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| Spec item # 1 | SPECIFICATION | TCMSB Field #: N/A |
| CCGS Henry Larsen 4160 Volt Switchboard FPE/SACE Breaker Replacement | | |

Part 1: SCOPE:

The intent of this specification shall be to replace the existing Medium Voltage 4160 Volt breakers in the Main Power switchboard. A total of 12 breakers are to be replaced with a new style equivalent to ratings of the existing SACE 7.2 - 40 breakers. One (1) of the breakers will be a spare (no installation required for spare). See Specification section for details on breakers to be replaced.

The Contractor shall supply and install the new breakers and remove and dispose of the existing specified SACE Air Circuit Breakers and is required to complete custom buss and rewiring if the new breakers are not exact replacements for the existing breakers.

See list of breakers in the Table at the end of this Specification item.

- 1.1 The original SACE breakers shall be removed and transported ashore to CCG Tech Stores by the contractor.
- 1.2 The existing Busswork and connections are to be used, however the contractor is responsible for any modifications made to busswork for connection of the new contractor supplied breakers.
- 1.3 New breakers shall have 120Vac charging and closing circuit and 24Vdc tripping circuit.
- 1.4 Any modifications to the existing panel doors shall be similar in standard, material, design, strength, mounting and coated with the same standard and color paint as per the existing access doors.
- 1.5 Each new breaker door shall be fitted with a new lamacoid label (2 ½ " x 4", white on black) indicating the breaker name, number and description, plus breaker trip characteristics.
- 1.6 All work shall be completed to the satisfaction of the owner's representative and Transport Canada Marine Safety (TCMS).
- 1.7 The Contractor shall provide confirmation from the breaker manufacturer that the new breakers have a manufacturer stated minimum rating of 10000 cycles before refurbishment /maintenance is required.

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- 1.8 All new breakers shall be identical and have the ability to be swapped between cells without modification and shall have the provision to be racked out for maintenance.
- 1.9 All breakers shall be able to operate in 40 Degree Celcius ambient temperature.
- 1.10 New breakers shall have a mechanical interlock to prevent racking out the breaker unless it is in the open and discharged position. Removal or activation of the interlock shall cause the breaker to trip.
- 1.11 New Breakers shall have a mechanical indication of the breaker contact state, charge condition, and operational cycles performed.
- 1.12 New breakers shall have the same number of auxiliary contacts as original breakers. See drawing W5339C1005.dwg for typical wiring diagram for the SACE breakers.
- 1.13 Protection relays are mounted external to the existing breakers and are not required to be integral with the new breakers.
- 1.14 Breakers shall be fitted with the ability for future upgrading for the provision of remote racking to mitigate ArcFlash hazards. The Contractor shall provide the manufacturer's technical information for the remote racking device and tools.
- 1.15 All wiring modifications for the auxiliary contacts are the responsibility of the contractor. No splices in the existing wiring shall be used. If the existing wiring can not be used, new wiring of appropriate voltage, insulation and AWG ratings shall be installed from the nearest terminal or connection point. All wire numbers shall be replaced as per the original numbering.
- 1.16 The Contractor shall supply the technical information and provide a separate price quote for the supply of a remote racking device for the replacement breakers. (This amount is not included in the bid price for the supply and install of the breakers)
- 1.17 Breakers shall have the ability to add ArcFlash sensing and tripping to reduce fault clearing times. Contractor shall provide a separate price quote and the manufacturer's technical information for adding this functionality to the new breakers. (This amount is not included in the bid price for the supply and install of the breakers)
- 1.18 The spare breaker shall be supplied with a contractor supplied cradle provided to secure it to the steel deck.

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Part 2: REFERENCES:

2.1 Guidance Drawings/Nameplate Data

Breaker Nameplate Data

SACE Type : DR 7.2 – 40

Serial # H516997 (for 1 of 12)

Rated Voltage: 7.2 kV

Rated Normal Current: 1250 A

Rated Frequency : 50-60HZ

3S Short-Time Withstand Current : 40 kA

Lightning Impulse Withstand Voltage: 75 kV

Closing Time : 50 ms

Opening Time: 50ms

Breaking Capacity: 32 kA at 7.2kV

Making Capacity : 100 kA at 7.2kV

Mass : 350kg

Charging and closing circuit : 120Vac

Tripping circuit : 24Vdc

SACE Instruction and Maintenance Manual Pdf's available upon request.

Approximate Dimensions of the existing breaker are shown in figure 1 below.

