

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this contract includes supply of six hydraulic cylinders constructed in conformance with the design drawings and technical specifications.

1.2 RELATED REQUIREMENTS

- .1 None

1.3 REFERENCES

- .1 ASTM International
 - .1 ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
 - .2 ASTM B271/271M - Standard Specification for Copper-Base Alloy Centrifugal Castings.
 - .3 ASTM A519 – Standard Specification for Seamless Carbon and Alloy Steel Mechanical Tubing.
 - .4 ASTM A564 / A564M - Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
 - .5 ASTM F593 Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 - .6 ASTM F594 - Standard Specification for Stainless Steel Nuts.
- .2 Canadian Standards Agency
 - .1 CSA G40.20/G40.21 - General Requirements for Rolled or Welded Structural Quality Steel.
 - .2 CSA W47.1 - Certification of companies for fusion welding of steel.
 - .3 CSA W59 - Welded steel construction (metal arc welding).
 - .4 W178.2-14 - Certification of welding inspectors.
- .3 American Welding Society
 - .1 AWS D1.1 - Structural Welding Code - Steel
 - .2 AWS D14.9/D14.9M - Specification for the Welding of Hydraulic Cylinders.
- .4 Society of Automotive Engineers
 - .1 SAE J429 - Mechanical and Material Requirements for Externally Threaded Fasteners.
 - .2 SAE J995 - Mechanical and Material Requirements for Steel Nuts.
- .5 International Standards Organization
 - .1 ISO 4406 - Hydraulic fluid power -- Fluids -- Method for coding the level of contamination by solid particles.

- .2 ISO 10100 - Hydraulic fluid power -- Cylinders – Acceptance tests.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with PWGSC Procurement Procedures.
 - .1 Shop drawings shall be provided for all fabricated components.
 - .2 The manufacturer and part numbers shall be provided for all purchased components.
 - .3 Submit 1 electronic copy and 2 printed copies of shop drawings complete with Bill of Materials indicating manufacturers and part numbers of purchased components.
- .2 At least 1 week prior to beginning work, submit to Departmental Representative:
 - .1 Shop drawings and proposed specifications of components.
 - .2 Proof of certification for any required fabrication.
 - .3 Written work plan for coating application

1.5 QUALITY ASSURANCE

- .1 All materials used in the construction of the cylinders are to meet the specified material standards and grades.
 - .1 Submit all mill test certificates for all raw materials used in fabrication to the Departmental Representative within 2 days of receipt.
 - .2 Submit packing slips for purchased components within 2 days of receipt.
- .2 All welds are to be inspected or tested by non-destructive means as required by a third party weld inspector engaged by the Contractor. The weld inspector shall be certified in accordance with CSA W178.2 to level 2.
 - .1 100% of fillet welds shall be visually inspected.
 - .2 50% of groove welds and 100% of full penetration welds shall be inspected by ultrasonic or radiographic methods.
 - .3 Submit all weld test results to the Departmental Representative within 2 days of receipt.
- .3 All surface coatings are to be inspected by a third-party NACE certified coatings inspector, engaged by the Contractor.
 - .1 Typical testing SSPC PA2 rule allowing for 80% of minimum DFT for spot measurement shall not apply. The minimum DFT shall be 16 mils on any spot measured.
 - .2 Test for coating continuity (Holiday Testing) in accordance with manufacturer's instructions after the epoxy anti-corrosive has sufficiently cured.
 - .3 Submit all coating test results to the Departmental Representative within 2 days of receipt.

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- .4 Cylinders are to be tested and flushed by the supplier prior to delivery.
 - .1 Cylinders shall be pressure tested in accordance with ISO 10100 by the supplier.
 - .2 Cylinders shall be flushed with hydraulic fluid compatible with Mobil Nuto H hydraulic oil to a cleanliness level of 16/14/12 in accordance with ISO 4406.
 - .3 Cylinder test reports and particulate count reports shall be provided with supply of cylinders.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 All materials shall be transported and stored in accordance with the manufacturer's written instructions.

Part 2 Products

2.1 PERFORMANCE CRITERIA

- .1 All components utilized in manufacture of cylinders are to be suitable for service at a maximum pressure of 140bar (2000psi).
 - .1 Structural elements are to have a 4:1 design factor against burst or rupture.
 - .2 All seals are to be zero-leak type.
 - .3 Cylinders are to be suitable for immersion in a salt water marine environment.
 - .4 Cylinders construction shall be suitable for a maximum piston and rod speed of 100 mm/s.
 - .5 Cylinders shall be free from any seal induced vibration during operation.

2.2 MATERIAL SPECIFICATIONS

- .1 Cylinder barrel material is to be in accordance with ASTM A519 Gr. 1026.
- .2 Cylinder rod material is to be in accordance with ASTM A564 Gr. 630.
- .3 Cylinder end cap, gland or other plate material is to be in accordance with CSA G40.21 Gr. 300W.
- .4 Cylinder piston material is to be in accordance with ASTM A108 Gr. 1018 RT.
- .5 Wear rings are to be C93200 bronze in accordance with ASTM B271.
- .6 O-rings are to be 70 durometer nitrile.
- .7 Piston seals are to be Chevron type seal sets, 2 per cylinder or approved equivalents.
- .8 Rod seals are to be Chevron type seal sets, 1 per cylinder or approved equivalents.

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- .9 Rod wipers are to be AN29 urethane wiper seals or approved equivalents.
- .10 Plain or plated fasteners are to be in accordance with SAE J429 Gr. 8 or SAE J995 Gr. 8.
- .11 Stainless steel fasteners are to be in accordance with ASTM F593 Group 1 or ASTM F594 Group 1.

2.3 COATING MATERIALS

- .1 Cylinder coating is to consist of a high solids polyamide epoxy with 15 year durability suitable for a C5-M environment (high corrosivity – marine) under ISO 12944-2, including immersion, with the following requirements:
 - .1 Coating is to be self-priming.
 - .2 Minimum number of coats = 2.
 - .3 Minimum total dry film thickness = 16 mils
 - .4 Coating shall not be “Bituminous” or contain coal tar.

Part 3 Execution

3.1 CYLINDER MANUFACTURE

- .1 All fabricated components of the cylinders shall be manufactured in accordance with the approved shop drawings.
- .2 Cylinders shall be assembled utilizing the fabricated components and approved seals and wipers.

3.2 COATING INSTALLATION/APPLICATION

- .1 All exterior surfaces of cylinders not excluded in para 3.2.5 shall be coated with the cylinders fully assembled.
- .2 Where necessary remove all weld splatter, smooth weld seams and sharp edges. Fresh water wash to remove all dirt and contamination, as necessary. Degrease according to SSPC-SP1 solvent cleaning.
- .3 Abrasive blast all surfaces to be coated to SSPC SP10, near-white metal. Surface profile shall be >3 mils.
- .4 Coatings shall be applied and cured as per the manufacturer’s written instructions. Stripe coats should be applied to all welds, lap joints, plate edges, corners, sharp edges, and any other areas where spray application of the overall coating system may prove difficult resulting in low dry film thickness.
- .5 All sealing, bearing or faying surfaces shall be protected from coating.

END OF SECTION