons	E	C400T2
With red RUN pilot light	F	—
With red RUN/green OFF lights	G	—
HAND/OFF/AUTO selector switch	H	C400T12
With red RUN pilot light	J	—
With red RUN/green OFF lights	K	—
START pushbutton	L	C400T3
ON pushbutton	M	C400T4
OFF pushbutton	N	C400T5
Red RUN pilot light	P	C400T9 ^②
Green OFF	Q	C400T10 ^②
Red RUN/green OFF pilot lights	R	C400T11 ^②
START/STOP selector switch	S	C400T13
With red RUN pilot light	T	—
With red RUN/green OFF lights	U	—
ON/OFF selector switch	V	C400T14
With red RUN pilot light	W	—
With red RUN/green OFF lights	X	—
Reversing		
No cover mounted pilot devices	A	—
FOR/REV/STOP pushbuttons	B	C400T6
With two red pilot lights	C	—
With two red/one green pilot lights	D	—
UP/STOP/DOWN pushbuttons	E	—
With two red pilot lights	F	—
FOR/OFF/REV selector switch	H	C400T15
With two red pilot lights	J	—
With two red/one green pilot lights	K	—
Two red pilot lights	P	③
One green pilot light	Q	C400T10 ^②
Two red/one green pilot lights	R	—
OPEN/OFF/CLOSE selector switch	V	C400T16
With two red pilot lights	W	—
With two red/one green pilot lights	X	—

Notes

- ① For Type 1 non-combination field installation kits, see **Page V10-T2-7**.
- ② Add code letter from the table below to catalog number for voltage—kits only. Example: C400T9**B**.

Rating	Code Letter	Rating	Code Letter	Rating	Code Letter
120 V 60 Hz	A	277 V 60 Hz	H	480 V 60 Hz	C
208V 60 Hz	E	380 V 50 Hz	L	600 V 60 Hz	D
240 V 60 Hz	B				

- ③ Order quantity (2) of **C400T10**.

Type 1 Non-Combination Empty Enclosure (Box 1 Only)

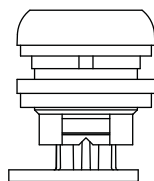
There is a universal empty enclosure for the non-metallic Type 1 Non-Combination Box 1 regardless of the starter or the contactor needed. The only difference is the length of the easily interchangeable reset rod. The reset rod kit provides everything needed to install the correct reset rod, including all the reset rod lengths, a protective shroud, a paddle and a reset button with nut.

Box 1 offering includes FVNR contactors size 00–2, FVR contactors size 00–0, FVNR electronic starters size 00–2, and FVNR bi-metallic starters size 00-1.

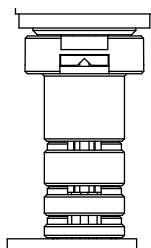
Empty Enclosure Stocking Needs	Catalog Number
Empty enclosure	C899B001
Reset rod kit	RESET001

The table below shows which reset rod is used with each starter or contactor.

Starter or Contactor	Reset Rod Length
NEMA FVNR Size 00–2, solid-state overload	0.43-inch reset
NEMA FVNR Size 00–1, bi-metallic overload	1.68-inch reset
All NEMA FVNR and FVR contactors	No reset needed



FVNR Solid State
OL Reset—0.43 inches



FVNR Bi-Metallic
OL Reset—1.68 inches

Combination Starters—Fusible and Non-Fusible

Features

- Three-phase magnetic
- Three-pole non-reversing or reversing
- Standard interchangeable heater OLR
- Optional electronic overload
- 600 V maximum
- 100,000 rms short-circuit rating with fuses

Product Selection

Class ECN16—Combination Non-Reversing Starter—Fusible Disconnect

NEMA Size	Motor Voltage	Maximum hp Rating		Fuse Clip Amps	Type 1	Type 3R	Type 4X	Type 12	Component Starter (Open)
		Dual Element Fuses	Magnet Coil Voltage		General Purpose	Rainproof	Watertight and Dust-Tight Stainless Steel ①	Dust-Tight Industrial External Reset ②③	
					Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number
00	—	—	120	30 A	ECN16A1AAB	ECN16A2AAB	ECN16A4AAB	ECN16A8AAB	AN16AN0AC
	200	1-1/2	208		ECN16A1EAB	ECN16A2EAB	ECN16A4EAB	ECN16A8EAB	AN16AN0EC
	230	1-1/2	240		ECN16A1BAB	ECN16A2BAB	ECN16A4BAB	ECN16A8BAB	AN16AN0BC
	460	2	480		ECN16A1CAC	ECN16A2CAC	ECN16A4CAC	ECN16A8CAC	AN16AN0CC
	575	2	600		ECN16A1DAC	ECN16A2DAC	ECN16A4DAC	ECN16A8DAC	AN16AN0DC
0	—	—	120	30 A	ECN1601AAB	ECN1602AAB	ECN1604AAB	ECN1608AAB	AN16BN0AC
	200	3	208		ECN1601EAB	ECN1602EAB	ECN1604EAB	ECN1608EAB	AN16BN0EC
	230	3	240		ECN1601BAB	ECN1602BAB	ECN1604BAB	ECN1608BAB	AN16BN0BC
	460	5	480		ECN1601CAC	ECN1602CAC	ECN1604CAC	ECN1608CAC	AN16BN0CC
	575	5	600		ECN1601DAC	ECN1602DAC	ECN1604DAC	ECN1608DAC	AN16BN0DC
1	—	—	120	30 A	ECN1611AAB	ECN1612AAB	ECN1614AAB	ECN1618AAB	AN16DN0AB
	200	7-1/2	208		ECN1611EAB	ECN1612EAB	ECN1614EAB	ECN1618EAB	AN16DN0EB
	230	7-1/2	240		ECN1611BAB	ECN1612BAB	ECN1614BAB	ECN1618BAB	AN16DN0BB
	460	10	480		ECN1611CAC	ECN1612CAC	ECN1614CAC	ECN1618CAC	AN16DN0CB
	575	10	600		ECN1611DAC	ECN1612DAC	ECN1614DAC	ECN1618DAC	AN16DN0DB
2	—	—	120	60 A	ECN1621AAD	ECN1622AAD	ECN1624AAD	ECN1628AAD	AN16GN0AB
	200	10	208		ECN1621EAD	ECN1622EAD	ECN1624EAD	ECN1628EAD	AN16GN0EB
	230	15	240		ECN1621BAD	ECN1622BAD	ECN1624BAD	ECN1628BAD	AN16GN0BB
	460	25	480		ECN1621CAE	ECN1622CAE	ECN1624CAE	ECN1628CAE	AN16GN0CB
	575	25	600		ECN1621DAE	ECN1622DAE	ECN1624DAE	ECN1628DAE	AN16GN0DB
3	—	—	120	100 A	ECN1631AAF	ECN1632AAF	ECN1634AAF	ECN1638AAF	AN16KN0A
	200	25	208		ECN1631EAF	ECN1632EAF	ECN1634EAF	ECN1638EAF	AN16KN0E
	230	30	240		ECN1631BAF	ECN1632BAF	ECN1634BAF	ECN1638BAF	AN16KN0B
	460	50	480		ECN1631CAG	ECN1632CAG	ECN1634CAG	ECN1638CAG	AN16KN0C
	575	50	600		ECN1631DAG	ECN1632DAG	ECN1634DAG	ECN1638DAG	AN16KN0D

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

① The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit. Example: ECN16A4AAB. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

② All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.

③ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.

2.1

NEMA Contactors and Starters

Freedom Full Voltage Controls

2

Class ECN16—Combination Non-Reversing Starter—Fusible Disconnect, continued

NEMA Size	Motor Voltage	Maximum hp Rating		Fuse Clip Amps	Type 1	Type 3R	Type 4X	Type 12	Component Starter (Open)
		Dual Element Fuses	Magnet Coil Voltage		General Purpose	Rainproof	Watertight and Dust-Tight Stainless Steel ^①	Dust-Tight Industrial External Reset ^{②③}	
					Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number
4	—	—	120	200 A	ECN1641AAH	ECN1642AAH	ECN1644AAH	ECN1648AAH	AN16NN0A
	200	40	208		ECN1641EAH	ECN1642EAH	ECN1644EAH	ECN1648EAH	AN16NN0E
	230	50	240		ECN1641BAH	ECN1642BAH	ECN1644BAH	ECN1648BAH	AN16NN0B
	460	100	480		ECN1641CAJ	ECN1642CAJ	ECN1644CAJ	ECN1648CAJ	AN16NN0C
	575	100	600		ECN1641DAJ	ECN1642DAJ	ECN1644DAJ	ECN1648DAJ	AN16NN0D
5	—	—	120	400 A	ECN1651AAK	ECN1652AAK	ECN1654AAK	ECN1658AAK	AN16SN0AB
	200	75	208		ECN1651EAK	ECN1652EAK	ECN1654EAK	ECN1658EAK	AN16SN0EB
	230	100	240		ECN1651BAK	ECN1652BAK	ECN1654BAK	ECN1658BAK	AN16SN0BB
	460	200	480		ECN1651CAL	ECN1652CAL	ECN1654CAL	ECN1658CAL	AN16SN0CB
	575	200	600		ECN1651DAL	ECN1652DAL	ECN1654DAL	ECN1658DAL	AN16SN0DB
6	—	—	120	600 A	ECN1661AAM	ECN1662AAM	ECN1663AAM ^④	ECN1668AAM	AN16TN0AB
	200	150	208		ECN1661EAM	ECN1662EAM	ECN1663EAM ^④	ECN1668EAM	AN16TN0EB
	230	200	240		ECN1661BAM	ECN1662BAM	ECN1663BAM ^④	ECN1668BAM	AN16TN0BB
	460	400	480		ECN1661CAN	ECN1662CAN	ECN1663CAN ^④	ECN1668CAN	AN16TN0CB
	575	400	600		ECN1661DAN	ECN1662DAN	ECN1663DAN ^④	ECN1668DAN	AN16TN0DB
7	—	—	120	⑤	ECN1671AAU	ECN1672AAU	ECN1673AAU ^④	ECN1678AAU	AN16UN0AB
	230	300	240		ECN1671BAU	ECN1672BAU	ECN1673BAU ^④	ECN1678BAU	AN16UN0BB
	460	600	480		ECN1671CAU	ECN1672CAU	ECN1673CAU ^④	ECN1678CAU	AN16UN0CB
	575	600	600		ECN1671DAU	ECN1672DAU	ECN1673DAU ^④	ECN1678DAU	AN16UN0DB
8	—	—	120	⑤	ECN1681AAU	ECN1682AAU	ECN1683AAU ^④	ECN1688AAU	AN16VN0AB
	230	450	240		ECN1681BAU	ECN1682BAU	ECN1683BAU ^④	ECN1688BAU	AN16VN0BB
	460	900	480		ECN1681CAU	ECN1682CAU	ECN1683CAU ^④	ECN1688CAU	AN16VN0CB
	575	900	600		ECN1681DAU	ECN1682DAU	ECN1683DAU ^④	ECN1688DAU	AN16VN0DB
9	—	—	120	⑤	ECN1691AAU	ECN1692AAU	ECN1693AAU ^④	ECN1698AAU	AN16WN0A
	230	800	240		ECN1691BAU	ECN1692BAU	ECN1693BAU ^④	ECN1698BAU	AN16WN0B
	460	1000 ^⑥	480		ECN1691CAU	ECN1692CAU	ECN1693CAU ^④	ECN1698CAU	AN16WN0C
	575	1000	600		ECN1691DAU	ECN1692DAU	ECN1693DAU ^④	ECN1698DAU	AN16WN0D

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

- ① The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit. Example: ECN1644AAH. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.
- ② All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.
- ③ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.
- ④ Type 4 (painted steel) sizes 6–9.
- ⑤ Supply hp, voltage, FLA and whether motor is design E or not when ordering the starter.
- ⑥ For 1250 and 1600 hp ratings at 460 V, consult Eaton.

Class ECN16—Combination Non-Reversing Starter—Non-Fusible Disconnect ①

NEMA Size	Motor Voltage	Maximum hp Rating	Magnet Coil Voltage	Disconnect Amps	Type 1 General Purpose Catalog Number	Type 3R Rainproof Catalog Number	Type 4X Watertight and Dust-Tight Stainless Steel ② Catalog Number	Type 12 Dust-Tight Industrial External Reset ③④ Catalog Number	Component Starter (Open) Catalog Number
00	—	—	120	30 A	ECN16A1AAA	ECN16A2AAA	ECN16A4AAA	ECN16A8AAA	AN16AN0AC
	200	1-1/2	208		ECN16A1EAA	ECN16A2EAA	ECN16A4EAA	ECN16A8EAA	AN16AN0EC
	230	1-1/2	240		ECN16A1BAA	ECN16A2BAA	ECN16A4BAA	ECN16A8BAA	AN16AN0BC
	460	2	480		ECN16A1CAA	ECN16A2CAA	ECN16A4CAA	ECN16A8CAA	AN16AN0CC
	575	2	600		ECN16A1DAA	ECN16A2DAA	ECN16A4DAA	ECN16A8DAA	AN16AN0DC
0	—	—	120	30 A	ECN1601AAA	ECN1602AAA	ECN1604AAA	ECN1608AAA	AN16BN0AC
	200	3	208		ECN1601EAA	ECN1602EAA	ECN1604EAA	ECN1608EAA	AN16BN0EC
	230	3	240		ECN1601BAA	ECN1602BAA	ECN1604BAA	ECN1608BAA	AN16BN0BC
	460	5	480		ECN1601CAA	ECN1602CAA	ECN1604CAA	ECN1608CAA	AN16BN0CC
	575	5	600		ECN1601DAA	ECN1602DAA	ECN1604DAA	ECN1608DAA	AN16BN0DC
1	—	—	120	30 A	ECN1611AAA	ECN1612AAA	ECN1614AAA	ECN1618AAA	AN16DN0AB
	200	7-1/2	208		ECN1611EAA	ECN1612EAA	ECN1614EAA	ECN1618EAA	AN16DN0EB
	230	7-1/2	240		ECN1611BAA	ECN1612BAA	ECN1614BAA	ECN1618BAA	AN16DN0BB
	460	10	480		ECN1611CAA	ECN1612CAA	ECN1614CAA	ECN1618CAA	AN16DN0CB
	575	10	600		ECN1611DAA	ECN1612DAA	ECN1614DAA	ECN1618DAA	AN16DN0DB
2	—	—	120	60 A	ECN1621AAA	ECN1622AAA	ECN1624AAA	ECN1628AAA	AN16GN0AB
	200	10	208		ECN1621EAA	ECN1622EAA	ECN1624EAA	ECN1628EAA	AN16GN0EB
	230	15	240		ECN1621BAA	ECN1622BAA	ECN1624BAA	ECN1628BAA	AN16GN0BB
	460	25	480		ECN1621CAA	ECN1622CAA	ECN1624CAA	ECN1628CAA	AN16GN0CB
	575	25	600		ECN1621DAA	ECN1622DAA	ECN1624DAA	ECN1628DAA	AN16GN0DB
3	—	—	120	100 A	ECN1631AAA	ECN1632AAA	ECN1634AAA	ECN1638AAA	AN16KN0A
	200	25	208		ECN1631EAA	ECN1632EAA	ECN1634EAA	ECN1638EAA	AN16KN0E
	230	30	240		ECN1631BAA	ECN1632BAA	ECN1634BAA	ECN1638BAA	AN16KN0B
	460	50	480		ECN1631CAA	ECN1632CAA	ECN1634CAA	ECN1638CAA	AN16KN0C
	575	50	600		ECN1631DAA	ECN1632DAA	ECN1634DAA	ECN1638DAA	AN16KN0D
4	—	—	120	200 A	ECN1641AAA	ECN1642AAA	ECN1644AAA	ECN1648AAA	AN16NN0A
	200	40	208		ECN1641EAA	ECN1642EAA	ECN1644EAA	ECN1648EAA	AN16NN0E
	230	50	240		ECN1641BAA	ECN1642BAA	ECN1644BAA	ECN1648BAA	AN16NN0B
	460	100	480		ECN1641CAA	ECN1642CAA	ECN1644CAA	ECN1648CAA	AN16NN0C
	575	100	600		ECN1641DAA	ECN1642DAA	ECN1644DAA	ECN1648DAA	AN16NN0D

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

① Field installed fuse clips available, see **Tab 13**.

② The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit. Example: ECN16A4AAA. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

③ All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.

④ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.

2.1

NEMA Contactors and Starters

Freedom Full Voltage Controls

Class ECN16—Combination Non-Reversing Starter—Non-Fusible Disconnect, continued ^①

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NEMA Size	Motor Voltage	Maximum hp Rating	Magnet Coil Voltage	Disconnect Amps	Type 1	Type 3R	Type 4X	Type 12	Component Starter (Open)
					General Purpose	Rainproof	Watertight and Dust-Tight Stainless Steel ^②	Dust-Tight Industrial External Reset ^{③④}	
					Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number
5	—	—	120	400 A	ECN1651AAA	ECN1652AAA	ECN1654AAA	ECN1658AAA	AN16SN0AB
	200	75	208		ECN1651EAA	ECN1652EAA	ECN1654EAA	ECN1658EAA	AN16SN0EB
	230	100	240		ECN1651BAA	ECN1652BAA	ECN1654BAA	ECN1658BAA	AN16SN0BB
	460	200	480		ECN1651CAA	ECN1652CAA	ECN1654CAA	ECN1658CAA	AN16SN0CB
	575	200	600		ECN1651DAA	ECN1652DAA	ECN1654DAA	ECN1658DAA	AN16SN0DB
6	—	—	120	600 A	ECN1661AAA	ECN1662AAA	ECN1663AAA ^⑤	ECN1668AAA	AN16TN0AB
	200	150	208		ECN1661EAA	ECN1662EAA	ECN1663EAA ^⑤	ECN1668EAA	AN16TN0EB
	230	200	240		ECN1661BAA	ECN1662BAA	ECN1663BAA ^⑤	ECN1668BAA	AN16TN0BB
	460	400	480		ECN1661CAA	ECN1662CAA	ECN1663CAA ^⑤	ECN1668CAA	AN16TN0CB
	575	400	600		ECN1661DAA	ECN1662DAA	ECN1663DAA ^⑤	ECN1668DAA	AN16TN0DB
7	—	—	120	^⑥	ECN1671AAA	ECN1672AAA	ECN1673AAA ^⑤	ECN1678AAA	AN16UN0AB
	230	300	240		ECN1671BAA	ECN1672BAA	ECN1673BAA ^⑤	ECN1678BAA	AN16UN0BB
	460	600	480		ECN1671CAA	ECN1672CAA	ECN1673CAA ^⑤	ECN1678CAA	AN16UN0CB
	575	600	600		ECN1671DAA	ECN1672DAA	ECN1673DAA ^⑤	ECN1678DAA	AN16UN0DB
8	—	—	120	^⑥	ECN1681AAA	ECN1682AAA	ECN1683AAA ^⑤	ECN1688AAA	AN16VN0AB
	230	450	240		ECN1681BAA	ECN1682BAA	ECN1683BAA ^⑤	ECN1688BAA	AN16VN0BB
	460	900	480		ECN1681CAA	ECN1682CAA	ECN1683CAA ^⑤	ECN1688CAA	AN16VN0CB
	575	900	600		ECN1681DAA	ECN1682DAA	ECN1683DAA ^⑤	ECN1688DAA	AN16VN0DB
9	—	—	120	^⑥	ECN1691AAA	ECN1692AAA	ECN1693AAA ^⑤	ECN1698AAA	AN16WN0A
	230	800	240		ECN1691BAA	ECN1692BAA	ECN1693BAA ^⑤	ECN1698BAA	AN16WN0B
	460	1000 ^⑦	480		ECN1691CAA	ECN1692CAA	ECN1693CAA ^⑤	ECN1698CAA	AN16WN0C
	575	1000	600		ECN1691DAA	ECN1692DAA	ECN1693DAA ^⑤	ECN1698DAA	AN16WN0D

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

^① Field installed fuse clips available, see **Tab 13**.

^② The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit. Example: ECN1654AAA. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

^③ All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.

^④ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.

^⑤ Type 4 (painted steel) sizes 6–9.

^⑥ Supply hp, voltage, FLA and whether motor is design E or not when ordering the starter.

^⑦ For 1250 and 1600 hp ratings at 460 V, consult Eaton.