IMPORTANT: Dimensions are not exact and must be confirmed by contractor for the purposes of installation. Approximate Dimension of cabinet are 515mm wide, 1111mm deep and 1335mm high. **Dimensions to be confirmed by contractor**

See list of drawings below:

W5330D0002-1 (Front Elevation Main Power Swbd).dwg

W5330D0002-2 (Front Elevation Main Power Swbd).dwg

W5330D0002-3 (Cross Elevation Main Power Swbd).dwg

W5330D0002-4 (Cross Elevation Main Power Swbd).dwg

W5330D0002-5 (Cross Elevation Main Power Swbd).dwg

W5339C1000 (Standard Wiring Diagram for SACE HV Breakers).dwg

W5339C1005 (Standard Wiring Diagram for PT Drawers).dwg

W5339C2141-1 (Breaker Schematic- Air Bubblers).dwg

W5339C2141-2 (Breaker Contactor Control Schematic).dwg

W5339C2141-2A (Vacuum Contactor Control Schematic).dwg

W5339C2414-1(Main Swbd Cell 2 Door Wiring Diagrams).dwg

W5339C2414-2(Main Swbd Cell 7 Door Wiring Diagrams).dwg

W5339C2414-3(Main Swbd Cell 14 Door Wiring Diagrams).dwg

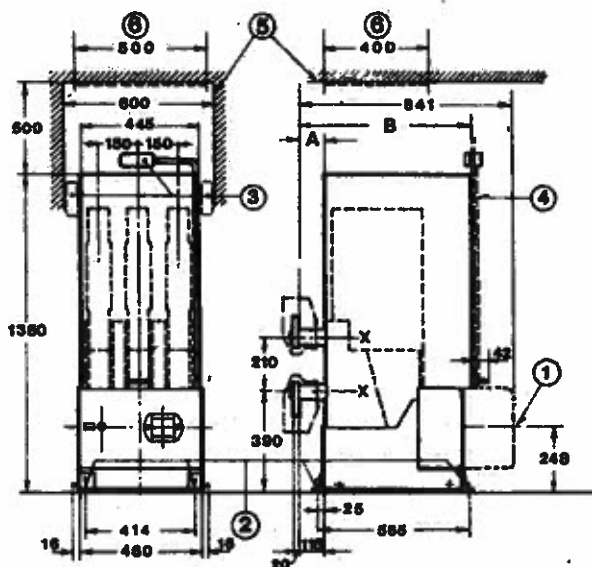
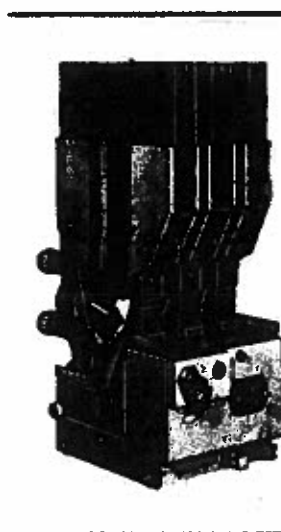
W5339D1278 (Single Line Drawing Main Swbd).dwg

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W5339D1288-1(Main Swbd Cell 1 & 2 Power Schematic).dwg
 W5339D1288-2(Main Swbd Cell 2 & 3 Power Schematic).dwg
 W5339D1288-3(Main Swbd Cell 3 Power Schematic).dwg
 W5339D1288-4(Main Swbd Cell 4 5 6 & 7 Power Schematic).dwg
 W5339D1288-5(Transformer Differential Protection Port Power Schematic).dwg
 W5339D1288-6(Main Swbd Cell 8 Power Schematic).dwg
 W5339D1288-7(Main Swbd Cell 8 Power Schematic).dwg
 W5339D1288-8(Main Swbd Cell 9 Power Schematic).dwg
 W5339D1288-9(Main Swbd Cell 10 11 & 12 Power Schematic).dwg
 W5339D1288-10(Transformer Differential Protection Port Power Schematic).dwg
 W5339D1288-11(Main Swbd Cell 13 Power Schematic).dwg
 W5339D1288-12(Main Swbd Cell 13 Power Schematic).dwg
 W5339D1288-13(Main Swbd Cell 12 & 13 Power Schematic).dwg
 W5339D1288-14(Main Swbd Generator Totalizing Power Schematic).dwg
 W5339D2141-3(Breaker Control Schematic- Stbd Gen - G1).dwg
 W5339D2141-4(Breaker Control Schematic- Bkr 52 EX-1).dwg
 W5339D2141-5(Breaker Control Schematic- Prop Motors).dwg
 W5339D2141-6(Breaker Control Schematic- Center Gen - G2).dwg
 W5339D2141-7(Breaker Control Schematic- Bkr 52 EX-2).dwg
 W5339D2141-8(Breaker Control Schematic- Port Gen - G3).dwg
 W5339D2141-9(Main Generators Synchronizing Schematic).dwg
 W5339D2413-1(Cell 1 wiring Diagram).dwg
 W5339D2413-2(Cell 2 wiring Diagram).dwg
 W5339D2413-3(Cell 3 wiring Diagram).dwg
 W5339D2413-4(Cell 4 wiring Diagram).dwg
 W5339D2413-5(Cell 5 wiring Diagram).dwg
 W5339D2413-6(Cell 6 wiring Diagram).dwg
 W5339D2413-7(Cell 7 wiring Diagram).dwg
 W5339D2413-8(Cell 8 wiring Diagram).dwg
 W5339D2413-9(Cell 9 wiring Diagram).dwg
 W5339D2413-10(Cell 10 wiring Diagram).dwg
 W5339D2413-11(Cell 11 wiring Diagram).dwg
 W5339D2413-12(Cell 12 wiring Diagram).dwg
 W5339D2413-13(Cell 13 wiring Diagram).dwg
 W5339D2413-14(Cell 14 wiring Diagram).dwg
 W5339D2413-15(Cell 15 wiring Diagram).dwg
 W5339D2418 (Relay Control Wiring Diagram).dwg
 W5340C0070 (Relay Control Cabinet Outline).dwg

