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II. BILL OF MATERIAL

PROJECT: DTE ENI 280

ASCO Bulletin 956 Synchropower® Generator Control Switchgear to automatically start, synchronize and parallel one diesel generator sets rated 280 kW at 480Y/277V, 60 Hz with a Utility source. System will be per the attached Bill of Material. Equipment is as follows:

Generator Control Cubicles (1 required) each containing:

(Approximate Dimensions - 38"W x 38"D?? x 91"H) – NEMA 1

DESIGNATION	QTY	DESCRIPTION
52G, NCT	1	Generator Circuit Breaker (Square D MP), 800 ampere frame, 475 ampere trip, electrically operated, drawout, 120VAC charge and close, 24 VDC shunt trip, bell alarm, 2a & 2b auxiliary contacts and cover for manual close pushbutton with long delay, short delay, instantaneous and ground fault trip settings (65KAIC)
52F1	1	Circuit Breaker (Square D FCL24030), 100AF, 30AT, 2 pole, molded case, manually operated, thermal magnetic trip, 80% rated – this will feed an external 10KVA transformer (supplied by others). The circuit breaker shall be fed from the load side of the generator breaker
52F2	1	Motor Starter Group Circuit Breaker (Square D FCL34030), 100AF, 30AT, 3 pole, molded case, manually operated, thermal magnetic trip, 80% rated – this will feed the manual motor starter protector and the variable frequency drive unit. The circuit breaker shall be fed from the load side of the generator breaker
MSP1, MSP2	2	Vent Fan manual motor starter protector (Square D GV2M08), 3 pole, 2.5 – 4 A thermal setting
M1	1	<ul style="list-style-type: none"> VFD motor starter contactor (Square D LP1D3210BD), 3 pole, 32A contact rating, 24V DC coil, 1 normally open auxiliary contact Varistor (Square D LA4DE1E), electrical noise suppression for motor starter contactor
M2, M3	2	<ul style="list-style-type: none"> Vent Fan motor starter contactor (Square D LP1D0910BD), 3 pole, 9A contact rating, 24V DC coil, 1 normally open auxiliary contact Varistor (Square D LA4DE1E), electrical noise suppression for motor starter contactor Common mounting plate for manual motor start protector and motor starter contactor (Square D GK2AF01)
X1	1	VFD reactor assembly, 15kW (Square D RL03503)
EGCP-2	1	<p>Engine Generator Control Panel (Woodward EGCP II) with the following features and functions:</p> <ul style="list-style-type: none"> 2 – 4 line LCD displays for indication of generator electrical



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DESIGNATION	QTY	DESCRIPTION
		<p>parameters, engine generator alarms, engine generator status and configuration parameters</p> <ul style="list-style-type: none"> • Engine control including starting, cranking, monitoring, cooldown and shutdown • Automatic Synchronizer with voltage, frequency, phase angle matching, and phase lock control (Device 25) • Real Load Control • Reactive Load Control • Generator Protective Features – under/over voltage, over/under frequency, reverse power, loss of excitation and speed/frequency mismatch • Engine Protective Features – high/low coolant temperature, high/low oil pressure, overspeed, over crank, start failure • Modbus RTU communications port
PM-XP	1	<p>Generator Power Manager XP (ASCO) to provide the following:</p> <ul style="list-style-type: none"> • Digital display of 3 phase V & A, KW, KVAR, KVA, KWH, KVAH, KVARH, KW Demand, HZ, pF • 8 digital inputs and 4 digital outputs • Modbus RTU communications port • Programmable Protective Relay Functions – under/over voltage, over/under frequency, reverse power, phase imbalance voltage and phase imbalance current relay.
BE3-25	1	Synch Check Relay w/ Dead Bus (BE3251A1N5)
CT	3	Generator Line Side Current transformers, 800:5 ratio, (WICC ND800)
SCTB-1	1	CT Shorting Block
PT	1	Generator Line Side Potential Transformer Assembly, open-delta, 4:1 ratio w/ integral fuses (ITI 2VT460FF480)
PT	1	Generator Load Side Potential Transformer Assembly, single phase, 4:1 ratio w/ integral fuses (ITI 460480FF)
CPT	1	Control Power Transformer, 500VA, 4:1 ratio w/ integral fuses (Square D CG0500480120F)
10VS	1	Overspeed protective relay, MPU input (Crompton C253-PH3U-BGBX-FS-V4)
SW1	1	Idle/Rated toggle switch, SPDT
CB1, CB2	2	Circuit Breaker, 10A, 1 pole
CB3	1	Circuit Breaker, 30A, 2 pole
DC-DC	1	DC/DC Convertor, Vicor, 100W
BBA2	1	Rectifier, 25A (IXYS VBO2016A02)
OIT	1	<ul style="list-style-type: none"> • Operator Interface Panel (GE Quick Panel Jr. QPK2D100S2P) – touchscreen, 6" STN Color LCD, 8 color, 240 x 320, 24V DC supply • Cable, OIT/PLC (HMICABC82)
E-Stop	1	Emergency Stop Pushbutton, momentary w/ 2 normally closed contacts