Class ECN16—Special Enclosure Combination Non-Reversing Starter—Fusible/Non-Fusible Disconnect

NEMA Size	Motor Voltage	Maximum hp Rating	Magnet Coil Voltage	Fuse Clip Amperes ^①	Type 1	Type 4X	Type 12	Component Starter (Open)	
					General Purpose	Watertight and Dust-Tight Stainless Steel	Dust-Tight Industrial ^②	External Reset Catalog Number	Internal Reset Catalog Number
Horizontal Enclosure—Fusible									
1	—	—	120	30 A	ECN1611AAB-E13	—	ECN1618AAB-E13	ECN1618AAB-E13R5	AN16DN0AB
	200	7-1/2	208		ECN1611EAB-E13	—	ECN1618EAB-E13	ECN1618EAB-E13R5	AN16DN0EB
	230	7-1/2	240		ECN1611BAB-E13	—	ECN1618BAB-E13	ECN1618BAB-E13R5	AN16DN0BB
	460	10	480		ECN1611CAC-E13	—	ECN1618CAC-E13	ECN1618CAC-E13R5	AN16DN0CB
	575	10	600		ECN1611DAC-E13	—	ECN1618DAC-E13	ECN1618DAC-E13R5	AN16DN0DB
2	—	—	120	60 A	ECN1621AAD-E13	—	ECN1628AAD-E13	ECN1628AAD-E13R5	AN16GN0AB
	200	10	208		ECN1621EAD-E13	—	ECN1628EAD-E13	ECN1628EAD-E13R5	AN16GN0EB
	230	15	240		ECN1621BAD-E13	—	ECN1628BAD-E13	ECN1628BAD-E13R5	AN16GN0BB
	460	25	480		ECN1621CAE-E13	—	ECN1628CAE-E13	ECN1628CAE-E13R5	AN16GN0CB
	575	25	600		ECN1621DAE-E13	—	ECN1628DAE-E13	ECN1628DAE-E13R5	AN16GN0DB
Horizontal Enclosure—Non-Fusible									
1	—	—	120	—	ECN1611AAA-E13	—	ECN1618AAA-E13	ECN1618AAA-E13R5	AN16DN0AB
	200	7-1/2	208	—	ECN1611EAA-E13	—	ECN1618EAA-E13	ECN1618EAA-E13R5	AN16DN0EB
	230	7-1/2	240	—	ECN1611BAA-E13	—	ECN1618BAA-E13	ECN1618BAA-E13R5	AN16DN0BB
	460	10	480	—	ECN1611CAA-E13	—	ECN1618CAA-E13	ECN1618CAA-E13R5	AN16DN0CB
	575	10	600	—	ECN1611DAA-E13	—	ECN1618DAA-E13	ECN1618DAA-E13R5	AN16DN0DB
2	—	—	120	—	ECN1621AAA-E13	—	ECN1628AAA-E13	ECN1628AAA-E13R5	AN16GN0AB
	200	10	208	—	ECN1621EAA-E13	—	ECN1628EAA-E13	ECN1628EAA-E13R5	AN16GN0EB
	230	15	240	—	ECN1621BAA-E13	—	ECN1628BAA-E13	ECN1628BAA-E13R5	AN16GN0BB
	460	25	480	—	ECN1621CAA-E13	—	ECN1628CAA-E13	ECN1628CAA-E13R5	AN16GN0CB
	575	25	600	—	ECN1621DAA-E13	—	ECN1628DAA-E13	ECN1628DAA-E13R5	AN16GN0DB

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

^① Fuse clips are for Class R fuses only. For H and J fuses, see modifications in **Tab 15**.

^② To order Type 12 enclosures with safety door interlock add modification **E11**.

2.1

NEMA Contactors and Starters

Freedom Full Voltage Controls

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Class ECN16—Special Enclosure Combination Non-Reversing Starter—Fusible/Non-Fusible Disconnect, continued

NEMA Size	Motor Voltage	Maximum hp Rating	Magnet Coil Voltage	Fuse Clip Amperes ^①	Type 1	Type 4X	Type 12	Internal Reset Catalog Number	Component Starter (Open) Catalog Number
					General Purpose External Reset Catalog Number	Watertight and Dust-Tight Stainless Steel ^② External Reset Catalog Number	Dust-Tight Industrial ^③ External Reset Catalog Number		
OverSize Enclosure—without Control Transformer—Fusible									
0	—	—	120	30 A	ECN1601AAB-E3	ECN1604AAB-E3	ECN1608AAB-E3	ECN1608AAB-E3R5	AN16BN0AC
	200	3	208		ECN1601EAB-E3	ECN1604EAB-E3	ECN1608EAB-E3	ECN1608EAB-E3R5	AN16BN0EC
	230	3	240		ECN1601BAB-E3	ECN1604BAB-E3	ECN1608BAB-E3	ECN1608BAB-E3R5	AN16BN0BC
	460	5	480		ECN1601CAC-E3	ECN1604CAC-E3	ECN1608CAC-E3	ECN1608CAC-E3R5	AN16BN0CC
	575	5	600		ECN1601DAC-E3	ECN1604DAC-E3	ECN1608DAC-E3	ECN1608DAC-E3R5	AN16BN0DC
1	—	—	120	30 A	ECN1611AAB-E3	ECN1614AAB-E3	ECN1618AAB-E3	ECN1618AAB-E3R5	AN16DN0AB
	200	7-1/2	208		ECN1611EAB-E3	ECN1614EAB-E3	ECN1618EAB-E3	ECN1618EAB-E3R5	AN16DN0EB
	230	7-1/2	240		ECN1611BAB-E3	ECN1614BAB-E3	ECN1618BAB-E3	ECN1618BAB-E3R5	AN16DN0BB
	460	10	480		ECN1611CAC-E3	ECN1614CAC-E3	ECN1618CAC-E3	ECN1618CAC-E3R5	AN16DN0CB
	575	10	600		ECN1611DAC-E3	ECN1614DAC-E3	ECN1618DAC-E3	ECN1618DAC-E3R5	AN16DN0DB
2	—	—	120	60 A	ECN1621AAD-E3	ECN1624AAD-E3	ECN1628AAD-E3	ECN1628AAD-E3R5	AN16GN0AB
	200	10	208		ECN1621EAD-E3	ECN1624EAD-E3	ECN1628EAD-E3	ECN1628EAD-E3R5	AN16GN0EB
	230	15	240		ECN1621BAD-E3	ECN1624BAD-E3	ECN1628BAD-E3	ECN1628BAD-E3R5	AN16GN0BB
	460	25	480		ECN1621CAE-E3	ECN1624CAE-E3	ECN1628CAE-E3	ECN1628CAE-E3R5	AN16GN0CB
	575	25	600		ECN1621DAE-E3	ECN1624DAE-E3	ECN1628DAE-E3	ECN1628DAE-E3R5	AN16GN0DB
OverSize Enclosure—without Control Transformer—Non-Fusible									
0	—	—	120	—	ECN1601AAA-E3	ECN1604AAA-E3	ECN1608AAA-E3	ECN1608AAA-E3R5	AN16BN0AC
	200	3	208	—	ECN1601EAA-E3	ECN1604EAA-E3	ECN1608EAA-E3	ECN1608EAA-E3R5	AN16BN0EC
	230	3	240	—	ECN1601BAA-E3	ECN1604BAA-E3	ECN1608BAA-E3	ECN1608BAA-E3R5	AN16BN0BC
	460	5	480	—	ECN1601CAA-E3	ECN1604CAA-E3	ECN1608CAA-E3	ECN1608CAA-E3R5	AN16BN0CC
	575	5	600	—	ECN1601DAA-E3	ECN1604DAA-E3	ECN1608DAA-E3	ECN1608DAA-E3R5	AN16BN0DC
1	—	—	120	—	ECN1611AAA-E3	ECN1614AAA-E3	ECN1618AAA-E3	ECN1618AAA-E3R5	AN16DN0AB
	200	7-1/2	208	—	ECN1611EAA-E3	ECN1614EAA-E3	ECN1618EAA-E3	ECN1618EAA-E3R5	AN16DN0EB
	230	7-1/2	240	—	ECN1611BAA-E3	ECN1614BAA-E3	ECN1618BAA-E3	ECN1618BAA-E3R5	AN16DN0BB
	460	10	480	—	ECN1611CAA-E3	ECN1614CAA-E3	ECN1618CAA-E3	ECN1618CAA-E3R5	AN16DN0CB
	575	10	600	—	ECN1611DAA-E3	ECN1614DAA-E3	ECN1618DAA-E3	ECN1618DAA-E3R5	AN16DN0DB
2	—	—	120	—	ECN1621AAA-E3	ECN1624AAA-E3	ECN1628AAA-E3	ECN1628AAA-E3R5	AN16GN0AB
	200	10	208	—	ECN1621EAA-E3	ECN1624EAA-E3	ECN1628EAA-E3	ECN1628EAA-E3R5	AN16GN0EB
	230	15	240	—	ECN1621BAA-E3	ECN1624BAA-E3	ECN1628BAA-E3	ECN1628BAA-E3R5	AN16GN0BB
	460	25	480	—	ECN1621CAA-E3	ECN1624CAA-E3	ECN1628CAA-E3	ECN1628CAA-E3R5	AN16GN0CB
	575	25	600	—	ECN1621DAA-E3	ECN1624DAA-E3	ECN1628DAA-E3	ECN1628DAA-E3R5	AN16GN0DB

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

^① Fuse clips are for Class R fuses only. For H and J fuses, see modifications in **Tab 13**.

^② The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit. Example: ECN1604AAB-E3. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

^③ To order Type 12 enclosures with safety door interlock add modification **E11**.

Class ECN17—Combination Reversing Starter—Fusible Disconnect

NEMA Size	Motor Voltage	Maximum hp Rating		Fuse Clip Amperes	Type 1	Type 3R	Type 4X	Type 12	Component Starter (Open)
		Dual Element Fuses	Magnet Coil Voltage		General Purpose	Rainproof	Watertight and Dust-Tight Stainless Steel ①	Dust-Tight Industrial ②③	
					Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number
0	—	—	120	30 A	ECN1701AAB	ECN1702AAB	ECN1704AAB	ECN1708AAB	AN56BN0AC
	200	3	208		ECN1701EAB	ECN1702EAB	ECN1704EAB	ECN1708EAB	AN56BN0EC
	230	3	240		ECN1701BAB	ECN1702BAB	ECN1704BAB	ECN1708BAB	AN56BN0BC
	460	5	480		ECN1701CAC	ECN1702CAC	ECN1704CAC	ECN1708CAC	AN56BN0CC
	575	5	600		ECN1701DAC	ECN1702DAC	ECN1704DAC	ECN1708DAC	AN56BN0DC
1	—	—	120	30 A	ECN1711AAB	ECN1712AAB	ECN1714AAB	ECN1718AAB	AN56DN0AB
	200	7-1/2	208		ECN1711EAB	ECN1712EAB	ECN1714EAB	ECN1718EAB	AN56DN0EB
	230	7-1/2	240		ECN1711BAB	ECN1712BAB	ECN1714BAB	ECN1718BAB	AN56DN0BB
	460	10	480		ECN1711CAC	ECN1712CAC	ECN1714CAC	ECN1718CAC	AN56DN0CB
	575	10	600		ECN1711DAC	ECN1712DAC	ECN1714DAC	ECN1718DAC	AN56DN0DB
2	—	—	120	60 A	ECN1721AAD	ECN1722AAD	ECN1724AAD	ECN1728AAD	AN56GN0AB
	200	10	208		ECN1721EAD	ECN1722EAD	ECN1724EAD	ECN1728EAD	AN56GN0EB
	230	15	240		ECN1721BAD	ECN1722BAD	ECN1724BAD	ECN1728BAD	AN56GN0BB
	460	25	480		ECN1721CAE	ECN1722CAE	ECN1724CAE	ECN1728CAE	AN56GN0CB
	575	25	600		ECN1721DAE	ECN1722DAE	ECN1724DAE	ECN1728DAE	AN56GN0DB
3	—	—	120	100 A	ECN1731AAF	ECN1732AAF	ECN1734AAF	ECN1738AAF	AN56KN0A
	200	25	208		ECN1731EAF	ECN1732EAF	ECN1734EAF	ECN1738EAF	AN56KN0E
	230	30	240		ECN1731BAF	ECN1732BAF	ECN1734BAF	ECN1738BAF	AN56KN0B
	460	50	480		ECN1731CAG	ECN1732CAG	ECN1734CAG	ECN1738CAG	AN56KN0C
	575	50	600		ECN1731DAG	ECN1732DAG	ECN1734DAG	ECN1738DAG	AN56KN0D
4	—	—	120	200 A	ECN1741AAH	ECN1742AAH	ECN1744AAH	ECN1748AAH	AN56NN0A
	200	40	208		ECN1741EAH	ECN1742EAH	ECN1744EAH	ECN1748EAH	AN56NN0E
	230	50	240		ECN1741BAH	ECN1742BAH	ECN1744BAH	ECN1748BAH	AN56NN0B
	460	100	480		ECN1741CAJ	ECN1742CAJ	ECN1744CAJ	ECN1748CAJ	AN56NN0C
	575	100	600		ECN1741DAJ	ECN1742DAJ	ECN1744DAJ	ECN1748DAJ	AN56NN0D

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

① The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit. Example: ECN1704AAB. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

② All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.

③ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.

2.1

NEMA Contactors and Starters

Freedom Full Voltage Controls

Class ECN17—Combination Reversing Starter—Fusible Disconnect, continued

2

NEMA Size	Motor Voltage	Maximum hp Rating		Fuse Clip Amperes	Type 1	Type 3R	Type 4X	Type 12	Component
		Dual Element Fuses	Magnet Coil Voltage		General Purpose	Rainproof	Watertight and Dust-Tight Stainless Steel ①	Dust-Tight Industrial ②③	Starter (Open)
					Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number
5	—	—	120	400 A	ECN1751AAK	ECN1752AAK	ECN1754AAK	ECN1758AAK	AN56SN0AB
	200	75	208		ECN1751EAK	ECN1752EAK	ECN1754EAK	ECN1758EAK	AN56SN0EB
	230	100	240		ECN1751BAK	ECN1752BAK	ECN1754BAK	ECN1758BAK	AN56SN0BB
	460	200	480		ECN1751CAL	ECN1752CAL	ECN1754CAL	ECN1758CAL	AN56SN0CB
	575	200	600		ECN1751DAL	ECN1752DAL	ECN1754DAL	ECN1758DAL	AN56SN0DB
6	—	—	120	600 A	ECN1761AAM	ECN1762AAM ④	ECN1763AAM	ECN1768AAM	AN56TN0AB
	200	150	208		ECN1761EAM	ECN1762EAM ④	ECN1763EAM	ECN1768EAM	AN56TN0EB
	230	200	240		ECN1761BAM	ECN1762BAM ④	ECN1763BAM	ECN1768BAM	AN56TN0BB
	460	400	480		ECN1761CAN	ECN1762CAN ④	ECN1763CAN	ECN1768CAN	AN56TN0CB
	575	400	600		ECN1761DAN	ECN1762DAN ④	ECN1763DAN	ECN1768DAN	AN56TN0DB
7	—	—	120	⑤	ECN1771AAU	ECN1772AAU ④	ECN1773AAU	ECN1778AAU	AN56UN0AB
	230	300	240		ECN1771BAU	ECN1772BAU ④	ECN1773BAU	ECN1778BAU	AN56UN0BB
	460	600	480		ECN1771CAU	ECN1772CAU ④	ECN1773CAU	ECN1778CAU	AN56UN0CB
	575	600	600		ECN1771DAU	ECN1772DAU ④	ECN1773DAU	ECN1778DAU	AN56UN0DB
8	—	—	120	⑤	ECN1781AAU	ECN1782AAU ④	ECN1783AAU	ECN1788AAU	AN56VN0AB
	230	450	240		ECN1781BAU	ECN1782BAU ④	ECN1783BAU	ECN1788BAU	AN56VN0BB
	460	900	480		ECN1781CAU	ECN1782CAU ④	ECN1783CAU	ECN1788CAU	AN56VN0CB
	575	900	600		ECN1781DAU	ECN1782DAU ④	ECN1783DAU	ECN1788DAU	AN56VN0DB
9	—	—	120	⑤	ECN1791AAU	ECN1792AAU ④	ECN1793AAU	ECN1798AAU	AN56WN0A
	230	800	240		ECN1791BAU	ECN1792BAU ④	ECN1793BAU	ECN1798BAU	AN56WN0B
	460	1000 ⑥	480		ECN1791CAU	ECN1792CAU ④	ECN1793CAU	ECN1798CAU	AN56WN0C
	575	1000	600		ECN1791DAU	ECN1792DAU ④	ECN1793DAU	ECN1798DAU	AN56WN0D

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

① The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit. Example: ECN1754AAK. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

② All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.

③ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.

④ Type 4 (painted steel) sizes 6–9.

⑤ Supply hp, voltage, FLA and whether motor is design E or not when ordering the starter.

⑥ For 1250 and 1600 hp ratings at 460 V, consult Eaton.

Class ECN17—Combination Reversing Starter—Non-Fusible Disconnect

NEMA Size	Motor Voltage	Maximum hp Rating	Magnet Coil Voltage	Disconnect Amps	Type 1 General Purpose Catalog Number	Type 3R Rainproof Catalog Number	Type 4X Watertight and Dust-Tight Stainless Steel ① Catalog Number	Type 12 Dust-Tight Industrial External Reset ②③ Catalog Number	Component Starter (Open) Catalog Number
0	—	—	120	30 A	ECN1701AAA	ECN1702AAA	ECN1704AAA	ECN1708AAA	AN56BN0AC
	200	3	208		ECN1701EAA	ECN1702EAA	ECN1704EAA	ECN1708EAA	AN56BN0EC
	230	3	240		ECN1701BAA	ECN1702BAA	ECN1704BAA	ECN1708BAA	AN56BN0BC
	460	5	480		ECN1701CAA	ECN1702CAA	ECN1704CAA	ECN1708CAA	AN56BN0CC
	575	5	600		ECN1701DAA	ECN1702DAA	ECN1704DAA	ECN1708DAA	AN56BN0DC
1	—	—	120	30 A	ECN1711AAA	ECN1712AAA	ECN1714AAA	ECN1718AAA	AN56DN0AB
	200	7-1/2	208		ECN1711EAA	ECN1712EAA	ECN1714EAA	ECN1718EAA	AN56DN0EB
	230	7-1/2	240		ECN1711BAA	ECN1712BAA	ECN1714BAA	ECN1718BAA	AN56DN0BB
	460	10	480		ECN1711CAA	ECN1712CAA	ECN1714CAA	ECN1718CAA	AN56DN0CB
	575	10	600		ECN1711DAA	ECN1712DAA	ECN1714DAA	ECN1718DAA	AN56DN0DB
2	—	—	120	60 A	ECN1721AAA	ECN1722AAA	ECN1724AAA	ECN1728AAA	AN56GN0AB
	200	10	208		ECN1721EAA	ECN1722EAA	ECN1724EAA	ECN1728EAA	AN56GN0EB
	230	15	240		ECN1721BAA	ECN1722BAA	ECN1724BAA	ECN1728BAA	AN56GN0BB
	460	25	480		ECN1721CAA	ECN1722CAA	ECN1724CAA	ECN1728CAA	AN56GN0CB
	575	25	600		ECN1721DAA	ECN1722DAA	ECN1724DAA	ECN1728DAA	AN56GN0DB
3	—	—	120	100 A	ECN1731AAA	ECN1732AAA	ECN1734AAA	ECN1738AAA	AN56KN0A
	200	25	208		ECN1731EAA	ECN1732EAA	ECN1734EAA	ECN1738EAA	AN56KN0E
	230	30	240		ECN1731BAA	ECN1732BAA	ECN1734BAA	ECN1738BAA	AN56KN0B
	460	50	480		ECN1731CAA	ECN1732CAA	ECN1734CAA	ECN1738CAA	AN56KN0C
	575	50	600		ECN1731DAA	ECN1732DAA	ECN1734DAA	ECN1738DAA	AN56KN0D
4	—	—	120	200 A	ECN1741AAA	ECN1742AAA	ECN1744AAA	ECN1748AAA	AN56NN0A
	200	40	208		ECN1741EAA	ECN1742EAA	ECN1744EAA	ECN1748EAA	AN56NN0E
	230	50	240		ECN1741BAA	ECN1742BAA	ECN1744BAA	ECN1748BAA	AN56NN0B
	460	100	480		ECN1741CAA	ECN1742CAA	ECN1744CAA	ECN1748CAA	AN56NN0C
	575	100	600		ECN1741DAA	ECN1742DAA	ECN1744DAA	ECN1748DAA	AN56NN0D

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

① The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit. Example: ECN1704AAA. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

② All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.

③ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.

2.1

NEMA Contactors and Starters

Freedom Full Voltage Controls

Class ECN17—Combination Reversing Starter—Non-Fusible Disconnect, continued

2

NEMA Size	Motor Voltage	Maximum hp Rating	Magnet Coil Voltage	Disconnect Amps	Type 1 General Purpose Catalog Number	Type 3R Rainproof Catalog Number	Type 4X Watertight and Dust-Tight Stainless Steel ^① Catalog Number	Type 12 Dust-Tight Industrial External Reset ^{②③} Catalog Number	Component Starter (Open) Catalog Number
5	—	—	120	400 A	ECN1751AAA	ECN1752AAA	ECN1754AAA	ECN1758AAA	AN56SN0AB
	200	75	208		ECN1751EAA	ECN1752EAA	ECN1754EAA	ECN1758EAA	AN56SN0EB
	230	100	240		ECN1751BAA	ECN1752BAA	ECN1754BAA	ECN1758BAA	AN56SN0BB
	460	200	480		ECN1751CAA	ECN1752CAA	ECN1754CAA	ECN1758CAA	AN56SN0CB
	575	200	600		ECN1751DAA	ECN1752DAA	ECN1754DAA	ECN1758DAA	AN56SN0DB
6	—	—	120	600 A	ECN1761AAA	ECN1762AAA	ECN1763AAA ^④	ECN1768AAA	AN56TN0AB
	200	150	208		ECN1761EAA	ECN1762EAA	ECN1763EAA ^④	ECN1768EAA	AN56TN0EB
	230	200	240		ECN1761BAA	ECN1762BAA	ECN1763BAA ^④	ECN1768BAA	AN56TN0BB
	460	400	480		ECN1761CAA	ECN1762CAA	ECN1763CAA ^④	ECN1768CAA	AN56TN0CB
	575	400	600		ECN1761DAA	ECN1762DAA	ECN1763DAA ^④	ECN1768DAA	AN56TN0DB
7	—	—	120	^⑤	ECN1771AAA	ECN1772AAA	ECN1773AAA ^④	ECN1778AAA	AN56UN0AB
	230	300	240		ECN1771BAA	ECN1772BAA	ECN1773BAA ^④	ECN1778BAA	AN56UN0BB
	460	600	480		ECN1771CAA	ECN1772CAA	ECN1773CAA ^④	ECN1778CAA	AN56UN0CB
	575	600	600		ECN1771DAA	ECN1772DAA	ECN1773DAA ^④	ECN1778DAA	AN56UN0DB
8	—	—	120	^⑤	ECN1781AAA	ECN1782AAA	ECN1783AAA ^④	ECN1788AAA	AN56VN0AB
	230	450	240		ECN1781BAA	ECN1782BAA	ECN1783BAA ^④	ECN1788BAA	AN56VN0BB
	460	900	480		ECN1781CAA	ECN1782CAA	ECN1783CAA ^④	ECN1788CAA	AN56VN0CB
	575	900	600		ECN1781DAA	ECN1782DAA	ECN1783DAA ^④	ECN1788DAA	AN56VN0DB
9	—	—	120	^⑤	ECN1791AAA	ECN1792AAA	ECN1793AAA ^④	ECN1798AAA	AN56WN0A
	230	800	240		ECN1791BAA	ECN1792BAA	ECN1793BAA ^④	ECN1798BAA	AN56WN0B
	460	1000 ^⑥	480		ECN1791CAA	ECN1792CAA	ECN1793CAA ^④	ECN1798CAA	AN56WN0C
	575	1000	600		ECN1791DAA	ECN1792DAA	ECN1793DAA ^④	ECN1798DAA	AN56WN0D

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

- ① The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit. Example: ECN1754AAA. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.
- ② All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.
- ③ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.
- ④ Type 4 (painted steel) sizes 6–9.
- ⑤ Supply hp, voltage, FLA and whether motor is design E or not when ordering the starter.
- ⑥ For 1250 and 1600 hp ratings at 460 V, consult Eaton.