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10. INGOMBRI Interruttori tipi DR7.2-25 DR7.2-35 DR7.2-50 DR12-25 DR12-35 DR12-50 (800 + 2500 A)
OVERALL DIMENSIONS Circuit-breakers types DR7.2-25 DR7.2-35 DR7.2-50 DR12-25 DR12-35 DR12-50 (800 + 2500 A)

Esecuzione fissa Fixed construction

- | | |
|---|--|
| 1 Corrente protetta | 1 Extended operating mechanism |
| 2 4 poli 0 12 mm per fissaggio interruttore | 2 4 holes 0 12 mm for circuit-breaker fixing |
| 3 Possibilità sistemazioni delle prese-apina | 3 Plug-in arrangements of plug and socket |
| 4 Connettore per i circuiti ausiliari - lunghezza del cavo: 1200 mm | 4 Connection for the auxiliary circuits. Length of cable: 1200 mm |
| 5 Superfici metalliche a nastro (non devono condurre) in rame | 5 Grounded metallic surface (no alive conductors are allowed) |
| 6 Zona sopra gas sopra gli interruttori per la quale il rapporto superficie cavo/pagina deve essere 1/2 | 6 Gas exhaust area above the circuit-breakers the ratio open/closed surface of which must be 1/2 |

Dimensions not confirmed, to be checked by contractor

**Posizione e dimensioni
attacchi**

Gli attacchi dei poli laterali possono essere montati anche con inclinazioni differenti da quelle mostrate in figura.

Arrangement and dimensions of terminals

The terminals of lateral poles can also be fitted with inclinations different from those indicated on the figure

| type | type | A mm | B mm |
|-----------|-----------|---------|---------|
| DR 7.5-20 | DR 7.5-20 | 92 | 800 |
| DR 15-25 | DR 15-25 | | |
| DR 7.5-20 | DR 15-25 | 64 | 704 |

Applicazione egenciatori elettromagnetici a massaia corrente
Firing of overcurrent electromagnetic releases

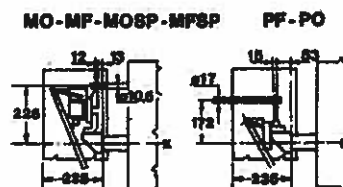
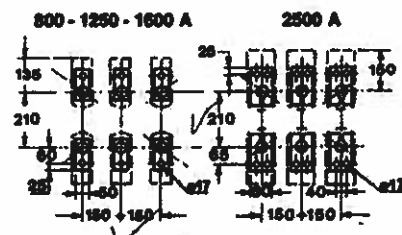


Figure 1

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2.2 Standards

The Contractor is to perform all of the following work and provide fully certified personnel acceptable to TCMS in accordance to Ship Safety Electrical Standards TP127E and IEEE Standard 45 Recommended Practice for Electrical Installation on Shipboard.

All work shall be completed in accordance with Canadian Coast Guard's Ship's ISM Fleet Safety and Security Manual concerning Hot Work, and Lock-Out and Tag Out Procedures.

2.3 Regulations

All work performed and any modifications made, must be compliant with the latest Canada Shipping Act Regulations and in particular to the Marine Machinery Regulations. All work shall meet Transport Canada approved class regulations.

2.4 Furnished Equipment

The contractor shall supply all materials, equipment, and parts required to perform the specified work unless otherwise stated.