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DESIGNATION	QTY	DESCRIPTION
Reset	1	Emergency Stop Reset Lighted Pushbutton, momentary w/ normally open contacts, red lamp, 24V DC
ES	1	Engine control switch, selector switch, series 24 (Electroswitch 24904QB)
1TR	1	<ul style="list-style-type: none"> Engine Run timer, multimode (SSAC TRU3) Timer socket, 11 pin (SSAC NDS11)
CS	1	Circuit Breaker Control Switch w/ position indicating lights (Electroswitch 20PHD42)
PLC Rack	1	PLC 10 slot rack, GE Fanuc 90-30 (IC693CHS391)
PLC Slot 0	1	PLC power supply, GE Fanuc 90-30 (IC693PWR322)
PLC Slot 1	1	PLC CPU352, GE Fanuc 90-30 (IC693CPU352)
PLC Slot 2,4 & 9	3	PLC 16 channel digital input card, GE Fanuc 90-30, 24V AC/DC (IC693MDL241)
PLC Slot 3 & 5	2	PLC 16 channel digital relay output card, GE Fanuc 90-30 (IC693MDL940)
PLC Slot 6	1	PLC 4 channel analog input card, GE Fanuc 90-30 (IC693ALG221)
PLC Slot 7	1	PLC 8 channel thermocouple input card, Horner (HE693THM809)
PLC Slot 8	1	PLC 8 channel analog output card, GE Fanuc 90-30 (IC693ALG392)
PLC Slot 10	1	PLC Modbus communication card (HE693RTM900)
TC wire	1	Thermocouple extension wire, Omega (EXPP-K-20S-TWSH-UL)
ESD, 52GX, GBCR, GBTR, MBCR, MBTR, V1, V2, REN, RFW, VFD, CHP, UR, BR, K1, K2, K3, AFPS, KNDDT, LOLA, HWTF, LOPE, UP, 52U	24	<ul style="list-style-type: none"> Control relay, 3PDT w/ LED, 24V DC coil (IDEC RR3BULDC24V) Relay Socket, 11 blade (IDEC SR3B05) Relay hold down (IDEC SR3B02F1)
Lugs	6	Lugs, mechanical type, #6 - 350MCM, 1 hole, 1 conductor (IlSCO TA350)
Lugs	2	Lugs, mechanical type, #2 - 600MCM, 2 hole, 4 conductor (IlSCO PB4600)
Lugs	18	Lugs, mechanical type, #2 - 600MCM, 1 hole, 1 conductor (IlSCO TA600)
TB1	44	Terminal strip w/ 44 points
TB2	22	Terminal strip w/ 22 points
TB3	10	Terminal strip w/ 10 points
TB4	12	Terminal strip w/ 12 points
TB5	6	Terminal strip w/ 6 points
TB-X1	16	Terminal strip w/ 16 points
TB-X2	25	Terminal strip w/ 25 points
TB-Temp	25	Terminal strip w/ 25 points

IV



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DESIGNATION	QTY	DESCRIPTION

Provisions (space in the cubicle only) to add a 10 slot PLC expansion rack

Provisions for mounting and wiring of electronic governor control (Woodward 2301D) and associated accessories (As required, supplied by others)

Load Bus Stab, 800A fully silver-plated copper, 3 phase, 3 wire to extend out the rear of the enclosure 6" – 9"***

Neutral Bus Stab, 800A fully silver-plated copper, to extend out the rear of the enclosure 6" – 9"***

Ground Bus Stab, 200A fully silver-plated copper, to extend out the rear of the enclosure 6" – 9"***

**Customer to provide an enclosure around the stab connections for protection and safety.