Class ECN18—Combination Non-Reversing Starter—Fusible Disconnect with CPT ①

NEMA Size	Primary Voltage ②	Maximum hp Rating	Magnet Coil Voltage	Fuse Clip Amps	Type 1 General Purpose Catalog Number	Type 3R Rainproof Catalog Number	Type 4X Watertight and Dust-Tight Stainless Steel ③ Catalog Number	Type 12 Dust-Tight Industrial External Reset ④⑤ Catalog Number	Component Starter (Open) Catalog Number
00	208	1-1/2	120	30 A ⑥	ECN18A1EAB	ECN18A2EAB	ECN18A4EAB	ECN18A8EAB	AN16AN0EC
	240	1-1/2			ECN18A1BAB	ECN18A2BAB	ECN18A4BAB	ECN18A8BAB	AN16AN0BC
	480	2			ECN18A1CAC	ECN18A2CAC	ECN18A4CAC	ECN18A8CAC	AN16AN0CC
	600	2			ECN18A1DAC	ECN18A2DAC	ECN18A4DAC	ECN18A8DAC	AN16AN0DC
0	208	3	120	30 A ⑥	ECN1801EAB	ECN1802EAB	ECN1804EAB	ECN1808EAB	AN16BN0EC
	240	3			ECN1801BAB	ECN1802BAB	ECN1804BAB	ECN1808BAB	AN16BN0BC
	480	5			ECN1801CAC	ECN1802CAC	ECN1804CAC	ECN1808CAC	AN16BN0CC
	600	5			ECN1801DAC	ECN1802DAC	ECN1804DAC	ECN1808DAC	AN16BN0DC
1	208	7-1/2	120	30 A ⑥	ECN1811EAB	ECN1812EAB	ECN1814EAB	ECN1818EAB	AN16DN0EB
	240	7-1/2			ECN1811BAB	ECN1812BAB	ECN1814BAB	ECN1818BAB	AN16DN0BB
	480	10			ECN1811CAC	ECN1812CAC	ECN1814CAC	ECN1818CAC	AN16DN0CB
	600	10			ECN1811DAC	ECN1812DAC	ECN1814DAC	ECN1818DAC	AN16DN0DB
2	208	10	120	60 A ⑥	ECN1821EAD	ECN1822EAD	ECN1824EAD	ECN1828EAD	AN16GN0EB
	240	15			ECN1821BAD	ECN1822BAD	ECN1824BAD	ECN1828BAD	AN16GN0BB
	480	25			ECN1821CAE	ECN1822CAE	ECN1824CAE	ECN1828CAE	AN16GN0CB
	600	25			ECN1821DAE	ECN1822DAE	ECN1824DAE	ECN1828DAE	AN16GN0DB
3	208	25	120	100 A	ECN1831EAF	ECN1832EAF	ECN1834EAF	ECN1838EAF	AN16KN0E
	240	30			ECN1831BAF	ECN1832BAF	ECN1834BAF	ECN1838BAF	AN16KN0B
	480	50			ECN1831CAG	ECN1832CAG	ECN1834CAG	ECN1838CAG	AN16KN0C
	600	50			ECN1831DAG	ECN1832DAG	ECN1834DAG	ECN1838DAG	AN16KN0D
4	208	40	120	200 A	ECN1841EAH	ECN1842EAH	ECN1844EAH	ECN1848EAH	AN16NN0E
	240	50			ECN1841BAH	ECN1842BAH	ECN1844BAH	ECN1848BAH	AN16NN0B
	480	100			ECN1841CAJ	ECN1842CAJ	ECN1844CAJ	ECN1848CAJ	AN16NN0C
	600	100			ECN1841DAJ	ECN1842DAJ	ECN1844DAJ	ECN1848DAJ	AN16NN0D

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

① 100,000 rms short-circuit rating.

② Other control power transformer primary and/or secondary voltages, see **Page V10-T2-4**.

③ The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit. Example: ECN1804EAB. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

④ All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.

⑤ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.

⑥ Fuse clips are for Class R fuses. For H and J fuses, see modifications in **Tab 15**.

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NEMA Contactors and Starters

Freedom Full Voltage Controls

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Class ECN18—Combination Non-Reversing Starter—Fusible Disconnect with CPT, continued ^①

NEMA Size	Primary Voltage ^②	Maximum hp Rating	Magnet Coil Voltage	Fuse Clip Amps	Type 1	Type 3R	Type 4X	Type 12	Component Starter (Open)
					General Purpose	Rainproof	Watertight and Dust-Tight Stainless Steel ^③	Dust-Tight Industrial External Reset ^{④⑤}	
					Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number
5	208	75	120	400 A	ECN1851EAK	ECN1852EAK	ECN1854EAK	ECN1858EAK	AN16SN0EB
	240	100			ECN1851BAK	ECN1852BAK	ECN1854BAK	ECN1858BAK	AN16SN0BB
	480	200			ECN1851CAL	ECN1852CAL	ECN1854CAL	ECN1858CAL	AN16SN0CB
	600	200			ECN1851DAL	ECN1852DAL	ECN1854DAL	ECN1858DAL	AN16SN0DB
6	208	150	120	600 A	ECN1861EAM	ECN1862EAM	ECN1863EAM ^⑥	ECN1868EAM	AN16TN0EB
	240	200			ECN1861BAM	ECN1862BAM	ECN1863BAM ^⑥	ECN1868BAM	AN16TN0BB
	480	400			ECN1861CAN	ECN1862CAN	ECN1863CAN ^⑥	ECN1868CAN	AN16TN0CB
	600	400			ECN1861DAN	ECN1862DAN	ECN1863DAN ^⑥	ECN1868DAN	AN16TN0DB
7	240	300	120	⑦	ECN1871BAU	ECN1872BAU	ECN1873BAU ^⑥	ECN1878BAU	AN16UN0BB
	480	600			ECN1871CAU	ECN1872CAU	ECN1873CAU ^⑥	ECN1878CAU	AN16UN0CB
	600	600			ECN1871DAU	ECN1872DAU	ECN1873DAU ^⑥	ECN1878DAU	AN16UN0DB
8	240	450	120	⑦	ECN1881BAU	ECN1882BAU	ECN1883BAU ^⑥	ECN1888BAU	AN16VN0BB
	480	900			ECN1881CAU	ECN1882CAU	ECN1883CAU ^⑥	ECN1888CAU	AN16VN0CB
	600	900			ECN1881DAU	ECN1882DAU	ECN1883DAU ^⑥	ECN1888DAU	AN16VN0DB
9	240	800	120	⑦	ECN1891BAU	ECN1892BAU	ECN1893BAU ^⑥	ECN1898BAU	AN16WN0B
	480	1000 ^⑧			ECN1891CAU	ECN1892CAU	ECN1893CAU ^⑥	ECN1898CAU	AN16WN0C
	600	1000			ECN1891DAU	ECN1892DAU	ECN1893DAU ^⑥	ECN1898DAU	AN16WN0D

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

^① 100,000 rms short-circuit rating.

^② Other control power transformer primary and/or secondary voltages, see **Page V10-T2-4**.

^③ The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit.
Example: ECN1854EAK. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**.
To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

^④ All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.

^⑤ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.

^⑥ Type 4 (painted steel) sizes 6–9.

^⑦ Supply hp, voltage, FLA and whether motor is design E or not when ordering the motor.

^⑧ For 1250 and 1600 hp ratings at 460 V, consult Eaton.

Class ECN18—Combination Non-Reversing Starter—Non-Fusible Disconnect with CPT

NEMA Size	Primary Voltage ①	Maximum hp Rating	Magnet Coil Voltage	Disconnect Switch Rating	Type 1 General Purpose Catalog Number	Type 3R Rainproof Catalog Number	Type 4X Watertight and Dust-Tight Stainless Steel ② Catalog Number	Type 12 Dust-Tight Industrial External Reset ③④ Catalog Number	Component Starter (Open) Catalog Number
00	208	1-1/2	120	30 A	ECN18A1EAA	ECN18A2EAA	ECN18A4EAA	ECN18A8EAA	AN16AN0EC
	240	1-1/2			ECN18A1BAA	ECN18A2BAA	ECN18A4BAA	ECN18A8BAA	AN16AN0BC
	480	2			ECN18A1CAA	ECN18A2CAA	ECN18A4CAA	ECN18A8CAA	AN16AN0CC
	600	2			ECN18A1DAA	ECN18A2DAA	ECN18A4DAA	ECN18A8DAA	AN16AN0DC
0	208	3	120	30 A	ECN1801EAA	ECN1802EAA	ECN1804EAA	ECN1808EAA	AN16BN0EC
	240	3			ECN1801BAA	ECN1802BAA	ECN1804BAA	ECN1808BAA	AN16BN0BC
	480	5			ECN1801CAA	ECN1802CAA	ECN1804CAA	ECN1808CAA	AN16BN0CC
	600	5			ECN1801DAA	ECN1802DAA	ECN1804DAA	ECN1808DAA	AN16BN0DC
1	208	7-1/2	120	30 A	ECN1811EAA	ECN1812EAA	ECN1814EAA	ECN1818EAA	AN16DN0EB
	240	7-1/2			ECN1811BAA	ECN1812BAA	ECN1814BAA	ECN1818BAA	AN16DN0BB
	480	10			ECN1811CAA	ECN1812CAA	ECN1814CAA	ECN1818CAA	AN16DN0CB
	600	10			ECN1811DAA	ECN1812DAA	ECN1814DAA	ECN1818DAA	AN16DN0DB
2	208	10	120	60 A	ECN1821EAA	ECN1822EAA	ECN1824EAA	ECN1828EAA	AN16GN0EB
	240	15			ECN1821BAA	ECN1822BAA	ECN1824BAA	ECN1828BAA	AN16GN0BB
	480	25			ECN1821CAA	ECN1822CAA	ECN1824CAA	ECN1828CAA	AN16GN0CB
	600	25			ECN1821DAA	ECN1822DAA	ECN1824DAA	ECN1828DAA	AN16GN0DB
3	208	25	120	100 A	ECN1831EAA	ECN1832EAA	ECN1834EAA	ECN1838EAA	AN16KN0E
	240	30			ECN1831BAA	ECN1832BAA	ECN1834BAA	ECN1838BAA	AN16KN0B
	480	50			ECN1831CAA	ECN1832CAA	ECN1834CAA	ECN1838CAA	AN16KN0C
	600	50			ECN1831DAA	ECN1832DAA	ECN1834DAA	ECN1838DAA	AN16KN0D
4	208	40	120	200 A	ECN1841EAA	ECN1842EAA	ECN1844EAA	ECN1848EAA	AN16NN0E
	240	50			ECN1841BAA	ECN1842BAA	ECN1844BAA	ECN1848BAA	AN16NN0B
	480	100			ECN1841CAA	ECN1842CAA	ECN1844CAA	ECN1848CAA	AN16NN0C
	600	100			ECN1841DAA	ECN1842DAA	ECN1844DAA	ECN1848DAA	AN16NN0D

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

① Other control power transformer primary and/or secondary voltages, see **Page V10-T2-4**.

② The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit. Example: ECN1804EAA. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

③ All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.

④ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.

2.1

NEMA Contactors and Starters

Freedom Full Voltage Controls

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Class ECN18—Combination Non-Reversing Starter—Non-Fusible Disconnect with CPT, continued

NEMA Size	Primary Voltage ^①	Maximum hp Rating	Magnet Coil Voltage	Disconnect Switch Rating	Type 1	Type 3R	Type 4X	Type 12	Component Starter
					General Purpose	Rainproof	Watertight and Dust-Tight Stainless Steel ^②	Dust-Tight Industrial External Reset ^{③④}	(Open)
					Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number
5	208	75	120	400 A	ECN1851EAA	ECN1852EAA	ECN1854EAA	ECN1858EAA	AN16SN0EB
	240	100			ECN1851BAA	ECN1852BAA	ECN1854BAA	ECN1858BAA	AN16SN0BB
	480	200			ECN1851CAA	ECN1852CAA	ECN1854CAA	ECN1858CAA	AN16SN0CB
	600	200			ECN1851DAA	ECN1852DAA	ECN1854DAA	ECN1858DAA	AN16SN0DB
6	208	150	120	600 A	ECN1861EAA	ECN1862EAA	ECN1863EAA ^⑤	ECN1868EAA	AN16TN0EB
	240	200			ECN1861BAA	ECN1862BAA	ECN1863BAA ^⑤	ECN1868BAA	AN16TN0BB
	480	400			ECN1861CAA	ECN1862CAA	ECN1863CAA ^⑤	ECN1868CAA	AN16TN0CB
	600	400			ECN1861DAA	ECN1862DAA	ECN1863DAA ^⑤	ECN1868DAA	AN16TN0DB
7	240	300	120	⑥	ECN1871BAA	ECN1872BAA	ECN1873BAA ^⑤	ECN1878BAA	AN16UN0BB
	480	600			ECN1871CAA	ECN1872CAA	ECN1873CAA ^⑤	ECN1878CAA	AN16UN0CB
	600	600			ECN1871DAA	ECN1872DAA	ECN1873DAA ^⑤	ECN1878DAA	AN16UN0DB
8	240	450	120	⑥	ECN1881BAA	ECN1882BAA	ECN1883BAA ^⑤	ECN1888BAA	AN16VN0BB
	480	900			ECN1881CAA	ECN1882CAA	ECN1883CAA ^⑤	ECN1888CAA	AN16VN0CB
	600	900			ECN1881DAA	ECN1882DAA	ECN1883DAA ^⑤	ECN1888DAA	AN16VN0DB
9	240	800	120	⑥	ECN1891BAA	ECN1892BAA	ECN1893BAA ^⑤	ECN1898BAA	AN16WN0B
	480	1000 ^⑦			ECN1891CAA	ECN1892CAA	ECN1893CAA ^⑤	ECN1898CAA	AN16WN0C
	600	1000			ECN1891DAA	ECN1892DAA	ECN1893DAA ^⑤	ECN1898DAA	AN16WN0D

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

① Other control power transformer primary and/or secondary voltages, see **Page V10-T2-4**.

② The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit. Example: ECN1854EAA. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

③ All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.

④ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.

⑤ Type 4 (painted steel) sizes 6–9.

⑥ Supply hp, voltage, FLA and whether motor is design E or not when ordering the starter.

⑦ For 1250 and 1600 hp ratings at 460 V, consult Eaton.

Combination Starters—Circuit Breaker

Features

- Three-phase magnetic
- Three-pole non-reversing or reversing
- Standard interchangeable heater OLR
- Optional electronic overload
- 600 V maximum
- 100,000 rms 480 V, 25,000 rms 600 V

Product Selection

Class ECN22—Combination Non-Reversing Starter—Circuit Breaker

NEMA Size	Motor Voltage	Maximum hp Rating	Magnet Coil Voltage ①	Circuit Breaker Size	Type 1	Type 3R	Type 4X	Type 12	Component Starter (Open)		
					General Purpose	Rainproof	Watertight and Dust-Tight Stainless Steel ②	Dust-Tight Industrial External Reset ③④			
					Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number		
00	200	1	120	7A	ECN22A1AAC	ECN22A2AAC	ECN22A4AAC	ECN22A8AAC	AN16AN0AC		
		1-1/2		15A	ECN22A1AAD	ECN22A2AAD	ECN22A4AAD	ECN22A8AAD			
	230	1	7A	ECN22A1AAC	ECN22A2AAC	ECN22A4AAC	ECN22A8AAC				
		1-1/2	15A	ECN22A1AAD	ECN22A2AAD	ECN22A4AAD	ECN22A8AAD				
	460	1	3A	ECN22A1AAB	ECN22A2AAB	ECN22A4AAB	ECN22A8AAB				
		2	7A	ECN22A1AAC	ECN22A2AAC	ECN22A4AAC	ECN22A8AAC				
	575	1	3A	ECN22A1AAB	ECN22A2AAB	ECN22A4AAB	ECN22A8AAB				
		2	7A	ECN22A1AAC	ECN22A2AAC	ECN22A4AAC	ECN22A8AAC				
	0	200	1	120	7A	ECN2201AAC	ECN2202AAC	ECN2204AAC		ECN2208AAC	AN16BN0AC
			3		15A	ECN2201AAD	ECN2202AAD	ECN2204AAD		ECN2208AAD	
		230	1	7A	ECN2201AAC	ECN2202AAC	ECN2204AAC	ECN2208AAC			
			3	15A	ECN2201AAD	ECN2202AAD	ECN2204AAD	ECN2208AAD			
460		1	3A	ECN2201AAB	ECN2202AAB	ECN2204AAB	ECN2208AAB				
		3	7A	ECN2201AAC	ECN2202AAC	ECN2204AAC	ECN2208AAC				
575		1	3A	ECN2201AAB	ECN2202AAB	ECN2204AAB	ECN2208AAB				
		3	15A	ECN2201AAD	ECN2202AAD	ECN2204AAD	ECN2208AAD				
		5	7A	ECN2201AAC	ECN2202AAC	ECN2204AAC	ECN2208AAC				

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

① For other magnet coil voltages substitute the eighth digit with appropriate digit based on modification table on **Page V10-T2-4**.

② The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit. Example: ECN2204AAC. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

③ All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.

④ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.

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NEMA Contactors and Starters

Freedom Full Voltage Controls

Class ECN22—Combination Non-Reversing Starter—Circuit Breaker, continued

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NEMA Size	Motor Voltage	Maximum hp Rating	Magnet Coil Voltage ①	Circuit Breaker Size	Type 1	Type 3R	Type 4X	Type 12	Component Starter (Open)
					General Purpose	Rainproof	Watertight and Dust-Tight Stainless Steel ②	Dust-Tight Industrial External Reset ③④	
					Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number
1	200	1	120	7 A	ECN2211AAC	ECN2212AAC	ECN2214AAC	ECN2218AAC	AN16DN0AB
				15 A	ECN2211AAD	ECN2212AAD	ECN2214AAD	ECN2218AAD	
				30 A	ECN2211AAE	ECN2212AAE	ECN2214AAE	ECN2218AAE	
				50 A	ECN2211AAF	ECN2212AAF	ECN2214AAF	ECN2218AAF	
	230	1	3	7 A	ECN2211AAC	ECN2212AAC	ECN2214AAC	ECN2218AAC	
				15 A	ECN2211AAD	ECN2212AAD	ECN2214AAD	ECN2218AAD	
				30 A	ECN2211AAE	ECN2212AAE	ECN2214AAE	ECN2218AAE	
				50 A	ECN2211AAF	ECN2212AAF	ECN2214AAF	ECN2218AAF	
	460	1	3	3 A	ECN2211AAB	ECN2212AAB	ECN2214AAB	ECN2218AAB	
				7 A	ECN2211AAC	ECN2212AAC	ECN2214AAC	ECN2218AAC	
				15 A	ECN2211AAD	ECN2212AAD	ECN2214AAD	ECN2218AAD	
				30 A	ECN2211AAE	ECN2212AAE	ECN2214AAE	ECN2218AAE	
	575	1	3	3 A	ECN2211AAB	ECN2212AAB	ECN2214AAB	ECN2218AAB	
				7 A	ECN2211AAC	ECN2212AAC	ECN2214AAC	ECN2218AAC	
				15 A	ECN2211AAD	ECN2212AAD	ECN2214AAD	ECN2218AAD	
				30 A	ECN2211AAE	ECN2212AAE	ECN2214AAE	ECN2218AAE	
2	200	10	120	50 A	ECN2221AAF	ECN2222AAF	ECN2224AAF	ECN2228AAF	AN16GN0AB
				70 A	ECN2221AAW	ECN2222AAW	ECN2224AAW	ECN2228AAW	
	230	10	50 A	ECN2221AAF	ECN2222AAF	ECN2224AAF	ECN2228AAF		
			70 A	ECN2221AAW	ECN2222AAW	ECN2224AAW	ECN2228AAW		
	460	25	50 A	ECN2221AAF	ECN2222AAF	ECN2224AAF	ECN2228AAF		
			70 A	ECN2221AAW	ECN2222AAW	ECN2224AAW	ECN2228AAW		
	575	15	30 A	ECN2221AAE	ECN2222AAE	ECN2224AAE	ECN2228AAE		
			50 A	ECN2221AAF	ECN2222AAF	ECN2224AAF	ECN2228AAF		
3	200	20	120	100 A	ECN2231AAG	ECN2232AAG	ECN2234AAG	ECN2238AAG	AN16KN0A
				150 A	ECN2231AAX	ECN2232AAX	ECN2234AAX	ECN2238AAX	
	230	25	100 A	ECN2231AAG	ECN2232AAG	ECN2234AAG	ECN2238AAG		
			150 A	ECN2231AAX	ECN2232AAX	ECN2234AAX	ECN2238AAX		
	460	50	100 A	ECN2231AAG	ECN2232AAG	ECN2234AAG	ECN2238AAG		
			150 A	ECN2231AAX	ECN2232AAX	ECN2234AAX	ECN2238AAX		
	575	30	50 A	ECN2231AAF	ECN2232AAF	ECN2234AAF	ECN2238AAF		
			100 A	ECN2231AAG	ECN2232AAG	ECN2234AAG	ECN2238AAG		
4	200	40	120	150 A	ECN2241AAH	ECN2242AAH	ECN2244AAH	ECN2248AAH	AN16NN0A
				200 A	ECN2241AAL	ECN2242AAL	ECN2244AAL	ECN2248AAL	
	230	50	150 A	ECN2241AAH	ECN2242AAH	ECN2244AAH	ECN2248AAH		
			200 A	ECN2241AAL	ECN2242AAL	ECN2244AAL	ECN2248AAL		
460	100	150 A	ECN2241AAH	ECN2242AAH	ECN2244AAH	ECN2248AAH			
		200 A	ECN2241AAL	ECN2242AAL	ECN2244AAL	ECN2248AAL			
575	100	150 A	ECN2241AAH	ECN2242AAH	ECN2244AAH	ECN2248AAH			
		200 A	ECN2241AAL	ECN2242AAL	ECN2244AAL	ECN2248AAL			

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

① For other magnet coil voltages substitute the eighth digit with appropriate digit based on modification table on **Page V10-T2-4**.