Part 3: TECHNICAL DESCRIPTION:

3.1 General

Breakers to be replaced consist of the following with locations:

| Item | Circuit | Description | Location |
|------|---------|-----------------------------|---|
| 1 | P-04001 | Port Main Generator | Main Power Switchboard, Control Room, Cell 3 |
| 2 | P-04002 | Centre Main Generator | Main Power Switchboard, Control Room, Cell 8 |
| 3 | P-04003 | Stbd Main Generator | Main Power Switchboard, Control Room, Cell 13 |
| 4 | P-4001 | Port Air Bubbler | Main Power Switchboard, Control Room, Cell 15 |
| 5 | PP-4001 | Port Propulsion Transformer | Main Power Switchboard, Control Room, Cell 10 |
| 6 | PP-4001 | Port Propulsion Transformer | Main Power Switchboard, Control Room, Cell 11 |
| 7 | PP-4003 | Port Excitation | Main Power Switchboard, Control Room, Cell 12 |
| 8 | PP-4004 | Stbd Excitation | Main Power Switchboard, Control Room, Cell 4 |
| 9 | PP-4002 | Stbd Propulsion Transformer | Main Power Switchboard, Control Room, Cell 5 |
| 10 | PP-4002 | Stbd Propulsion Transformer | Main Power Switchboard, Control Room, Cell 6 |
| 11 | P-4002 | Stbd Air Bubbler | Main Power Switchboard, Control Room, Cell 1 |
| 12 | | Spare Breaker | Main Control Room Stbd |

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3.2 This work shall be carried out by contractor in conjunction with the following:

The work is confined to the Main Power Switchboard and as a result will require racking out and Lockout/Tagout the Main tie breaker P0505 located in the ship service switchboard in the control room . Contractor shall isolate the 24Vdc tripping voltage in each cell by removing fuses located in each cell. Contractor is responsible for testing to ensure dead bus before proceeding with any modifications .

3.3 Contractor shall prove through full live testing that all auxiliary contacts, trips and operational circuits operate as per original. Contractor shall provide a detailed report on each breaker including class approval and testing of individual control circuits. 48 hours notice shall be given before power is to be applied to the switchboard. Any work on energized electrical equipment shall be carried out with proper arc flash protection PPE and procedures as per ISM and Industry safety standards listed below.

Location

See Table

3.4 Interferences

Contractor is responsible for the identification of interference items, their temporary removal, storage and refitting to vessel.

Part 4: PROOF OF PERFORMANCE:

4.1 Inspection

All work shall be completed to the satisfaction of the Chief Engineer.

4.2 Testing

After installation all breakers shall be tested and all associated functions proven operational along with remote controls and indication circuits. A detail report of all testing for each individual breaker to be given to the Chief Engineer .

4.3 Certification

All breakers shall be currently certified by an approved Marine Classification Society (Lloyd's Register of Shipping, American Bureau of Shipping,

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Germanischer Lloyd, Det Norske Veritas or Bureau Veritas) Copies of each certification shall be given to the vessel's Chief Engineer.

Part 5: DELIVERABLES:

5.1 Drawings/Reports

The Contractor shall update the associated drawings using AutoCAD to reflect any and all changes. A detail report of all testing and copies of certification for each breaker to be given to the Chief Engineer.

5.2 Spares

A list of recommended spares shall be provided upon completion of installation. A separate price breakdown of recommended spare is to be provided. All special tools required for lifting or racking out breakers shall be supplied.

5.3 Training

The Contractor shall provide One (1) day of training to the ship's Electrical Officer that demonstrates the correct operation and preventative maintenance of the breakers to be performed during usage.

5.4 Manuals

The Contractor shall supply 3 printed copies of operation and maintenance manuals as well as a pdf -electronic copy left with the vessel upon completion of project.

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Mandatory Requirements for Bid Evaluation:

| Item | Description | Comply |
|------|---|--------|
| 1. | Supply and install 11 identical 4160 V breakers + one spare | |
| 2. | Existing busswork shall be used. Any modifications are part of this contract and included in the bid price. | |
| 3. | Breakers have 120VAC charging and closing plus a 24 VDC tripping circuit. | |
| 4. | New breakers must have a documented manufacturer's 10000 cycle of operation before requiring maintenance or refurbishment. | |
| 5. | Breakers have the ability to be racked-out for maintenance | |
| 6. | Breakers are capable of operating in 40 degree Celcius. | |
| 7. | Breakers have a mechanical interlock to prevent racking out the breaker unless in the open and discharged position. (Technical information and separate price quote required) | |
| 8. | Breakers to have the same number of auxiliary contacts as the original breakers. | |
| 9. | Breakers have mechanical indication of breaker contact state, charge condition and operational cycles. | |
| 10. | Breakers are capable of being upgraded for the provision of remote racking to mitigate ArcFlash hazards. (Technical information and separate price quote required) | |
| 11. | Breakers are capable of being upgraded to add ArcFlash sensing and tripping to reduce fault clearing times. (Technical information and separate price quote required) | |
| 12. | Breakers shall be supplied with a current certification by a Marine Classification Society | |