② The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit.

Example: ECN2214AAC. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

③ All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.

④ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.

Class ECN22—Combination Non-Reversing Starter—Circuit Breaker, continued

NEMA Size	Motor Voltage	Maximum hp Rating	Magnet Coil Voltage ①	Circuit Breaker Size	Type 1	Type 3R	Type 4X	Type 12	Component Starter (Open)
					General Purpose	Rainproof	Watertight and Dust-Tight Stainless Steel ②	Dust-Tight Industrial External Reset ③④	
					Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number
5	200	50	120	250 A	ECN2251AAJ	ECN2252AAJ	ECN2254AAJ	ECN2258AAJ	AN16SN0AB
		75		400 A	ECN2251AAK	ECN2252AAK	ECN2254AAK	ECN2258AAK	
	230	60	250 A	ECN2251AAJ	ECN2252AAJ	ECN2254AAJ	ECN2258AAJ		
		100	400 A	ECN2251AAK	ECN2252AAK	ECN2254AAK	ECN2258AAK		
	460	125	250 A	ECN2251AAJ	ECN2252AAJ	ECN2254AAJ	ECN2258AAJ		
		200	400 A	ECN2251AAK	ECN2252AAK	ECN2254AAK	ECN2258AAK		
	575	150	250 A	ECN2251AAJ	ECN2252AAJ	ECN2254AAJ	ECN2258AAJ		
		200	400 A	ECN2251AAK	ECN2252AAK	ECN2254AAK	ECN2258AAK		
6	200	150	120	600 A	ECN2261AAL	ECN2262AAL	ECN2263AAL ⑤	ECN2268AAL	AN16TN0AB
	230	200		ECN2261AAL	ECN2262AAL	ECN2263AAL ⑤	ECN2268AAL		
	460	350		ECN2261AAL	ECN2262AAL	ECN2263AAL ⑤	ECN2268AAL		
		400		1200 A	ECN2261AAP	ECN2262AAP	ECN2263AAP ⑤	ECN2268AAP	
	575	400		600 A	ECN2261AAL	ECN2262AAL	ECN2263AAL ⑤	ECN2268AAL	
7	230	300	120	—	ECN2271AAU	ECN2272AAU	ECN2273AAU ⑤	ECN2278AAU	AN16UN0AB
	460	600		—	ECN2271AAU	ECN2272AAU	ECN2273AAU ⑤	ECN2278AAU	
	575	600		—	ECN2271AAU	ECN2272AAU	ECN2273AAU ⑤	ECN2278AAU	
8	230	450	120	—	ECN2281AAU	ECN2282AAU	ECN2283AAU ⑤	ECN2288AAU	AN16VN0AB
	460	900		—	ECN2281AAU	ECN2282AAU	ECN2283AAU ⑤	ECN2288AAU	
	575	900		—	ECN2281AAU	ECN2282AAU	ECN2283AAU ⑤	ECN2288AAU	
9	230	800	120	—	ECN2291AAU	ECN2292AAU	ECN2293AAU ⑤	ECN2298AAU	AN16WN0A
	460	1600		—	ECN2291AAU	ECN2292AAU	ECN2293AAU ⑤	ECN2298AAU	
	575	1600		—	ECN2291AAU	ECN2292AAU	ECN2293AAU ⑤	ECN2298AAU	

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

① For other magnet coil voltages substitute the eighth digit with appropriate digit based on modification table on **Page V10-T2-4**.

② The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit.

Example: ECN2254AAJ. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**.

To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

③ All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.

④ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.

⑤ Type 4 (painted steel) sizes 6–9.

2.1

NEMA Contactors and Starters

Freedom Full Voltage Controls

2

Class ECN22—Special Enclosure Combination Non-Reversing Starter—Circuit Breaker

NEMA Size	Motor Voltage	Maximum hp Rating	Magnet Coil Voltage ①	Circuit Breaker Size	Type 1	Type 4X	Type 12		Component Starter (Open) Catalog Number
					General Purpose Catalog Number	Watertight and Dust-Tight Stainless Steel ② Catalog Number	Dust-Tight Industrial ③ External Reset Catalog Number	Internal Reset Catalog Number	
Horizontal Enclosure									
1	200	1	120	7 A	ECN2211AAC-E13	ECN2212AAC-E13	ECN2214AAC-E13	ECN2218AAC-E13	AN16DN0AB
		3		15 A	ECN2211AAD-E13	ECN2212AAD-E13	ECN2214AAD-E13	ECN2218AAD-E13	
		5		30 A	ECN2211AAE-E13	ECN2212AAE-E13	ECN2214AAE-E13	ECN2218AAE-E13	
		7-1/2		50 A	ECN2211AAF-E13	ECN2212AAF-E13	ECN2214AAF-E13	ECN2218AAF-E13	
	230	1	7 A	ECN2211AAC-E13	ECN2212AAC-E13	ECN2214AAC-E13	ECN2218AAC-E13		
		3	15 A	ECN2211AAD-E13	ECN2212AAD-E13	ECN2214AAD-E13	ECN2218AAD-E13		
		5	30 A	ECN2211AAE-E13	ECN2212AAE-E13	ECN2214AAE-E13	ECN2218AAE-E13		
		7-1/2	50 A	ECN2211AAF-E13	ECN2212AAF-E13	ECN2214AAF-E13	ECN2218AAF-E13		
	460	1	3A	ECN2211AAB-E13	ECN2212AAB-E13	ECN2214AAB-E13	ECN2218AAB-E13		
		3	7 A	ECN2211AAC-E13	ECN2212AAC-E13	ECN2214AAC-E13	ECN2218AAC-E13		
		5	15 A	ECN2211AAD-E13	ECN2212AAD-E13	ECN2214AAD-E13	ECN2218AAD-E13		
		10	30 A	ECN2211AAE-E13	ECN2212AAE-E13	ECN2214AAE-E13	ECN2218AAE-E13		
	575	1	3 A	ECN2211AAB-E13	ECN2212AAB-E13	ECN2214AAB-E13	ECN2218AAB-E13		
		3	7 A	ECN2211AAC-E13	ECN2212AAC-E13	ECN2214AAC-E13	ECN2218AAC-E13		
		5	15 A	ECN2211AAD-E13	ECN2212AAD-E13	ECN2214AAD-E13	ECN2218AAD-E13		
		10	30 A	ECN2211AAE-E13	ECN2212AAE-E13	ECN2214AAE-E13	ECN2218AAE-E13		
2	200	10	120	50 A	ECN2221AAF-E13	ECN2222AAF-E13	ECN2224AAF-E13	ECN2228AAF-E13	AN16GN0AB
	230	10		ECN2221AAF-E13	ECN2222AAF-E13	ECN2224AAF-E13	ECN2228AAF-E13		
		15		70 A	ECN2221AAW-E13	ECN2222AAW-E13	ECN2224AAW-E13	ECN2228AAW-E13	
	460	25		50 A	ECN2221AAF-E13	ECN2222AAF-E13	ECN2224AAF-E13	ECN2228AAF-E13	
	575	15		30 A	ECN2221AAE-E13	ECN2222AAE-E13	ECN2224AAE-E13	ECN2228AAE-E13	
		25		50 A	ECN2221AAF-E13	ECN2222AAF-E13	ECN2224AAF-E13	ECN2228AAF-E13	

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

① For other magnet coil voltages substitute the eighth digit with appropriate digit based on modification table on **Page V10-T2-4**.

② The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit. Example: ECN2212AAC-E13. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

③ To order Type 12 enclosures with safety door interlock add modification **E11**.

Class ECN22—Special Enclosure Combination Non-Reversing Starter—Circuit Breaker, continued

NEMA Size	Motor Voltage	Maximum hp Rating	Magnet Coil Voltage ①	Circuit Breaker Size	Type 1	Type 4X	Type 12		Component Starter (Open) Catalog Number		
					General Purpose	Watertight and Dust-Tight Stainless Steel ②	Dust-Tight Industrial ③	External Reset		Internal Reset	
					Catalog Number	Catalog Number	Catalog Number	Catalog Number			
Enlarge Enclosure—without Control Transformer											
0	200	1	120	7 A	ECN2201AAC-E3	ECN2202AAC-E3	ECN2204AAC-E3	ECN2208AAC-E3	AN16BN0AC		
				15 A	ECN2201AAD-E3	ECN2202AAD-E3	ECN2204AAD-E3	ECN2208AAD-E3			
		230	1	7 A	ECN2201AAC-E3	ECN2202AAC-E3	ECN2204AAC-E3	ECN2208AAC-E3			
				15 A	ECN2201AAD-E3	ECN2202AAD-E3	ECN2204AAD-E3	ECN2208AAD-E3			
		460	1	3 A	ECN2201AAB-E3	ECN2202AAB-E3	ECN2204AAB-E3	ECN2208AAB-E3			
				7 A	ECN2201AAC-E3	ECN2202AAC-E3	ECN2204AAC-E3	ECN2208AAC-E3			
	3		15 A	ECN2201AAD-E3	ECN2202AAD-E3	ECN2204AAD-E3	ECN2208AAD-E3				
			5	15 A	ECN2201AAD-E3	ECN2202AAD-E3	ECN2204AAD-E3	ECN2208AAD-E3			
	575	1	3 A	ECN2201AAB-E3	ECN2202AAB-E3	ECN2204AAB-E3	ECN2208AAB-E3				
			15 A	ECN2201AAD-E3	ECN2202AAD-E3	ECN2204AAD-E3	ECN2208AAD-E3				
		3	15 A	ECN2201AAD-E3	ECN2202AAD-E3	ECN2204AAD-E3	ECN2208AAD-E3				
			5	7 A	ECN2201AAC-E3	ECN2202AAC-E3	ECN2204AAC-E3	ECN2208AAC-E3			
1	200	1	120	7 A	ECN2211AAC-E3	ECN2212AAC-E3	ECN2214AAC-E3	ECN2218AAC-E3	AN16DN0AB		
				15 A	ECN2211AAD-E3	ECN2212AAD-E3	ECN2214AAD-E3	ECN2218AAD-E3			
				5	30 A	ECN2211AAE-E3	ECN2212AAE-E3	ECN2214AAE-E3		ECN2218AAE-E3	
				7-1/2	50 A	ECN2211AAF-E3	ECN2212AAF-E3	ECN2214AAF-E3		ECN2218AAF-E3	
		230		1	7 A	ECN2211AAC-E3	ECN2212AAC-E3	ECN2214AAC-E3		ECN2218AAC-E3	
					15 A	ECN2211AAD-E3	ECN2212AAD-E3	ECN2214AAD-E3		ECN2218AAD-E3	
					5	30 A	ECN2211AAE-E3	ECN2212AAE-E3		ECN2214AAE-E3	ECN2218AAE-E3
					7-1/2	50 A	ECN2211AAF-E3	ECN2212AAF-E3		ECN2214AAF-E3	ECN2218AAF-E3
		460		1	3 A	ECN2211AAB-E3	ECN2212AAB-E3	ECN2214AAB-E3		ECN2218AAB-E3	
					7 A	ECN2211AAC-E3	ECN2212AAC-E3	ECN2214AAC-E3		ECN2218AAC-E3	
					15 A	ECN2211AAD-E3	ECN2212AAD-E3	ECN2214AAD-E3		ECN2218AAD-E3	
					30 A	ECN2211AAE-E3	ECN2212AAE-E3	ECN2214AAE-E3		ECN2218AAE-E3	
	3		7 A	ECN2211AAC-E3	ECN2212AAC-E3	ECN2214AAC-E3	ECN2218AAC-E3				
			15 A	ECN2211AAD-E3	ECN2212AAD-E3	ECN2214AAD-E3	ECN2218AAD-E3				
			30 A	ECN2211AAE-E3	ECN2212AAE-E3	ECN2214AAE-E3	ECN2218AAE-E3				
			10	30 A	ECN2211AAE-E3	ECN2212AAE-E3	ECN2214AAE-E3	ECN2218AAE-E3			
	575	1	3 A	ECN2211AAB-E3	ECN2212AAB-E3	ECN2214AAB-E3	ECN2218AAB-E3				
			7 A	ECN2211AAC-E3	ECN2212AAC-E3	ECN2214AAC-E3	ECN2218AAC-E3				
			15 A	ECN2211AAD-E3	ECN2212AAD-E3	ECN2214AAD-E3	ECN2218AAD-E3				
			30 A	ECN2211AAE-E3	ECN2212AAE-E3	ECN2214AAE-E3	ECN2218AAE-E3				
		3	7 A	ECN2211AAC-E3	ECN2212AAC-E3	ECN2214AAC-E3	ECN2218AAC-E3				
			15 A	ECN2211AAD-E3	ECN2212AAD-E3	ECN2214AAD-E3	ECN2218AAD-E3				
			30 A	ECN2211AAE-E3	ECN2212AAE-E3	ECN2214AAE-E3	ECN2218AAE-E3				
			10	30 A	ECN2211AAE-E3	ECN2212AAE-E3	ECN2214AAE-E3	ECN2218AAE-E3			
2	200	10	120	50 A	ECN2221AAF-E3	ECN2222AAF-E3	ECN2224AAF-E3	ECN2228AAF-E3	AN16GN0AB		
				70 A	ECN2221AAW-E3	ECN2222AAW-E3	ECN2224AAW-E3	ECN2228AAW-E3			
	230	10		50 A	ECN2221AAF-E3	ECN2222AAF-E3	ECN2224AAF-E3	ECN2228AAF-E3			
				70 A	ECN2221AAW-E3	ECN2222AAW-E3	ECN2224AAW-E3	ECN2228AAW-E3			
	460	25		50 A	ECN2221AAF-E3	ECN2222AAF-E3	ECN2224AAF-E3	ECN2228AAF-E3			
				30 A	ECN2221AAE-E3	ECN2222AAE-E3	ECN2224AAE-E3	ECN2228AAE-E3			
575	15	30 A	ECN2221AAE-E3	ECN2222AAE-E3	ECN2224AAE-E3	ECN2228AAE-E3					
		25	50 A	ECN2221AAF-E3	ECN2222AAF-E3	ECN2224AAF-E3	ECN2228AAF-E3				

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

① For other magnet coil voltages substitute the eighth digit with appropriate digit based on modification table on **Page V10-T2-4**.

② The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit.
Example: ECN2202AAC-E3. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**.
To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

③ To order Type 12 enclosures with safety door interlock add modification **E11**.

2.1

NEMA Contactors and Starters

Freedom Full Voltage Controls

2

Class ECN23—Combination Reversing Starter—Circuit Breaker ①

NEMA Size	Motor Voltage	Maximum hp Rating	Magnet Coil Voltage ②	Circuit Breaker Size	Type 1	Type 3R	Type 4X	Type 12	Component Starter (Open)		
					General Purpose	Rainproof	Watertight and Dust-Tight Stainless Steel ③	Dust-Tight Industrial External Reset ④⑤			
					Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number		
00	200	1	120	7 A	ECN23A1AAC	ECN23A2AAC	ECN23A4AAC	ECN23A8AAC	AN56AN0AC		
		1-1/2		15 A	ECN23A1AAD	ECN23A2AAD	ECN23A4AAD	ECN23A8AAD			
	230	1	7 A	ECN23A1AAC	ECN23A2AAC	ECN23A4AAC	ECN23A8AAC				
		1-1/2	15 A	ECN23A1AAD	ECN23A2AAD	ECN23A4AAD	ECN23A8AAD				
	460	1	3 A	ECN23A1AAB	ECN23A2AAB	ECN23A4AAB	ECN23A8AAB				
		2	7 A	ECN23A1AAC	ECN23A2AAC	ECN23A4AAC	ECN23A8AAC				
	575	1	3 A	ECN23A1AAB	ECN23A2AAB	ECN23A4AAB	ECN23A8AAB				
		2	7 A	ECN23A1AAC	ECN23A2AAC	ECN23A4AAC	ECN23A8AAC				
	0	200	1	120	7 A	ECN2301AAC	ECN2302AAC	ECN2304AAC		ECN2308AAC	AN56BN0AC
			3		15 A	ECN2301AAD	ECN2302AAD	ECN2304AAD		ECN2308AAD	
230		1	7 A	ECN2301AAC	ECN2302AAC	ECN2304AAC	ECN2308AAC				
		3	15 A	ECN2301AAD	ECN2302AAD	ECN2304AAD	ECN2308AAD				
460		1	3 A	ECN2301AAB	ECN2302AAB	ECN2304AAB	ECN2308AAB				
		3	7 A	ECN2301AAC	ECN2302AAC	ECN2304AAC	ECN2308AAC				
		5	15 A	ECN2301AAD	ECN2302AAD	ECN2304AAD	ECN2308AAD				
575		1	3 A	ECN2301AAB	ECN2302AAB	ECN2304AAB	ECN2308AAB				
		3	15 A	ECN2301AAD	ECN2302AAD	ECN2304AAD	ECN2308AAD				
		5	7 A	ECN2301AAC	ECN2302AAC	ECN2304AAC	ECN2308AAC				
			15 A	ECN2301AAD	ECN2302AAD	ECN2304AAD	ECN2308AAD				
1		200	1	120	7 A	ECN2311AAC	ECN2312AAC	ECN2314AAC	ECN2318AAC	AN56DN0AB	
			3		15 A	ECN2311AAD	ECN2312AAD	ECN2314AAD	ECN2318AAD		
			5		30 A	ECN2311AAE	ECN2312AAE	ECN2314AAE	ECN2318AAE		
	7-1/2		50 A		ECN2311AAF	ECN2312AAF	ECN2314AAF	ECN2318AAF			
	230	1	7 A	ECN2311AAC	ECN2312AAC	ECN2314AAC	ECN2318AAC				
		3	15 A	ECN2311AAD	ECN2312AAD	ECN2314AAD	ECN2318AAD				
		5	30 A	ECN2311AAE	ECN2312AAE	ECN2314AAE	ECN2318AAE				
		7-1/2	50 A	ECN2311AAF	ECN2312AAF	ECN2314AAF	ECN2318AAF				
	460	1	3 A	ECN2311AAB	ECN2312AAB	ECN2314AAB	ECN2318AAB				
		3	7 A	ECN2311AAC	ECN2312AAC	ECN2314AAC	ECN2318AAC				
		5	15 A	ECN2311AAD	ECN2312AAD	ECN2314AAD	ECN2318AAD				
		10	30 A	ECN2311AAE	ECN2312AAE	ECN2314AAE	ECN2318AAE				
	575	1	3 A	ECN2311AAB	ECN2312AAB	ECN2314AAB	ECN2318AAB				
		3	7 A	ECN2311AAC	ECN2312AAC	ECN2314AAC	ECN2318AAC				
		5	15 A	ECN2311AAD	ECN2312AAD	ECN2314AAD	ECN2318AAD				
		10	30 A	ECN2311AAE	ECN2312AAE	ECN2314AAE	ECN2318AAE				

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

① 100,000 rms short-circuit—480 V; 25,000 rms short-circuit—600 V.

② For other magnet coil voltages substitute the eighth digit with appropriate digit based on modification table on **Page V10-T2-4**.

③ The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit. Example: ECN2304AAC. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

④ All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.

⑤ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.

Class ECN23—Combination Reversing Starter—Circuit Breaker, continued ①

NEMA Size	Motor Voltage	Maximum hp Rating	Magnet Coil Voltage ②	Circuit Breaker Size	Type 1	Type 3R	Type 4X	Type 12	Component Starter (Open)
					General Purpose	Rainproof	Watertight and Dust-Tight Stainless Steel ③	Dust-Tight Industrial External Reset ④⑤	
					Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number
2	200	10	120	50 A	ECN2321AAF	ECN2322AAF	ECN2324AAF	ECN2328AAF	AN56GN0AB
		15			ECN2321AAF	ECN2322AAF	ECN2324AAF	ECN2328AAF	
	460	25	50 A	ECN2321AAW	ECN2322AAW	ECN2324AAW	ECN2328AAW		
		15		ECN2321AAF	ECN2322AAF	ECN2324AAF	ECN2328AAF		
	575	15	30 A	ECN2321AAE	ECN2322AAE	ECN2324AAE	ECN2328AAE		
		25		ECN2321AAF	ECN2322AAF	ECN2324AAF	ECN2328AAF		
3	200	20	120	100 A	ECN2331AAG	ECN2332AAG	ECN2334AAG	ECN2338AAG	AN56KN0A
		25			ECN2331AAX	ECN2332AAX	ECN2334AAX	ECN2338AAX	
	230	25	100 A	ECN2331AAG	ECN2332AAG	ECN2334AAG	ECN2338AAG		
		30		ECN2331AAX	ECN2332AAX	ECN2334AAX	ECN2338AAX		
	460	50	100 A	ECN2331AAG	ECN2332AAG	ECN2334AAG	ECN2338AAG		
		30		ECN2331AAF	ECN2332AAF	ECN2334AAF	ECN2338AAF		
	575	30	100 A	ECN2331AAG	ECN2332AAG	ECN2334AAG	ECN2338AAG		
		50		ECN2331AAG	ECN2332AAG	ECN2334AAG	ECN2338AAG		
4	200	40	120	150 A	ECN2341AAH	ECN2342AAH	ECN2344AAH	ECN2348AAH	AN56NN0A
		50			ECN2341AAH	ECN2342AAH	ECN2344AAH	ECN2348AAH	
	460	100	150 A	ECN2341AAH	ECN2342AAH	ECN2344AAH	ECN2348AAH		
		100		ECN2341AAH	ECN2342AAH	ECN2344AAH	ECN2348AAH		
5	200	50	230	250 A	ECN2351AAJ	ECN2352AAJ	ECN2354AAJ	ECN2358AAJ	AN56SN0AB
		75			ECN2351AAK	ECN2352AAK	ECN2354AAK	ECN2358AAK	
	230	60	250 A	ECN2351AAJ	ECN2352AAJ	ECN2354AAJ	ECN2358AAJ		
		100		ECN2351AAK	ECN2352AAK	ECN2354AAK	ECN2358AAK		
	460	125	250 A	ECN2351AAJ	ECN2352AAJ	ECN2354AAJ	ECN2358AAJ		
		200		ECN2351AAK	ECN2352AAK	ECN2354AAK	ECN2358AAK		
	575	150	250 A	ECN2351AAJ	ECN2352AAJ	ECN2354AAJ	ECN2358AAJ		
		200		ECN2351AAK	ECN2352AAK	ECN2354AAK	ECN2358AAK		

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

① 100,000 rms short-circuit—480 V; 25,000 rms short-circuit—600 V.

② For other magnet coil voltages substitute the eighth digit with appropriate digit based on modification table on **Page V10-T2-4**.

③ The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit. Example: ECN2324AAF. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

④ All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.

⑤ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.

2.1

NEMA Contactors and Starters

Freedom Full Voltage Controls

2

Class ECN23—Combination Reversing Starter—Circuit Breaker, continued ^①

NEMA Size	Motor Voltage	Maximum hp Rating	Magnet Coil Voltage ^②	Circuit Breaker Size	Type 1	Type 3R	Type 4X	Type 12	Component Starter (Open)
					General Purpose	Rainproof	Watertight and Dust-Tight Stainless Steel ^③	Dust-Tight Industrial External Reset ^{④⑤}	
					Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number
6	200	150	120	600 A	ECN2361AAL	ECN2362AAL	ECN2363AAL ^⑥	ECN2368AAL	AN56TN0AB
	230	200			ECN2361AAL	ECN2362AAL	ECN2363AAL ^⑥	ECN2368AAL	
	460	350			ECN2361AAL	ECN2362AAL	ECN2363AAL ^⑥	ECN2368AAL	
		400		1200 A	ECN2361AAP	ECN2362AAP	ECN2363AAP ^⑥	ECN2368AAP	
	575	400		600 A	ECN2361AAL	ECN2362AAL	ECN2363AAL ^⑥	ECN2368AAL	
7	230	300	120	—	ECN2371AAU ^⑦	ECN2372AAU ^⑦	ECN2373AAU ^{⑥⑦}	ECN2378AAU ^⑦	AN56UN0AB
	460	600		—	ECN2371AAU ^⑦	ECN2372AAU ^⑦	ECN2373AAU ^{⑥⑦}	ECN2378AAU ^⑦	
	575	600		—	ECN2371AAU ^⑦	ECN2372AAU ^⑦	ECN2373AAU ^{⑥⑦}	ECN2378AAU ^⑦	
8	230	450	120	—	ECN2381AAU ^⑦	ECN2382AAU ^⑦	ECN2383AAU ^{⑥⑦}	ECN2388AAU ^⑦	AN56VN0AB
	460	900		—	ECN2381AAU ^⑦	ECN2382AAU ^⑦	ECN2383AAU ^{⑥⑦}	ECN2388AAU ^⑦	
	575	900		—	ECN2381AAU ^⑦	ECN2382AAU ^⑦	ECN2383AAU ^{⑥⑦}	ECN2388AAU ^⑦	
9	230	800	120	—	ECN2391AAU ^⑦	ECN2392AAU ^⑦	ECN2393AAU ^{⑥⑦}	ECN2398AAU ^⑦	AN56WN0A
	460	1600		—	ECN2391AAU ^⑦	ECN2392AAU ^⑦	ECN2393AAU ^{⑥⑦}	ECN2398AAU ^⑦	
	575	1600		—	ECN2391AAU ^⑦	ECN2392AAU ^⑦	ECN2393AAU ^{⑥⑦}	ECN2398AAU ^⑦	

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

^① 100,000 rms short-circuit—480 V; 25,000 rms short-circuit—600 V.

^② For other magnet coil voltages substitute the eighth digit with appropriate digit based on modification table on **Page V10-T2-4**.

^③ The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit.

Example: ECN2363AAL. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**.

To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

^④ All Type 12 enclosures are standardized with external reset. For internal reset, order modification code **R5**.

^⑤ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification **E11**.

^⑥ Type 4 (painted steel) sizes 6–9.

^⑦ Provide FLA to size disconnect properly.

Class ECN24—Combination Non-Reversing Starter—Circuit Breaker with CPT ①

NEMA Size	Motor Voltage	Maximum hp Rating	Magnet Coil Voltage ②	Circuit Breaker Size	Type 1	Type 3R	Type 4X	Type 12	Component Starter (Open)			
					General Purpose	Rainproof	Watertight and Dust-Tight Stainless Steel ③	Dust-Tight Industrial External Reset ④⑤				
					Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number			
00	200	1	120	7 A	ECN24A1EAC	ECN24A2EAC	ECN24A4EAC	ECN24A8EAC	AN16AN0AC			
		1-1/2		15 A	ECN24A1EAD	ECN24A2EAD	ECN24A4EAD	ECN24A8EAD				
		230	1	7 A	ECN24A1BAC	ECN24A2BAC	ECN24A4BAC	ECN24A8BAC				
			1-1/2	15 A	ECN24A1BAD	ECN24A2BAD	ECN24A4BAD	ECN24A8BAD				
	460	1		3 A	ECN24A1CAB	ECN24A2CAB	ECN24A4CAB	ECN24A8CAB				
				7 A	ECN24A1CAC	ECN24A2CAC	ECN24A4CAC	ECN24A8CAC				
		2		3 A	ECN24A1DAB	ECN24A2DAB	ECN24A4DAB	ECN24A8DAB				
				7 A	ECN24A1DAC	ECN24A2DAC	ECN24A4DAC	ECN24A8DAC				
	575	1	3 A	ECN24A1DAB	ECN24A2DAB	ECN24A4DAB	ECN24A8DAB					
		2	7 A	ECN24A1DAC	ECN24A2DAC	ECN24A4DAC	ECN24A8DAC					
	0	200	1	120	7 A	ECN2401EAC	ECN2402EAC	ECN2404EAC		ECN2408EAC	AN16BN0AC	
			3		15 A	ECN2401EAD	ECN2402EAD	ECN2404EAD		ECN2408EAD		
230			1	7 A	ECN2401BAC	ECN2402BAC	ECN2404BAC	ECN2408BAC				
			3	15 A	ECN2401BAD	ECN2402BAD	ECN2404BAD	ECN2408BAD				
460		1		3 A	ECN2401CAB	ECN2402CAB	ECN2404CAB	ECN2408CAB				
				7 A	ECN2401CAC	ECN2402CAC	ECN2404CAC	ECN2408CAC				
		3		15 A	ECN2401CAD	ECN2402CAD	ECN2404CAD	ECN2408CAD				
				5	15 A	ECN2401CAD	ECN2402CAD	ECN2404CAD	ECN2408CAD			
575		1		3 A	ECN2401DAB	ECN2402DAB	ECN2404DAB	ECN2408DAB				
				7 A	ECN2401DAC	ECN2402DAC	ECN2404DAC	ECN2408DAC				
		3		15 A	ECN2401DAD	ECN2402DAD	ECN2404DAD	ECN2408DAD				
				5	7 A	ECN2401DAC	ECN2402DAC	ECN2404DAC	ECN2408DAC			
1		200	1	120	7 A	ECN2411EAC	ECN2412EAC	ECN2414EAC	ECN2418EAC	AN16DN0AB		
			3		15 A	ECN2411EAD	ECN2412EAD	ECN2414EAD	ECN2418EAD			
			230	5		30 A	ECN2411EAE	ECN2412EAE	ECN2414EAE			ECN2418EAE
				7-1/2		50 A	ECN2411EAF	ECN2412EAF	ECN2414EAF			ECN2418EAF
	1	7 A		ECN2411BAC		ECN2412BAC	ECN2414BAC	ECN2418BAC				
		3		15 A		ECN2411BAD	ECN2412BAD	ECN2414BAD	ECN2418BAD			
	460	1		30 A	ECN2411BAE	ECN2412BAE	ECN2414BAE	ECN2418BAE				
				7-1/2	50 A	ECN2411BAF	ECN2412BAF	ECN2414BAF	ECN2418BAF			
		3		3 A	ECN2411CAB	ECN2412CAB	ECN2414CAB	ECN2418CAB				
				7 A	ECN2411CAC	ECN2412CAC	ECN2414CAC	ECN2418CAC				
	575	1		15 A	ECN2411CAD	ECN2412CAD	ECN2414CAD	ECN2418CAD				
				30 A	ECN2411CAE	ECN2412CAE	ECN2414CAE	ECN2418CAE				
		3		3 A	ECN2411DAB	ECN2412DAB	ECN2414DAB	ECN2418DAB				
				7 A	ECN2411DAC	ECN2412DAC	ECN2414DAC	ECN2418DAC				
	10	1		15 A	ECN2411DAD	ECN2412DAD	ECN2414DAD	ECN2418DAD				
				30 A	ECN2411DAE	ECN2412DAE	ECN2414DAE	ECN2418DAE				

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

① 100,000 rms short-circuit—480 V; 25,000 rms short-circuit—600 V.

② For other magnet coil voltages substitute the eighth digit with appropriate digit based on modification table on **Page V10-T2-4**.

③ The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit.

Example: ECN24A4EAC. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

④ All Type 12 enclosures are standardized with external reset. For internal reset, order modification code R5.

⑤ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification E11.

2.1

NEMA Contactors and Starters

Freedom Full Voltage Controls

Class ECN24—Combination Non-Reversing Starter—Circuit Breaker with CPT, continued ^①

2

NEMA Size	Motor Voltage	Maximum hp Rating	Magnet Coil Voltage ^②	Circuit Breaker Size	Type 1	Type 3R	Type 4X	Type 12	Component Starter (Open)		
					General Purpose	Rainproof	Watertight and Dust-Tight Stainless Steel ^③	Dust-Tight Industrial External Reset ^{④⑤}			
					Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number		
2	200	10	120	50 A	ECN2421EAF	ECN2422EAF	ECN2424EAF	ECN2428EAF	AN16GN0AB		
					ECN2421BAF	ECN2422BAF	ECN2424BAF	ECN2428BAF			
					ECN2421BAW	ECN2422BAW	ECN2424BAW	ECN2428BAW			
	460	25	50 A	ECN2421CAF	ECN2422CAF	ECN2424CAF	ECN2428CAF				
				575	15	30 A	ECN2421CAE	ECN2422CAE		ECN2424CAE	ECN2428CAE
							50 A	ECN2421DAF		ECN2422DAF	ECN2424DAF
3	200	20	120	100 A	ECN2431EAG	ECN2432EAG	ECN2434EAG	ECN2438EAG	AN16KN0A		
					ECN2431EAX	ECN2432EAX	ECN2434EAX	ECN2438EAX			
	230	25		ECN2431BAG	ECN2432BAG	ECN2434BAG	ECN2438BAG				
				ECN2431BAX	ECN2432BAX	ECN2434BAX	ECN2438BAX				
	460	50		ECN2431CAG	ECN2432CAG	ECN2434CAG	ECN2438CAG				
				575	30	50 A	ECN2431DAF	ECN2432DAF		ECN2434DAF	ECN2438DAF
	100 A	ECN2431DAG	ECN2432DAG				ECN2434DAG	ECN2438DAG			
		4	200			40	120	150 A		ECN2441EAH	ECN2442EAH
ECN2441BAH	ECN2442BAH								ECN2444BAH	ECN2448BAH	
230	50			ECN2441CAH	ECN2442CAH	ECN2444CAH	ECN2448CAH				
				ECN2441DAH	ECN2442DAH	ECN2444DAH	ECN2448DAH				
5	200	50	120	250 A	ECN2451EAJ	ECN2452EAJ	ECN2454EAJ	ECN2458EAJ	AN16SN0AB		
					ECN2451EAK	ECN2452EAK	ECN2454EAK	ECN2458EAK			
	230	60		250 A	ECN2451BAJ	ECN2452BAJ	ECN2454BAJ	ECN2458BAJ			
					ECN2451BAK	ECN2452BAK	ECN2454BAK	ECN2458BAK			
	460	125		250 A	ECN2451CAJ	ECN2452CAJ	ECN2454CAJ	ECN2458CAJ			
					ECN2451CAK	ECN2452CAK	ECN2454CAK	ECN2458CAK			
	575	150		250 A	ECN2451DAJ	ECN2452DAJ	ECN2454DAJ	ECN2458DAJ			
					ECN2451DAK	ECN2452DAK	ECN2454DAK	ECN2458DAK			

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

^① 100,000 rms short-circuit—480 V; 25,000 rms short-circuit—600 V.

^② For other magnet coil voltages substitute the eighth digit with appropriate digit based on modification table on **Page V10-T2-4**.

^③ The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit. Example: ECN2424EAF. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

^④ All Type 12 enclosures are standardized with external reset. For internal reset, order modification code R5.

^⑤ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification E11.

Class ECN24—Combination Non-Reversing Starter—Circuit Breaker with CPT, continued ^①

NEMA Size	Motor Voltage	Maximum hp Rating	Magnet Coil Voltage ^②	Circuit Breaker Size	Type 1	Type 3R	Type 4X	Type 12	Component Starter (Open)
					General Purpose	Rainproof	Watertight and Dust-Tight Stainless Steel ^③	Dust-Tight Industrial External Reset ^{④⑤}	
					Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number
6	200	150	120	600 A	ECN2461EAL	ECN2462EAL	ECN2463EAL ^⑥	ECN2468EAL	AN16TN0AB
	230	200			ECN2461BAL	ECN2462BAL	ECN2463BAL ^⑥	ECN2468BAL	
	460	350			ECN2461CAL	ECN2462CAL	ECN2463CAL ^⑥	ECN2468CAL	
		400	1200 A	ECN2461CAP	ECN2462CAP	ECN2463CAP ^⑥	ECN2468CAP		
	575	400	600 A	ECN2461DAL	ECN2462DAL	ECN2463DAL ^⑥	ECN2468DAL		
7	230	300	120	—	ECN2471BAU ^⑦	ECN2472BAU ^⑦	ECN2473BAU ^{⑥⑦}	ECN2478BAU ^⑦	AN16UN0AB
	460	600	—	—	ECN2471CAU ^⑦	ECN2472CAU ^⑦	ECN2473CAU ^{⑥⑦}	ECN2478CAU ^⑦	
	575	600	—	—	ECN2471DAU ^⑦	ECN2472DAU ^⑦	ECN2473DAU ^{⑥⑦}	ECN2478DAU ^⑦	
8	230	450	120	—	ECN2481BAU ^⑦	ECN2482BAU ^⑦	ECN2483BAU ^{⑥⑦}	ECN2488BAU ^⑦	AN16VN0AB
	460	900	—	—	ECN2481CAU ^⑦	ECN2482CAU ^⑦	ECN2483CAU ^{⑥⑦}	ECN2488CAU ^⑦	
	575	900	—	—	ECN2481DAU ^⑦	ECN2482DAU ^⑦	ECN2483DAU ^{⑥⑦}	ECN2488DAU ^⑦	
9	230	800	120	—	ECN2491BAU ^⑦	ECN2492BAU ^⑦	ECN2493BAU ^{⑥⑦}	ECN2498BAU ^⑦	AN16WN0A
	460	1600	—	—	ECN2491CAU ^⑦	ECN2492CAU ^⑦	ECN2493CAU ^{⑥⑦}	ECN2498CAU ^⑦	
	575	1600	—	—	ECN2491DAU ^⑦	ECN2492DAU ^⑦	ECN2493DAU ^{⑥⑦}	ECN2498DAU ^⑦	

Notes

Starters do not include heater packs. Select one carton of three heater packs. For heater pack selection, see **Tab 15**.

Starters with electronic overload, see Modification Codes in **Tab 15**, or solid-state overload codes on **Page V10-T2-5**.

^① 100,000 rms short-circuit—480 V; 25,000 rms short-circuit—600 V.

^② For other magnet coil voltages substitute the eighth digit with appropriate digit based on modification table on **Page V10-T2-4**.

^③ The catalog numbers listed in the Type 4X column are for Type 4X 304-Grade stainless steel, as indicated by the **seventh** digit.

Example: ECN2463EAL. To order Type 4X 316-Grade stainless steel, change that digit to **9**. To order Type 4 painted steel, change that digit to **3**. To order non-metallic, change that digit to **5**. For details on these alternate enclosures, see **Tab 13**.

^④ All Type 12 enclosures are standardized with external reset. For internal reset, order modification code R5.

^⑤ Type 12 enclosure is without safety door interlock. When safety door interlock is required, add modification E11.

^⑥ Type 4 (painted steel) sizes 6–9.

^⑦ Provide FLA to size disconnect properly.

2.1

NEMA Contactors and Starters

Freedom Full Voltage Controls

Wiring Diagrams

Non-Reversing Starter—Single- and Three-Phase Non-Combination

2

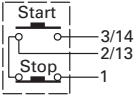
Remote Pilot Devices

Two-Wire Control

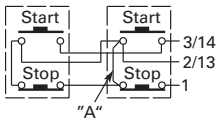


Not for Use with Auto Reset OL Relays

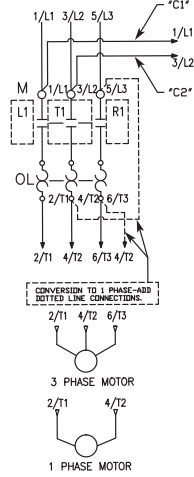
Three-Wire Control



When More than One Pushbutton Station is Used, Omit Connector "A" and Connect per Sketch Below



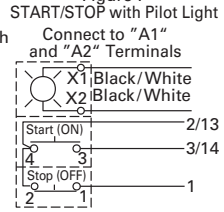
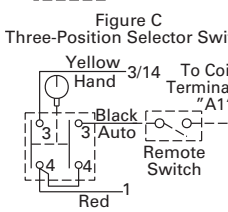
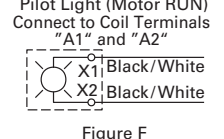
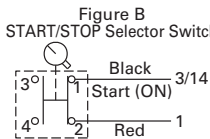
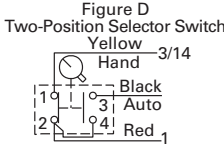
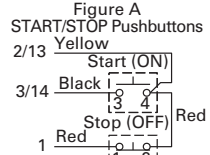
Connections for Non-Reversing Starter



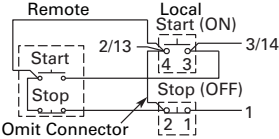
Non-Reversing Starter—Combination

Connections for Control Stations

Local Control



Combined Remote and Local for Figures 1 and 2

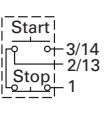


Remote Control

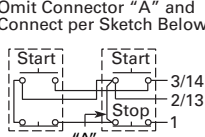
Two-Wire Control



Three-Wire Control



When More than One Pushbutton Station is Used Omit Connector "A" and Connect per Sketch Below



Connections for Starters

Figure 1 Front View Diagram

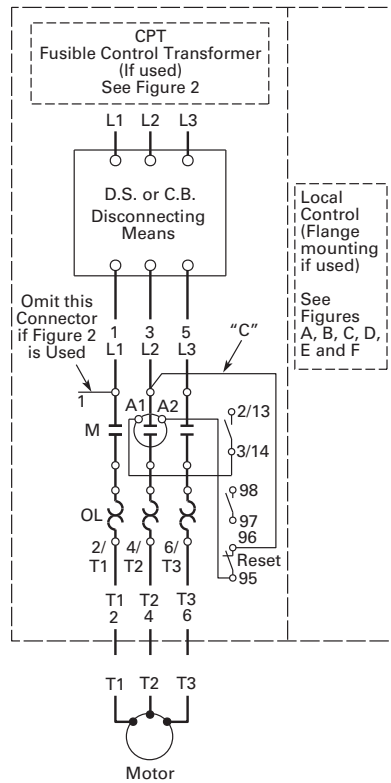
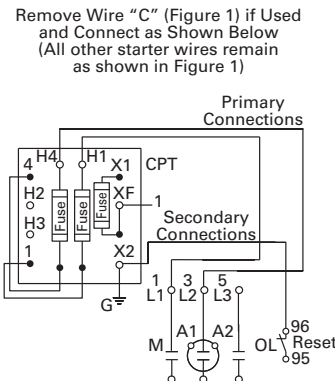
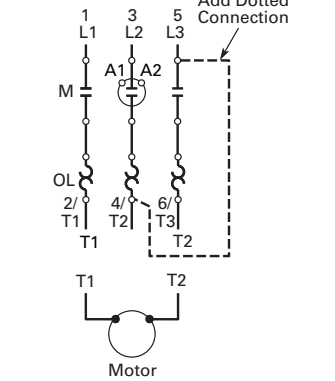


Figure 2 Fusible Control Transformer



Connections for Dual Voltage Rated Transformer—See Transformer Nameplate

Field Conversion to Single-Phase

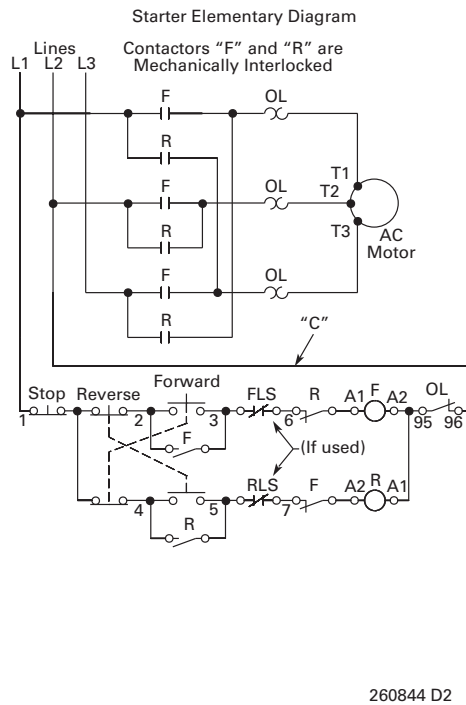
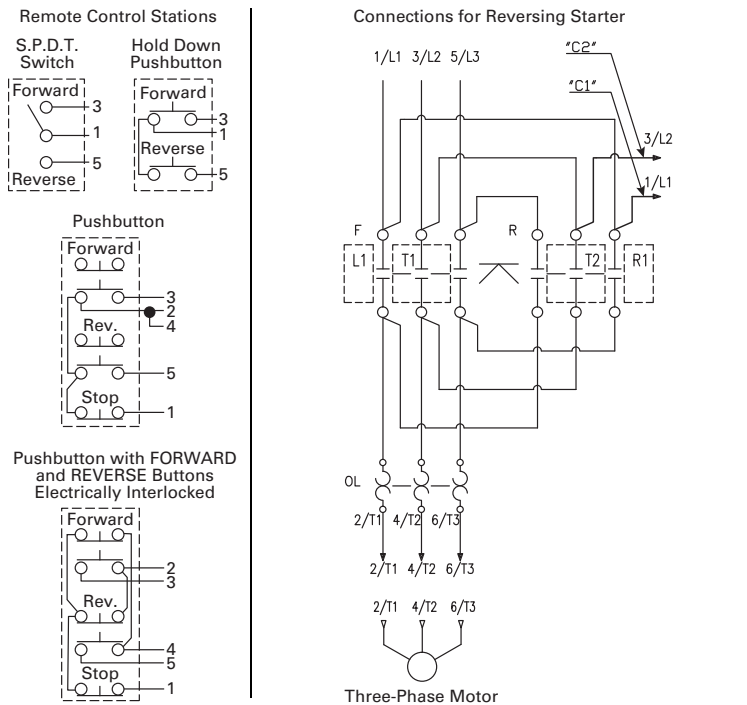


Separate Control

Remove Wire "C" if Supplied and Connect Separate Control Lines to the Number 1 Terminal on the Remote Pilot Device and to the Number 96 Terminal on the Overload Relay

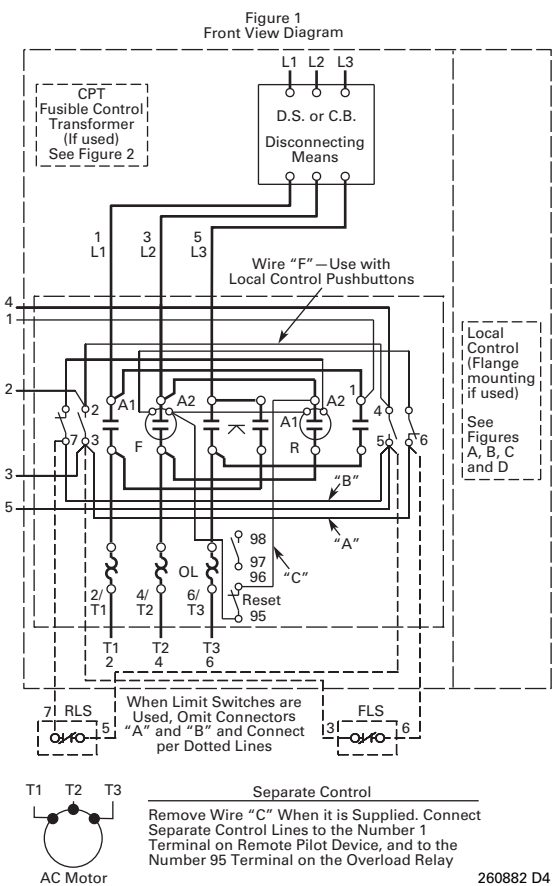
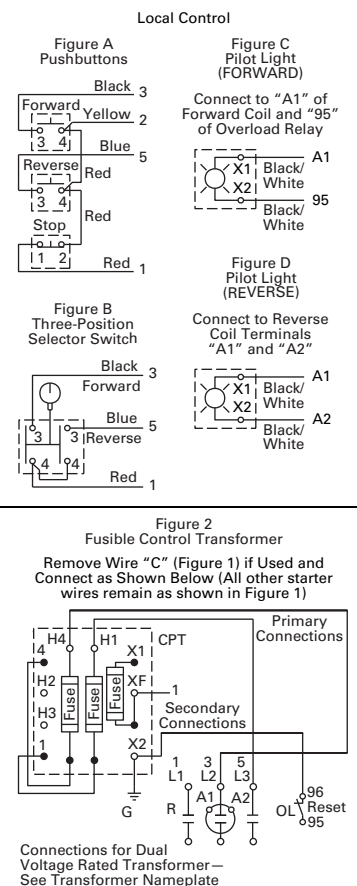
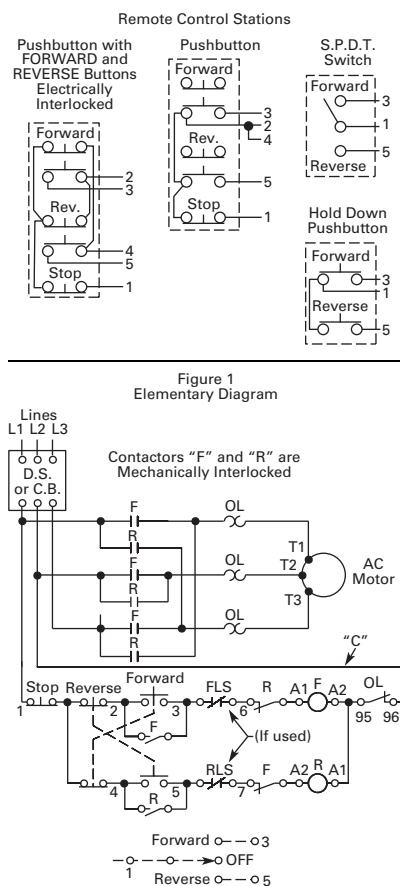
260878 D4

Reversing Starter—Non-Combination



260844 D2

Reversing Starter—Combination



260882 D4

2.1

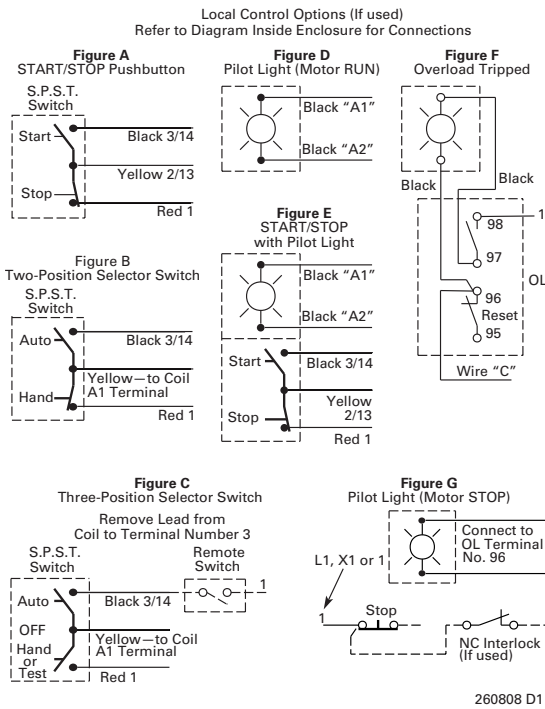
NEMA Contactors and Starters

Freedom Full Voltage Controls

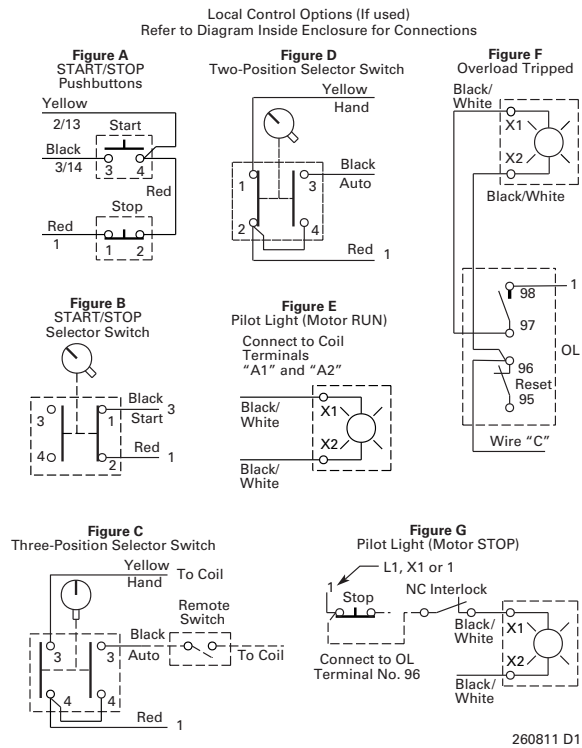
Non-Reversing Cover Control

Type 1 C400G Control Options

2

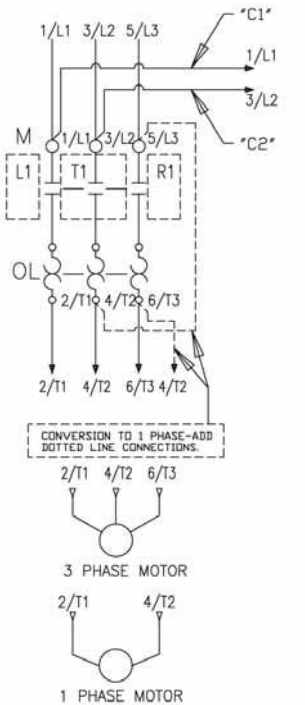


C400T Control Options



Type 1 C600M Control Options

Connections for Non-Reversing Starter



Schematic Symbol Legend

	Normally Open Auxiliary
	Normally Closed Auxiliary
	Normally Open Momentary PB
	Normally Closed Momentary PB
	Contactor Coil
	Red Pilot Light
	Green Pilot Light
	Normally Closed Overload Auxiliary
	Normally Open Overload Auxiliary
	M22-XLED230-T: Used to lower voltage for pilot lights.
	Two-position selector switch (STOP/START, OFF/ON)
	Three-position selector switch (HOA)
	Signifies Location of Side and Top Adder Auxiliary Referenced on Diagram Under Auxiliary Symbol

CAUTION

READ AND FOLLOW INSTRUCTIONS PRIOR TO WIRING OR CONNECTING POWER. THIS PRODUCT CAN BE FACTORY OR FIELD CONFIGURED FOR MULTIPLE CONTROL MODES OR CONTROL VOLTAGES. CHECK NAMEPLATE FOR COIL VOLTAGE.

SEPARATE CONTROL POWER

FOR COIL VOLTAGES 120V AND LESS: CONNECT SEPARATE CONTROL LINES TO THE NO. 91 TERMINAL ON THE TOP ADDER AUX. AND TO THE NO. 96 TERMINAL ON THE OVERLOAD RELAY.

FOR COIL VOLTAGES GREATER THAN 120V: REMOVE WIRE 'C2' IF SUPPLIED. IF WIRE 'C1' IS TERMINATED ON L1, DISCONNECT FROM L1. CONNECT SEPARATE CONTROL LINES TO THE 'C1' WIRE OR APPROPRIATE PILOT DEVICE TERMINAL PER DIAGRAM AND TO THE NO. 96 TERMINAL ON THE OVERLOAD RELAY.

COMMON CONTROL POWER

FOR COIL VOLTAGES 120V AND LESS: ADD WIRE 'C2' IF NOT SUPPLIED. ADD CONNECTOR BETWEEN L1 TERMINAL AND THE NO. 91 TERMINAL ON THE TOP ADDER AUX. OR APPROPRIATE PILOT DEVICE TERMINAL PER DIAGRAM. FOR COIL VOLTAGES GREATER THAN 120V: ADD WIRE 'C1' AND 'C2' IF NOT SUPPLIED.

Product Selection

When Ordering Supply

- Catalog number
- Heater pack number (see selection table, **Pages V5-T2-40 to V5-T2-42**) or full load current

Size 0 Non-Reversing Starter



Size 1 Reversing Starter



Type AN16/AN56 NEMA—Manual or Automatic Reset Overload Relay—Non-Reversing and Reversing ^①

NEMA Size	Continuous Ampere Rating	Service-Limit Current Rating (Amperes) ^④	Maximum UL Horsepower ^②						Three-Pole Non-Reversing ^③ Catalog Number	Three-Pole Reversing ^③ Catalog Number	Vertical Reversing ^③ Catalog Number
			Single-Phase		Three-Phase		115V	230V			
00	9	11	1/3	1	1-1/2	1-1/2	2	2	AN16AN0_C	AN56AN0_C	—
0	18	21	1	2	3	3	5	5	AN16BN0_C	AN56BN0_C	AN56BNV0_
1	27	32	2	3	7-1/2	7-1/2	10	10	AN16DN0_B	AN56DN0_B	AN56DNV0_
2	45	52	3	7-1/2	10	15	25	25	AN16GN0_B	AN56GN0_B	AN56GNV0_
3	90	104	—	—	25	30	50	50	AN16KN0_	AN56KN0_	AN56KNV0_
4	135	156	—	—	40	50	100	100	AN16NN0_	AN56NN0_	AN56NNV0_
5	270	311	—	—	75	100	200	200	AN16SN0_B	AN56SN0_B	—
6	540	621	—	—	150	200	400	400	AN16TN0_C	AN56TN0_C	—
7	810	932	—	—	200	300	600	600	AN16UN0_B	AN56UN0_B	—
8 ^⑤	1215	1400	—	—	400	450	900	900	AN16VN0_B	AN56VN0_B	—

Magnet Coils—AC or DC

Starter coils listed in this section also have a 50 Hz rating as shown in the adjacent table. Select required starter by catalog number and replace the magnet coil alpha designation

in the catalog number () with the proper code suffix from the table.

For Sizes 00–2 and 5–8, the magnet coil alpha designation will be the next to last digit of the listed catalog number.

EXAMPLE: For a 380V, 50 Hz coil, change AN16BN0_C to AN16BN0LC. For all other sizes, the magnet coil alpha designation will be the last digit of the listed catalog number.

For **DC Magnet Coils**, see Accessories, **Pages V5-T2-28 and V5-T2-29**.

AC Suffix

Coil Volts and Hertz	Code Suffix
120/60 or 110/50	A
240/60 or 220/50	B
480/60 or 440/50	C
600/60 or 550/50	D
208/60	E
277/60	H
208–240/60 ^⑥	J
240/50	K

Coil Volts and Hertz	Code Suffix
380–415/50	L
550/50	N
24/60, 24/50 ^⑦	T
24/50	U
32/50	V
48/60	W
48/50	Y
48/50	Y

Notes

- ^① Starter catalog numbers do not include heater packs. Select one carton of three heater packs. Heater pack selection, **Pages V5-T2-40 to V5-T2-42**.
- ^② Maximum horsepower rating of starters for 380V 50 Hz applications:

NEMA Size	00	0	1	2	3	4	5	6	7	8
Horsepower	1-1/2	5	10	25	50	75	150	300	600	900

- ^③ Underscore () indicates coil suffix required, see AC Suffix table.
- ^④ The service-limit current ratings represent the maximum rms current, in amperes, which the controller shall be permitted to carry for protracted periods in normal service. At service-limit current ratings, temperature rises shall be permitted to exceed those obtained by testing the controller at its continuous current rating. The current rating of overload relays or trip current of other motor protective devices used shall not exceed the service-limit current rating of the controller.
- ^⑤ Common control. For separate 120V control, insert letter **D** in 7th position of listed catalog number. Example: AN56VND0CB.
- ^⑥ NEMA Sizes 00 and 0 only.
- ^⑦ NEMA Sizes 00 and 0 only. Sizes 1–8 are 24/60 only.

Kits and Accessories

- Auxiliary contacts, contactor mounted—**Pages V5-T2-25 to V5-T2-27**
- Transient suppressor, for magnet coil—**Page V5-T2-24**
- Timers—solid-state and pneumatic, mount on contactor—**Page V5-T2-22**

**Renewal Parts
Publication Numbers**

- See **Page V5-T2-30**

Technical Data and Specifications

Wire (75°C) Sizes—AWG or kcmil—NEMA Sizes 00–2—Open and Enclosed

NEMA Size	Wire Size ^① Cu Only
Power Terminals—Line	
00	12–16 AWG stranded, 12–14 AWG solid
0	8–16 AWG stranded, 10–14 AWG solid
1	8–14 AWG stranded or solid
2	3–14 AWG (upper) and/or 6–14 AWG (lower) stranded or solid ^②
Power Terminals—Load—Cu Only (stranded or solid)	
00–0	14–6 AWG stranded or solid
1–2	14–2 AWG stranded or solid
Control Terminals—Cu Only	
12–16 AWG stranded, 12–14 AWG solid	

Wire (75°C) Sizes—AWG or kcmil—NEMA Sizes 3–8—Open and Enclosed

NEMA Size	Wire Size ^②
Power Terminals—Line and Load	
3	1/0–14 AWG Cu/Al
4	Open—3/0–8 AWG Cu; Enclosed—250 kcmil—6 AWG Cu/Al
5	750 kcmil—2 AWG; or (2) 250 kcmil—3/0 AWG Cu/Al
6	(2) 750 kcmil—3/0 AWG Cu/Al
7	(3) 750 kcmil—3/0 AWG Cu/Al
8	(4) 750 kcmil—1/0 AWG Cu/Al
Control Terminals—Cu Only	
12–16 AWG stranded, 12–14 AWG solid	

Plugging and Jogging Service Horsepower Ratings ^③

NEMA Size	200V	230V	460V	575V
00	—	1/2	1/2	1/2
0	1-1/2	1-1/2	2	2
1	3	3	5	5
2	7-1/2	10	15	15
3	15	20	30	30
4	25	30	60	60
5	60	75	150	150
6	125	150	300	300

Notes

- ① Minimum per NEC. Maximum wire size: Sizes 00 and 0 to 8 AWG and Sizes 1–2 to 2 AWG.
- ② Two compartment box lug.
- ③ Maximum horsepower where operation is interrupted more than 5 times per minute, or more than 10 times in a 10 minute period. NEMA Standard ICS2-1993 table 2-4-3.



Powering Business Worldwide

NEMA Motor Starters Freedom Series



NEMA AN19DN0A5E005
NEMA Size 1

General Description

The Freedom Series starters and contactors listed in this catalog feature a compact, space-saving design and high strength, impact and temperature-resistant insulating materials. Starters and contactors are available in the NEMA (National Electrical Manufacturers' Association) style. The NEMA devices are sized based on traditional NEMA classifications.

Features

Freedom NEMA

- Adjustable bimetallic ambient compensated overload relays with interchangeable heater packs—available in three basic sizes, covering applications up to 900 hp—reducing the number of different contactor/overload relay combinations that have to be stocked. Fixed heater overloads are optional
- Electronic overload relay (C440) available as a stand-alone unit and assembled with a Freedom contactor
- A full line of snap-on accessories—top and side mounted auxiliary contacts, solid-state and pneumatic timers, etc.
- Straight-through wiring—line lugs at top, load lugs at bottom
- Horizontal or vertical mounting on upright panel for application freedom
- Screw type power terminals have captive, backed-out self-lifting pressure plates with ± screws—reduced wiring time
- Accessible terminals for easy wiring. Optional fingerproof shields available to prevent electrical shock
- Top located coil terminals convenient and readily accessible. 45 mm contactor magnet coils have three terminals, permitting either top or diagonal wiring—easy to replace European or U.S. style starters or contactors without changing wiring layout
- Designed to meet or exceed NEMA, UL, CSA, VDE, BS and other international standards and listings
- American engineering—built by Eaton, using the latest in statistical process control methods to produce high quality, reliable products
- Sized based on standard NEMA classifications
- Easy coil change and inspectable/replaceable contacts
- Available in open and NEMA Type 1, 3R, 4/4X and 12 enclosures

Standards and Certifications

- Standard: Designed to meet or exceed UL, NEMA and CSA
- UL listed: UL File #E1491, Guide #NLDX—Open; UL File #E176513—Enclosed Combination Motor Controllers; UL File #E19224—Enclosed Non-Combination Motor Controllers; UL File #E195239—Enclosed Power Conversion Equipment
- CSA certified: CSA File #LR353, Class #321104 Open and NEMA 1 Enclosed

Certified Type 2 Coordination

Eaton's Freedom Series NEMA starters are now UL certified to achieve IEC 947 Type 2 coordination against 100,000 A short-circuit fault currents. Any brand of properly selected fuse can be used. Type 2 coordination means that the starter will be suitable for further use following a short-circuit fault.

Short-Circuit Protection

Fuses and inverse-time circuit breakers may be selected per Article 430, Part D of the National Electrical Code® to protect motor branch circuits from fault conditions. If higher ratings or settings are required to start the motor, do not exceed the maximum as listed in Exception No. 2, Article 430.52.

Technical Data

NEMA Sizes 00-8

Table 30.3-1. AC Coil Data

NEMA Sizes	Motor Voltage	Maximum hp Rating	P.U. Volts		P.U.			Sealed			D.O. Volts		Maximum Operation Rate Operations/Hour	P.U. Time ms	D.O. Time ms
			Cold	Hot	VAR	VA	Watts	VAR	VA	Watts	Cold	Hot			
00	200 230 460 575	1-1/2 1-1/2 2 2	74%	78%	64	80	49	7.1	7.5	2.4	45%	46%	12,000	12	12
0	200 230 460 575	3 3 5 5	74%	78%	78	100	65	9.2	10	3.1	45%	46%	12,000	12	12
1	200 230 460 575	7-1/2 7-1/2 10 10	74%	78%	210	230	95	27	28	7.8	49%	50%	12,000	20	14
2	200 230 460 575	10 15 25 25	74%	78%	210	230	95	27	28	7.8	49%	50%	12,000	20	14
3	200 230 460 575	25 30 50 50	72%	76%	374	390	112	48	49.8	13	50%	52%	7200	14	11
4	200 230 460 575	40 50 100 100	73%	76%	1132	1158	240	96	100	27.2	54%	56%	2400	28	14
5	200 230 460 575	75 100 200 200	75%	77%	1132	1158	240	96	100	27.2	63%	64%	2400	25	13

General Coil Data

- **Coil Offering**—tape wound:
 - NEMA Sizes 00–0
 - UL insulation rating: Class 130 (B)
- **Coil Offering**—encapsulated:
 - NEMA Sizes 1–3
 - UL insulation rating: Class 130 (A)
- **Coil Offering**—encapsulated:
 - NEMA Sizes 4–5
 - UL insulation rating: Class 155 (F)
- **Operational Limits:**
 - 85% to 110% of rated voltage—AC
 - 80% to 110% of rated voltage—DC

Table 30.3-2. Coil Data Notes

Description	
P.U.	Pickup time is the average time taken from closing of the coil circuit to main contact touch.
D.O.	Dropout time is the average time taken from opening of the coil circuit to main contact separation.
Cold	Coil data with a cold coil.
Hot	Coil data with a hot coil.

All data is based on a standard contactor with no auxiliary devices and a 120 Vac or 24 Vdc magnet coil. Coil data has a ±5% range depending on the application, therefore specific data may vary.

Table 30.3-3. DC Coil Data

NEMA Sizes	Motor Voltage	P.U.			Sealed		D.O. Volts (Hot)	P.U. Time ms	D.O. Time ms	Maximum Operation Rate Operations/Hour	Mechanical Life Millions
		Amperes	Watts	Volts (Hot)	Amperes	Watts					
00 and 0	12	6.4	76.8	80%	0.28	3.36	60%	22	17	3600	5
	24	3.2	76.8	80%	0.14	3.36	60%	22	17	3600	5
	48	1.6	76.8	80%	0.07	3.36	60%	22	17	3600	5
	120	0.64	76.8	80%	0.028	3.36	60%	22	17	3600	5
1 and 2	12	15.4	126	68%	0.42	4.98	30%	21	12	3600	2
	24	6.2	88.4	60%	0.21	4.96	29%	20	13	3600	2
	48	2.9	76.2	56%	0.11	5.04	28%	20	14	3600	2
	120	1.1	67.3	53%	0.041	4.87	29%	20	16	3600	2
3	12	24	293	65%	0.40	4.84	23%	39	14	3600	2
	24	12	288	61%	0.20	4.75	22%	38	14	3600	2
	48	6.1	295	62%	0.097	4.67	22%	37	14	3600	2
	120	2.5	298	61%	0.038	4.57	22%	37	16	3600	2
4 and 5	24	18	400	67%	0.22	5.3	25%	53	14	2400	2
	48	9.0	400	67%	0.11	5.2	25%	49	16	2400	2
	120	3.3	450	65%	0.05	5.4	28%	56	19	2400	2
	240	1.7	440	64%	0.02	4.9	26%	49	21	2400	2

General Coil Data

- **Coil Offering**—tape wound:
 - NEMA Sizes 00–0
 - UL insulation rating: Class 130 (B)
- **Coil Offering**—encapsulated:
 - NEMA Sizes 1–3
 - UL insulation rating: Class 130 (A)
- **Coil Offering**—encapsulated:
 - NEMA Sizes 4–5
 - UL insulation rating: Class 155 (F)
- **Operational Limits:**
 - 85% to 110% of rated voltage—AC
 - 80% to 110% of rated voltage—DC

Table 30.3-4. Coil Data Notes

Description	
P.U.	Pickup time is the average time taken from closing of the coil circuit to main contact touch.
D.O.	Dropout time is the average time taken from opening of the coil circuit to main contact separation.
Cold	Coil data with a cold coil.
Hot	Coil data with a hot coil.

All data is based on a standard contactor with no auxiliary devices and a 120 Vac or 24 Vdc magnet coil. Coil data has a ±5% range depending on the application, therefore specific data may vary.

Freedom Line—Technical Data—NEMA
Table 30.3-5. Specifications—Sizes 00–3

Description	Contactor Catalog Number/Size				
	CN15A NEMA Size 00	CN15B NEMA Size 0	CN15D NEMA Size 1	CN15G NEMA Size 2	CN15K NEMA Size 3
Configuration Number of poles Auxiliary contacts, standard Add-on auxiliary contacts	2, 3, 4 4th pole NO (1) Top (4) or side (4)	2, 3 Side NO (1) Top (4) or side (3)	2, 3, 4, 5 Side NO (1) Top (4) or side (3)	2, 3, 4, 5 Side NO (1) Top (4) or side (3)	2, 3 Side NO (1) Left side (4) or right side (3)
Frame size	45 mm	45 mm	65 mm	65 mm	90 mm
Maximum voltage rating	600 Vac	600 Vac	600 Vac	600 Vac	600 Vac
Continuous ampere ratings (I)	9 A	18 A	27 A	45 A	90 A
Maximum horsepower (hp) Single-phase 115 V 230 V	1/3 1	1 2	2 3	3 7-1/2	7-1/2 15
Three-phase 200 V 230 V 460 V 575 V	1-1/2 1-1/2 2 2	3 3 5 5	7-1/2 7-1/2 10 10	10 15 25 25	25 30 50 50
Coil operating range % of rated voltage	-15% to +10%	-15% to +10%	-15% to +10%	-15% to +10%	-15% to +10%
Operating temperature Maximum operating altitude in feet (m) Mechanical life	-20 °C to +65 °C 6000 (1828) 20,000,000	-20 °C to +65 °C 6000 (1828) 20,000,000	-20 °C to +65 °C 6000 (1828) 10,000,000	-20 °C to +65 °C 6000 (1828) 10,000,000	-20 °C to +65 °C 6000 (1828) 6,000,000
Electrical life (480 V/60 Hz) AC-3 AC-4	4,000,000 90,000	3,000,000 85,000	5,000,000 200,000	3,500,000 62,000	1,700,000 80,000
Wire range Power terminals	12–16 stranded, 12–14 solid Cu	8–16 stranded, 10–14 solid Cu	8–14 stranded or solid Cu	2–14 (upper) and/or 6–14 (lower) stranded or solid Cu	1/0–14 Cu
Control terminals	12–16 stranded, 12–14 solid Cu	12–16 stranded, 12–14 solid Cu	12–16 stranded, 12–14 solid Cu	12–16 stranded, 12–14 solid Cu	12–16 stranded 12–14 solid Cu
Power terminal torque Line and load—lb-in	7	15	20	40 (14–8 AWG) 45 (6–4 AWG) 50 (3 AWG)	35 (14–10 AWG) 40 (8 AWG) 45 (6–4 AWG) 50 (3–1/0 AWG)
Auxiliary contact rating	A600, P300				

Table 30.3-6. Specifications—Sizes 4–5

Description	Contactor Catalog Number/Size	
	CN15N NEMA Size 4	CN15S NEMA Size 5
Configuration Number of poles Auxiliary contacts, standard Add-on auxiliary contacts	2, 3 Side NO (1) Left side (3) or right side (4)	2, 3 Side NO (1) Left side (3) or right side (4)
Frame size	180 mm	180 mm
Maximum voltage rating	600 Vac	600 Vac
Continuous ampere ratings (i)	135 A	270 A
Maximum horsepower (hp) Single-phase 115 V 230 V	— —	— —
Three-phase 200 V 230 V 460 V 575 V	40 50 100 100	75 100 200 200
Coil operating range % of rated voltage	-15% to +10%	-15% to +10%
Operating temperature Maximum operating altitude in feet (m) Mechanical life	-20 °C to +65 °C 6000 (1828) 5,000,000	-20 °C to +65 °C 6000 (1828) 5,000,000
Electrical life (480 V/60 Hz) AC-3 AC-4	800,000 70,000	500,000 34,000
Wire range Power terminals	Open—3/0–8 Cu; Enclosed—250 kcmil–6 Cu/Al	750 kcmil—2 or (2) 250 kcmil–3/0 Cu/Al
Control terminals	12–16 stranded, 12–14 solid Cu	12–16 stranded, 12–14 solid Cu
Power terminal torque Line and load—lb-in	200	550
Auxiliary contact rating	A600, P300	

Freedom Line—Technical Data—NEMA

Table 30.3-7. 380V, 50 Hz Starters—Maximum hp Ratings

Description	NEMA Size					
	1	2	3	4	5	6
Maximum hp	10	25	50	75	150	300

Table 30.3-8. Motor FLA Current Ranges

Description	NEMA Size						
	1 ^①	1	2	3	4	5	6
1.15 to 1.25 S.F.	0.47–3.81	3.15–27.00	3.15–45.00	9.90–90.00	9.90–135.00	38.30–270.00	38.30–540.00
1.0 S.F.	0.51–4.14	3.43–27.00	3.43–45.00	10.80–90.00	10.80–135.00	41.70–270.00	41.70–540.00

① Size 1 Lower Current Range for motor hp range 1/4 hp to 2 hp at 460 V.

Table 30.3-9. Wire (75 °C) Sizes—AWG or kcmil—NEMA Sizes 00–2—Open and Enclosed

NEMA Size	Cu Only
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Power Terminals—Line

00	#12–#16 stranded, #12–#14 solid
0	#8–#16 stranded, #10–#14 solid
1	#8–#14 stranded or solid
2	#3–#14 (upper) and/or #6–#14 (lower) stranded or solid ^②

② Two compartment box lug.

Table 30.3-10. Overload Relay UL/CSA Contact Ratings Control Circuit^③

AC Volts	120 V	240 V	480 V	600 V
NC Contact B600				
Make and break amperes	30	15	7.5	6
Break amperes	3	1.5	0.75	0.6
Continuous amperes	5	5	5	5
NO Contact C600				
Make and break amperes	15	7.5	3.375	3
Break amperes	1.5	0.75	0.375	0.3
Continuous amperes	2.5	2.5	2.5	2.5

③ DC ratings cover Freedom Series coils only.

Table 30.3-11. Electronic Overload Relays up to 1500 A

Description	Specification	
	45 mm	55 mm
Capacity		
Load terminals		
Terminal capacity	12–10 AWG (4–6 mm ²) 8–6 AWG (6–16 mm ²)	6–1 AWG (16–50 mm ²)
Tightening torque	20–25 lb-in (2.3–2.8 Nm) 25–30 lb-in (2.8–3.4 Nm)	25–30 lb-in (2.8–3.4 Nm)
Input, auxiliary contact and remote reset terminals		
Terminal capacity	2 x (18–12) AWG	2 x (18–12) AWG
Tightening torque	5.3 lb-in (0.8–1.2 Nm)	5.3 lb-in (0.8–1.2 Nm)
Voltages		
Insulation voltage U _i (three-phase)	690 Vac	690 Vac
Insulation voltage U _i (control)	500 Vac	500 Vac
Rated impulse withstand voltage	6000 Vac	6000 Vac
Overvoltage category/pollution degree	III/3	III/3

Table 30.3-12. Wire (75 °C) Sizes—AWG or kcmil—NEMA Sizes 00–2 Open and Enclosed

Terminal	Wire Size ^④	Catalog Number
----------	------------------------	----------------

Power Terminals—Load—Cu Only (Stranded or Solid)

32 A	14–6 AWG	C306DN3B
75 A	14–2 AWG	C306GN3B
45 A	14–6 AWG	C396A_

④ Minimum per NEC. Maximum wire size: Sizes 00–0 to 8 AWG and Sizes 1–2 to 2 AWG.

Table 30.3-13. Wire (75 °C) Sizes—AWG or kcmil—NEMA Sizes 3–8—Open and Enclosed

NEMA Size	Wire Size
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C306 Power Terminals—Line and Load

3	10–14 AWG Al Cu
4	Open—#8–#3/0 Cu Enclosed—#6 250 kcmil—Al Cu
5	750 kcmil—#2 or (2) #3/0 250 kcmil—Al Cu

Table 30.3-14. C306 Control Terminals—Cu Only

Description
(2) #12–#16 stranded
(2) #12–#14 solid

**Electrical Life—AC-3 and AC-4
Utilization Categories**

Life Load Curves

Eaton’s Freedom Series NEMA contactors have been designed and manufactured for superior life performance in any worldwide application. All testing has been based on requirements as found in NEMA and UL standards and conducted by Eaton. Actual application life may vary depending on environmental conditions and application duty cycle.

Utilization Categories

AC-1—Non-inductive or slightly inductive loads, such as resistance furnaces and heating.

AC-2—Starting of slip-ring motors.

AC-3—Squirrel cage motors; starting, switching off motors during running.

AC-4—Squirrel cage motors; starting, plugging, inching or jogging.

Note: AC-3 tests are conducted at rated device currents and AC-4 tests are conducted at six times rated device currents. All tests have been run at 460 V, 60 Hz.

Contactors Choice

- Decide what utilization category your application is and choose the appropriate curve
- Locate the intersection of the life-load curve of the appropriate contactor with the applications operational current (Ie), as found on the horizontal axis
- Read the estimated contact life along the vertical axis in number of operational cycles

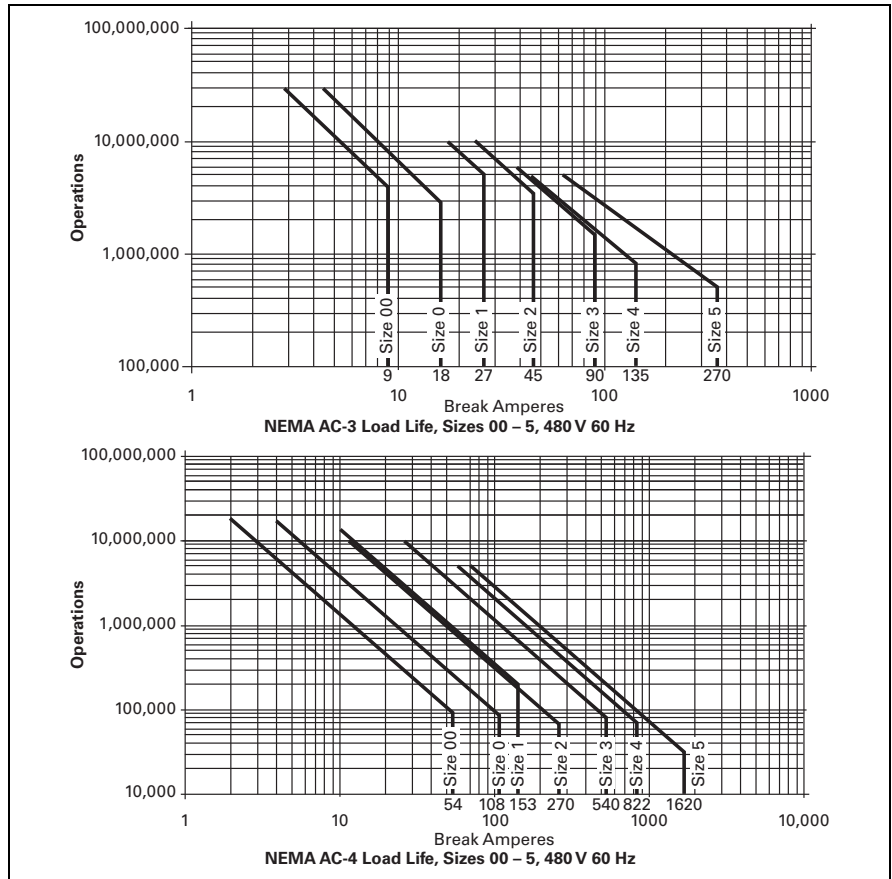


Figure 30.3-10. AC-3 and AC-4 Utilization Categories

AN19 Competitive Retrofit Kits

The retrofit kits provide a packaged solution to replace competitive starters with the Freedom AN19 starter using existing hole patterns. Suitable for replacement of Allen-Bradley, Square D, GE and Siemens starters.

Kit contents

- Competitive mounting plate
- AN19 starter
- Remote reset module
- NO 10250T pushbutton
- RESET pushbutton legend plate
- 16 gauge control wire

Table 30.3-15. AN19 Competitive Retrofit Kit—Product Selection

Size	Description	Catalog Number
1	120 Vac coil, 4–20 A overload	AN19DN0A5E020-CRK
2	120 Vac coil, 9–45 A overload	AN19GN0A5E045-CRK
3	120 Vac coil, 20–100 A overload	AN19KN0A5E100-CRK
4	120 Vac coil, 28–140 A overload	AN19NN0A5E140-CRK
5	120 Vac coil, 60–300 A overload	AN19SN0A5E300-CRK





Powering Business Worldwide

Modification Codes

A—Ammeters, Auxiliary Contacts, Accelerating Relays, Autotransformers

Modification	Description	Catalog Number Suffix
Ammeter	Panel type wired to current transformer in Line 1, Type 1, 12	A1
	Panel type wired to current transformer in Line 1, Type 3R, 4X	
	Panel type, selector switch and three current transformers wired to ammeter via switch, Type 1, 12	A2
	Panel type, selector switch and three current transformers wired to ammeter via switch, Type 3R, 4X	
	Miniature (single-phase), Type 1, 12	A3
	Miniature with selector switch, Type 1, 12	A4
	Switchboard (single-phase), Type 1, 12	A5
	Switchboard (single-phase), Type 3R, 4X	
	Switchboard with selector switch, Type 1, 12	A6
	Switchboard with selector switch, Type 3R, 4X	
	Three-panel type (single-phase), Type 1, 12	A7
	Three-panel type (single-phase), Type 3R, 4X	
	Three miniature (single-phase), Type 1, 3R, 4X, 12	A10
	Three switchboard type (single-phase), Type 1, 12	A11
Three switchboard type (single-phase), Type 3R, 4X		
Ammeter order by description, Type 1, 3R, 4X, 12	A12	
Auto-transformers	Hp rating selection, see Tab 5	A8
	Order by description	A9
Top-mounted auxiliary contacts ^① (unwired)	1NO	A13
	1NC	A14
NEMA Sizes 00–2 only (unwired)	1NO-1NC	A15
	2NO	A16
IEC Sizes B–L only (unwired)	2NC	A17
	2NO-1NC	A18
XT Series	1NO-2NC	A19
	3NO	A20
	3NC	A21
	3NO-1NC	A22
	2NO-2NC	A23
	1NO-3NC	A24
	4NO	A25
	4NC	A26

Note

^① Top-mounted auxiliary contacts cannot be added to contactors in Box 1 (Type 1).

A—Ammeters, Auxiliary Contacts, Accelerating Relays, Autotransformers, continued

Modification	Description	Catalog Number Suffix
Side-mounted auxiliary contacts ①	1NO	A27
	1NC	A28
	1NO-1NC	A29
	2NO	A30
	2NC	A31
	2NO-1NC	A32
	1NO-2NC	A33
	3NO	A34
	3NC	A35
	3NO-1NC	A36
	2NO-2NC	A37
	1NO-3NC	A38
	4NO	A39
	4NC	A40
Auxiliary contacts	Contacts mounted on operating mechanism of disconnect switch, 1NO-1NC	A42
	Contacts mounted on operating mechanism of disconnect switch, 2NO-2NC	A43
	With auxiliary contact omitted	A44
Accelerating relay	For two-speed	A46
	2NO/2NC 24 Vdc auxiliary relay— IT only	A47

B—Breaker Modifications, Backspin Timer, Undervoltage Release, Bell Alarm, Bus Choke

Modification	Description	Catalog Number Suffix
Breaker	1NO-1NC auxiliary contact on breaker	B1
	2NO-2NC auxiliary contacts on breaker	B2
	Shunt trip on circuit breaker—48–127 Vac or Vdc	B3
	Shunt trip on circuit breaker—9–24 Vac or Vdc	B4
	Shunt trip on circuit breaker—208–380 Vac	B5
	Shunt trip on circuit breaker—415–600 Vac or 220–250 Vdc	B6
	Undervoltage release for breaker	B8
	Current limiter mounted to breaker	B9
	Breaker—order by description	B10
	Thermal magnetic breaker	B11
	Backspin timer	180 seconds
Undervoltage release	Undervoltage release for circuit breaker—208–240 Vac	B13
	Undervoltage release for circuit breaker—380–480 Vac	B14
	Undervoltage release for circuit breaker—525–600 Vac	B15
Bell alarm	Bell alarm for circuit breaker	B16

Note

① Available on **XT** starters for 40A and greater only.

C—Control Power Transformer, Power Supplies, Control Relays, Cover Control (not elsewhere defined), Current Transformers, Compelling Relay, Control Wiring, Control Circuit Breaker, Separate Control, Customer-Supplied Components, Contactors, Counter, E-Stop Relay, DC/AC Interface, Separate Source Disconnect, Bypass Contactors

Modification	Description	Catalog Number Suffix
Control power transformers	Standard size control transformer, 120V/60 Hz, 110V/50 Hz secondary with two primary and one secondary fuse	C1
Make sure eighth character specifies primary/secondary voltage	Standard size control transformer, 24V/60 Hz secondary with two primary and one secondary fuse	C2
	50 VA extra capacity CPT 120V/60 Hz, 110V/50 Hz with two primary and one secondary	C42
	100 VA extra capacity CPT, 120V/60 Hz, 110V/50 Hz secondary with two primary and one secondary fuse	C3
	100 VA extra capacity CPT, 24V/60 Hz secondary with two primary and one secondary fuse	C4
	200 VA extra capacity CPT, 120V/60 Hz, 110V/50 Hz secondary with two primary and one secondary fuse	C5
	200 VA extra capacity CPT, 24V/60 Hz secondary with two primary and one secondary fuse	C6
	300 VA extra capacity CPT, 120V/60 Hz, 110V/50 Hz secondary with two primary and one secondary fuse	C7
	400 VA extra capacity CPT, 120V/60 Hz, 110V/50 Hz secondary with two primary and one secondary fuse	C8
	1 kVA extra capacity CPT, 120V/60 Hz, 110V/50 Hz secondary with two primary and one secondary fuse	C9
	2 kVA extra capacity CPT, 120V/60 Hz, 110V/50 Hz secondary with two primary and one secondary fuse	C10
	Control transformer—order by description	C11
	CPT with power supply for XT	C34
	Power supplies (XT only)	Separate control 120 Vac to 24 Vdc
Power supply with extra capacity—order by description		C28
Control relays	Four-pole interposing relay, 600V (2NO/2NC)	C12
	Four-pole, unwired, A600 rtg.—2NO-2NC	C14
	Eight-pole, unwired, A600 rtg.—4NO-4NC	C15
	Control relay—order by description	C16
	Three-wire control module (C30 lighting)	C18 ①
	Two-wire control relay for mechanical/magnetic lighting contactors	C20 ①
Cover control	Convert position seven to E30 type cover control	C17
	Lock-off attachment added on cover control	C19
	Change to M22 (22 mm) cover controls	C29
Current transformer(s)	In phase 1	C21
	In phases 1 and 2	C22
	In 3 phases	C23
Compelling relay	—	C25
Control wiring	Omit control wiring	C26
	With separate control wiring and two 250V fuses in holder	C30
	With common control wiring and two 600V (Class C) fuses in holder	C31
	Control wiring type—order by description	C33
Control circuit breaker	Order by description	C32
Separate control	Wired for separate control (reduced voltage)	C35
Customer supplied components	Customer supplied components to be installed	C36
	Customer supplied wiring diagram to use	C37

Note

① Not available for **XT** starters.

Modification Codes

C—Control Power Transformer, IT Power Supplies, Control Relays, Cover Control (not elsewhere defined), Current Transformers, Compelling Relay, Control Wiring, Control Circuit Breaker, Separate Control, Customer-Supplied Components, Contactors, Counter, E-Stop Relay, DC/AC Interface, Separate Source Disconnect, Bypass Contactors, continued

Modification	Description	Catalog Number Suffix
Contactor/starter	Contactor/starter—order by description	C40
Counter	Operations counter	C41
E-stop relay	E-stop relay (DeviceNet)	C43
DC/AC interface	DC/AC interface module	C44 ①
Separate source disconnect	IEC separate source disconnect for control circuitry	C45
Bypass contactors for IT RVSS	Isolation contactor	C46/J1
	Output contactor	C46/J2
	Bypass contactor	C46/J3
	Isolation/output/bypass contactor	C46/J4

D—Device Labels, Deceleration Relay, Drain and Breather, Duplex Modifications

Modification	Description	Catalog Number Suffix
Device labels	(Each label)	D1
Decel. relay ①	Two-speed	D2
Drain and breather (Type 7/9 enclosure) ①	Drain and breather	D5
	Drain only	D6
	Breather only	D7
Duplex modifications	Alternator omitted (deduct price)	D12
	START/STOP pushbuttons—supplied for each motor	D14
	HAND/OFF/AUTO selector switch—supplied for each motor	D15
	No. 1 lead—No. 2 lead selector switch for manual selection of lead pump (alternator is omitted)	D16
	Red RUN pilot light—supplied for each motor	D17
	Push-to-test red RUN pilot light—supplied for each motor	D18
	TEST pushbutton for each motor	D19
	CPT, 120V secondary, two primary fuses and one secondary fuse—supplied for each motor	D20
	CPT with 100VA extra capacity, 120V secondary, two primary fuses and one secondary fuse—supplied for each motor	D21
	CPT with 200VA extra capacity, 120V secondary, two primary fuses and one secondary fuse—supplied for each motor	D22
	CPT for duplex—order by description	D23
	Add two relays to modify controller to operate with single-pole pilot devices	D24
	Add three relays to modify controller to operate with single-pole pilot devices	D25
	Green—OFF for each starter	D26
	Green—push-to-test OFF for each starter	D27
	Green—RUN light (duplex pump)	D28
Red—STOP light (duplex pump)	D29	
P-T—green RUN light (duplex pump)	D30	
P-T—red STOP light (duplex pump)	D31	
Elapsed time meter (duplex pump)	D32	

Note

① Not available for **XT** starters.

E—Enclosure Modifications, Elapsed Time Meter, Duplex Outlet, Enclosure for Starter, Enclosure Clear Cover, Enclosure Material

Modification	Description	Catalog Number Suffix
Enclosure modifications	Oversize enclosure	E3
	Enclosure—order by description	E4
	Enclosure with pole mounting hardware	E5
	Removable end plates	E6
	Service entrance rating (ground/neutral banding SE labels)	E7
	Service entrance rating with ground bar	E8
	Safety door interlock	E11
Elapsed time meter	Wired across coil, Type 1, 12	E9
	Wired across coil, Type 3R, 4X	
	Elapsed time meter—order by description	E10
Duplex outlet	Convenience duplex outlet mounted in side of enclosure	E12
Enclosure for starter ^①	Horizontal combination starter, Size 0–2	E13
	Narrow combination starter, Size 0–2	E14
Enclosure clear cover for XT	Clear cover for Halyester enclosure non-metallic	E19
Enclosure material	Convert to 316 stainless steel	E16
	Convert from Type 3R to stainless steel	E21
Irrigation pump panel	Bottom entry	E17

F—Fuse Clips, Fuse Blocks, Fungus Protection, Fingerproof Covers, EMI Filter

Modification	Description	Catalog Number Suffix
Fuse clips ^①	Change fuse clips in position eight to Class J	F1
	Change fuse clips in position eight to Class H and K (30A and 60A only)	F2
Fuse blocks	Power fuses included—order by description	F4
	30A control circuit fuseholder (KTK) mounted on panel (unwired), fuse not supplied	F5
	30A control circuit fuseholder mounted on panel (unwired), FNQR fuse supplied	F6
	Three-pole power fuseholder mounted on front contactor	F7
	Separate fusing of control power supply— IT .	F8
	Blown fuse indicator (not for PFC)	F10
	Class CC fuses	F21

G—Ground Fault Relay, Grounding

Modification	Description	Catalog Number Suffix
Ground fault relay	Ground fault relay (wired)	G1
	Ground fault relay (unwired)	G3
Grounding	Special grounding—order by description	G5
	Ground fault protection and monitoring panel	G7

Note

^① Not available for **XT** starters.

15.2

Accessories and Modification Codes

Modification Codes

H—Heater (Space), Heater Packs Installed

Modification	Description	Catalog Number Suffix
Space heater	Space heater and thermostat	H1
	Space heater and NC interlock	H2
Install heater packs (Freedom Series)	Class 20	Class 10
	/D1 H2001B-3	/D25 H2101B-3
	/D2 H2002B-3	/D26 H2102B-3
	/D3 H2003B-3	/D27 H2103B-3
	/D4 H2004B-3	/D28 H2104B-3
	/D5 H2005B-3	/D29 H2105B-3
	/D6 H2006B-3	/D30 H2106B-3
	/D7 H2007B-3	/D31 H2107B-3
	/D8 H2008B-3	/D32 H2108B-3
	/D9 H2009B-3	/D33 H2109B-3
	/D10 H2010B-3	/D34 H2110B-3
	/D11 H2011B-3	/D35 H2111B-3
	/D12 H2012B-3	/D36 H2112B-3
	/D13 H2013B-3	/D37 H2113B-3
	/D14 H2014B-3	/D38 H2114B-3
	/D15 H2015B-3	/D39 H2115-3
	/D16 H2016B-3	/D40 H2116-3
	/D17 H2017B-3	/D41 H2117-3
	/D18 H2018-3	
	/D19 H2019-3	
	/D20 H2020-3	
	/D21 H2021-3	
	/D22 H2022-3	
	/D23 H2023-3	
	/D24 H2024-3	

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K—Keypad

Modification	Description	Catalog Number Suffix
Keypad	Door mounted keypad (RVSS)	K5

L—Labels and Lighting Contactors

Modification	Description	Catalog Number Suffix
Lighting arrestor	Lighting arrestor installed in enclosure on panel	L3
Lugs	Special lugs (order by description)	L9
Carton label	Customer marking—specify	L10
Lighting contactors	1 NC pole	L21
	2 NC pole	L22
	3 NC pole	L23
	4 NC pole	L24
	5 NC pole	L25
	6 NC pole	L26
	7 NC pole	L27
	8 NC pole	L28
	Three-wire 120 Vac	L29A
	Three-wire 240 Vac	L29B
	Three-wire 24 Vac	L29C
	Three-wire 24 Vdc	L29D
	Two-wire 120 Vac	L29E
	Two-wire 240 Vac	L29F
Two-wire 24 Vac	L29G	

N—Nameplates

Modification	Description	Catalog Number Suffix
Nameplates	Enclosure nameplates	N1

15.2

Accessories and Modification Codes

Modification Codes

P—Pilot Lights, Pushbuttons, Phase Relays, Potential Transformers, Power Factor Correction Capacitors, Program Timer, Percentage Timer, Photocell

Modification	Description	Catalog Number Suffix
Push-to-test pilot lights	Push-to-test pilot light (red RUN) wired to coil	P1
	Push-to-test pilot light (green OFF) wired in series with auxiliary contact	P2
	Combination of P1 and P2 above	P3
	Push-to-test pilot light (amber RUN) wired to coil	P4
	Push-to-test pilot light—green RUN	P49
	Push-to-test pilot light—green STOP	P57
Pushbuttons	EMERGENCY STOP—mushroom head	P5
	Pushbutton omitted	P6
	START/STOP	P7
	ON/OFF	P8
	START	P9
	ON	P10
	OFF	P11
	FORWARD/REVERSE/STOP	P12
	FAST/SLOW/STOP	P13
	FAST/OFF/SLOW	P14
	HIGH/LOW/STOP	P15
	HIGH/LOW	P16
	SLOW/FAST	P17
	Pushbutton with legend plate	P18
	UP/STOP/DOWN	P52
	OPEN/STOP/CLOSE	P53
	Red STOP pushbutton	P72
	START/STOP pushbuttons (located in top two holes)	P73
Green START pushbutton	P74	
Pilot lights	With one amber pilot light marked POWER AVAILABLE wired to load side of two fuses or circuit breaker	P19
	Pilot light (amber RUN) wired to coil	P20
	With one red pilot light marked RUN wired thru NO auxiliary contact	P21
	With one push-to-test red light marked RUN Wired thru NO auxiliary contact	P22
	Pilot light—red RUN	P23
	Pilot light—red ON	P24
	Pilot light—green OFF	P25
	Pilot light—order by description	P26
	Pilot light—red STOP	P29
	Pilot light—green STOP	P61
	FORWARD/REVERSE red pilot lights	P62
	UP/DOWN red pilot lights	P63
	OPEN/CLOSE red pilot lights	P64
	HIGH/LOW red pilot lights	P65
	FAST/SLOW red pilot lights	P66
	Green RUN light	P67
	LED bulbs	P68
	Blue OVERLOAD light	P69
	Amber fault pilot light	P71

P—Pilot Lights, Pushbuttons, Phase Relays, Potential Transformers, Power Factor Correction Capacitors, Program Timer, Percentage Timer, Photocell, continued

Modification	Description	Catalog Number Suffix
Illuminated pushbutton	Illuminated pushbutton—order by description	P27
Phase loss relay	Phase loss relay	P28
Phase reversal relay	Phase reversal relay	P30
Phase unbalance relay	Phase unbalance relay	P32
Phase monitoring relay	Phase monitoring relay	P34
Power factor correction capacitors	/F1 20 kVar /F9 70 kVar /F17 200 kVar	P38
	/F2 25 kVar /F10 75 kVar /F18 225 kVar	
	/F3 30 kVar /F11 80 kVar /F19 250 kVar	
	/F4 35 kVar /F12 90 kVar /F20 300 kVar	
	/F5 40 kVar /F13 100 kVar /F21 350 kVar	
	/F6 45 kVar /F14 125 kVar /F22 400 kVar	
	/F7 50 kVar /F15 150 kVar	
	/F8 60 kVar /F16 175 kVar	
Potential transformers	Potential transformer—wired L1–L2	P39
	Potential transformer—wired L1– L2 and L2–L3	P40
	Potential transformer—three phases	P41
Pump controller	Pump controller for <i>IT</i> .	P42
Program timers	15-minute program timer	P43
	24-hour program timer	P44
	7-day program timer with day omission feature	P45
Percentage timers	15-minute percentage timer	P47
	60-minute percentage timer	P48
Photocell	Photoelectric receptacle with photocell	P70

Q—IQ Products, DN50

Modification	Description	Catalog Number Suffix
IQ products	IQ 500	Q1
	IQ100	Q2
	IQ 1000	Q3
	IQ 4000	Q5
IQ data metering module	IQ data metering module	Q12
	IQ 220 with cable	Q14
DN50	DeviceNet input/output module	Q13

R—Ramp, Relays, Solid-State Electronic Overload Relays, Resets, Overload Relay Modifications, Reversing, DeviceNet Interface

Modification	Description	Catalog Number Suffix
Ramp	Extended ramp of <i>IT</i> .	R1
Relay	Overvoltage relay	R2
	Omit overload relay	R4

R—Ramp, Relays, Solid-State Electronic Overload Relays, Resets, Overload Relay Modifications, Reversing, DeviceNet Interface, continued

Modification	IEC Size	NEMA Size	Full Load Current Adjustment Range (A)	Three-Phase without Ground Fault Auto/Manual Reset Overload Selectable Class 10/20/30	Three-Phase with Ground Fault Auto/Manual Reset Overload Selectable Class 10/20/30
Solid-state electronic overload relay ^①	B and C	00	0.33–1.65 ^②	R63/A	R64/A
			1–5	R63/B	R64/B
			4–20	R63/C	R64/C
	C and D	0 and 1	0.33–1.65 ^②	R63/A	R64/A
			1–5	R63/B	R64/B
			4–20	R63/C	R64/C
			9–45	R63/D	R64/D
	D	2	9–45	R63/D	R64/D
	D, F and G	3	20–100	R63/E	R64/E
	G	4	28–140	R63/F	R64/F
	N/A	5	60–300 ^③	R63/G	R64/G
	N/A	6	120–600 ^④	R63/H	R64/H

Modification	Description	Catalog Number Suffix
Resets ^⑤	Change external reset to internal reset—hole covered with plug	R5
	Internal reset—no hole plug	R6
	Overload reset (order by description)	R7
	Manual reset only on overload relay	R44
	Auto reset only on overload relay	R45
	Internal trip indicator—no external reset	R47
	External reset with external trip indicator	R48
	External reset with bell alarm	R49
	N3R reset boot added (Type 1/12 only)	R71
Reversing ^⑥	Reversing contactor/starter	R54
Overload relay mods	Anti plug-in	R53
DeviceNet interface	DeviceNet interface	R69
	Standard reset for DeviceNet	R65
	Lighted reset for DeviceNet	R66
	Trip indicator for DeviceNet	R67

Notes

^① Features:

- Self-powered
- Phase loss protection
- Current adjustment knob
- ±1% repeat accuracy
- 1NO and 1NC isolated contacts

^② Not UL Listed.

^③ NEMA Size 5 starter available with 60–300A panel mounted CTs. Starter as an assembled unit with 1–5A C440 overload relay (C440A1A005SELAX or C440A2A005SELAX).

^④ NEMA Size 6 starter available with 120–600A panel mounted CTs. Starter as an assembled unit with 1–5A C440 overload relay (C440A1A005SELAX or C440A2A005SELAX).

^⑤ Not available for **XT** starters.

S—System Voltage, Selector Switches, Suppressor, Incomplete Sequence Protection, Single-Phase Jumper, Surge Capacitor, Speed Potentiometer

Modification	Description	Catalog Number Suffix
System voltage selection	System voltage selection for internal components	S1
	/H1 208V 60 Hz	
	/H2 240V 60 Hz	
	/H3 277V 60 Hz, single-phase	
	/H4 480V 60 Hz	
	/H5 600V 60 Hz	
	/H6 796V 60 Hz	
	/H7 220V 50 Hz	
	/H8 380V 50 Hz	
	/H9 415V 50 Hz	
	/H10 550V 50 Hz	
	/H11 660V 50 Hz	
	/H12 380V 60 Hz	
	/H13 1500V 60 Hz	
	System voltage selection—specify on order	S2
Selector switches ^①	HAND/OFF/AUTO	S3
	HAND/AUTO	S4
	HAND/OFF/AUTO selector switch with one red RUN pilot light	S5
	RUN/OFF/AUTO	S6
	AUTO/OFF/TEST	S7
	AUTO/OFF/TEST selector switch with one red RUN pilot light	S8
	AUTO/OFF/TEST selector switch with one red RUN pilot light and one green pilot light	S9
	OFF/AUTO	S10
	START/STOP	S11
	OFF/ON	S12
	HIGH/LOW	S13
	FAST/OFF/SLOW	S14
	SLOW/FAST	S15
	FORWARD/REVERSE	S16
	HIGH/OFF/LOW	S17
	HIGH/LOW/OFF/AUTO	S18
	Selector switch omitted (pumps only)	S19
	HAND/OFF/AUTO spring return from left	S21
	OPEN/OFF/CLOSE	S41
	FORWARD/OFF/REVERSE	S42
FAST/OFF/SLOW/AUTO	S43	
Selector switch omitted (pump panels only)	S19	
Selector switch—order by description	S40	
RVSS/BYPASS (soft starters only)	S44	
LOCAL/REMOTE selector switch	S45	
RUN/OFF selector switch	S46	
Suppressor	Transient suppressor mounted on magnet coil	S24
Surge suppression	MOV (IT)	S20
Sequence timer	Sequence timer (pump panels)	S26
Sequence protection	Incomplete sequence protection	S27
Pump	480V BP9000 pump	S28
Single-phase	Convert contactor or starter from three-phase to single-phase—install jumper	S29
	Single-phase rev. 120V	S30
	Single-phase rev. 240V	S31
Surge capacitor	Surge capacitor wired to disconnect line side	S37

Note

^① When using three-position selector switch with magnetic lighting contactor, mod **C20** must also be used (ECL04, ECL13, ECL15).

15.2

Accessories and Modification Codes

Modification Codes

T—Timers, Time Delay Relays, Terminal Blocks, Terminal Points, Ring Lug Connections

Modification	Description	Catalog Number Suffix
Timers	Pneumatic timer installed on contactor, unwired, 30 seconds maximum	T1
	Pneumatic timer installed on contactor, unwired, 180 seconds maximum	T2
	Pneumatic timer mounted in enclosure, unwired, 180 seconds maximum	T3
	Solid-state ON delay timer (1–30 seconds)	T4
	Solid-state ON delay timer (30–300 seconds)	T5
	Timer—order by description	T25
Time delay relays	Time delay relay, 3 minutes maximum, unwired, ON DELAY	T6
	Time delay relay, 3 minutes maximum, unwired, OFF DELAY	T7
	Time delay low voltage release relay	T8
Terminal blocks	With one single circuit terminal block, unwired	T9
	With two single circuit terminal block, unwired	T10
Terminal points	With 6 terminal points, unwired	T11
	With 12 terminal points, unwired	T12
	With 18 terminal points, unwired	T13
	Terminal point per customer specification, unwired (price each)	T14
	Terminal point per customer specification, wired (unwired without customer diagram)	T15
	Three terminals mounted between contactor and overload for power factor capacitors—Sizes 0–2	T21
	Three terminals mounted between contactor and overload for power factor capacitors—Sizes 3–4	T22
Ring lug connections	Quick-connect terminals added to DP contactor/starter	T23
	Ring lug connections on power wires	T16 ^①
	Ring lug connections on control wires	T17

15 U—Undervoltage Relay, Time Delay Undervoltage Relay

Modification	Description	Catalog Number Suffix
Undervoltage relays	Undervoltage relay, non-adjustable	U1
	Undervoltage relay, adjustable	U2
Time delay undervoltage relays	Time delay undervoltage relay, non-adjustable	U4
	Time delay undervoltage relay, adjustable	U5
Under- and overvoltage relay	Under- and overvoltage relay	U7

Note

① Not available for **XT** starters.

V— Voltmeter, Varmeter, Vacuum Starter

Modification	Description	Catalog Number Suffix
Voltsmeters	One panel type voltmeter wired L1–L2	V1
	Panel type voltmeter and selector switch wired to read three-line voltages	V2
	Miniature voltmeter wired L1–L2	V3 ①
	Miniature voltmeter and selector switch wired to read three-line voltages	V4 ①
	Switchboard type voltmeter wired L1 – L2	V5
	Switchboard type voltmeter and selector switch wired to read three-line voltage	V6 ①
	Three panel type voltmeters wired in each phase	V7
	Three miniature voltmeters wired in each phase	V8 ①
	Three switchboard type voltmeters wired in each phase	V9 ①
	Voltmeter—order by description	V10
Varmeter ②	Varmeter	V11
	Varmeter—order by description	V12
Vacuum starter ②	Vacuum starter—1500V rating	V13

W— Wattmeter, Watt-Hour Meter, Wiremarkers, Wiring Diagram

Modification	Description	Catalog Number Suffix
Wattmeter ①	Wattmeter	W1
Watt-hour meter ①	Watt-hour meter	W3
	Watt-hour meter with demand attachment	W5
Wiremarkers	Wiremarkers	W7
	Wiremarkers—order per customer diagram or specifications	W8
	Wiremarkers—order by description	W9
WYE-Delta hp	See Tab 5	W10 ②
Windows in enclosure	Enclosure windows	W11
Wiring diagram	Reduced copy of custom wiring diagram laminated on inside of door	W12

Notes

① Type 1/12 only.

② Not available for **XT** starters.