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**SOLICITATION AMENDMENT
MODIFICATION DE L'INVITATION**

The referenced document is hereby revised; unless otherwise indicated, all other terms and conditions of the Solicitation remain the same.

Ce document est par la présente révisé; sauf indication contraire, les modalités de l'invitation demeurent les mêmes.

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Title - Sujet EREP: Boom Reel Trailer System(s)	
Solicitation No. - N° de l'invitation F7047-190090/A	Amendment No. - N° modif. 011
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AMENDMENT 011

A. This amendment is raised to respond to the questions from the industry:

Question # 1

Reference Amendment 09 - Question #7

TSOR requirement 3.6.5.1 states that the swivel mechanism is to be fitted with a hydraulic motor. Would Canada consider alternative means of operating the swivel mechanism (provided all other clauses of the TSOR are met)?

Answer # 7

Canada will consider alternative means of providing rotational movement to the swivel mechanism as long as all other clauses of the TSOR are met.

TSOR Implications: 3.6.5.1 The Contractor must supply and fit one hydraulic motor (as per Section 3.7) at the Boom Reel and swivel mechanism's axis of rotation. Alternative means of operating the swivel mechanism may be proposed for consideration by Canada.

Asking for confirmation that:

1. We do NOT have to provide a solution using a hydraulic motor provided all other clauses are met. If this is the case, so that it is 100% clear to all, we ask to change the wording from Canada "will consider" to Canada "will accept".
2. It follows then that we ask that Section 3.6.5.2 should be changed to the "hydraulic motor or motors" to allow for the possibility that there is only one motor (i.e. at the boom reel) and one "alternate means of operating the swivel".

Answer #1

A solution that meets all other TSOR clauses is acceptable. 3.6.5.1 and 3.6.5.2. have been updated.

TSOR Implications:

3.6.5.1. The Contractor must supply and fit one hydraulic motor (as per Section 3.7) at the Boom Reel and swivel mechanism's axis of rotation. An additional hydraulic motor or alternative means of providing rotation to the swivel mechanism is acceptable provided all requirements herein are met.

3.6.5.2. The hydraulic motor or motors must be installed in a manner that facilitates their possible future removal.

B. This amendment is delete Annex B – Technical Statement of Requirements and replace it with revised Annex B – Technical Statement of Requirements.

ALL OTHER INSTRUCTIONS, TERMS AND CONDITIONS REMAIN UNCHANGED.

Annex B of the Bid Solicitation

Technical Statement of Requirements (TSOR)

**Environmental Response Equipment Modernization/Mobile
Incident Command Equipment Project**

Trailer – Equipment – Boom Reel Trailer System

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LIST OF ACRONYMS AND ABBREVIATIONS

ASME	American Society of Mechanical Engineers
ASTM	Formerly known as the American Society for Testing and Materials
CCG	Canadian Coast Guard
CMVSS	Canadian Motor Vehicle Safety Standards
CCSA	Canadian Standards Association
CWB	Canadian Welding Bureau
DD	Two-digit day
DID	Data Item Deliverable
ER	Environmental Response
GTW	Gross Trailer Weight
GVWR	Gross Vehicle Weight Rating
ISO	International Organization for Standardization
MM	Two-digit month
OEM	Original Equipment Manufacturer
SAE	Society of Automotive Engineers
SOR	Statutory Orders and Regulations
TSOR	Technical Statement of Requirements
UV	Ultraviolet
YYYY	Four-digit year

1 INTRODUCTION

1.1. PURPOSE

The Canadian Coast Guard (CCG) is the lead federal agency responsible for ensuring the clean-up of all ship-source and mystery-source pollution spills into waters under Canadian jurisdiction. In fulfillment of this legislated mandate, the CCG maintains a level of operational preparedness capacity to monitor, investigate, and respond, when required, to all reports of marine pollution incidents. The objective of the Environmental Response Equipment Modernization/ Mobile Incident Command Equipment (EREM/MICE) Project is to modernize CCG's initial response equipment inventory and its supporting infrastructure.

1.2. SCOPE

The CCG requires a means of rapid transportation and deployment/recovery for fence boom and associated accessories. Fence Boom is a deployable containment boom design that uses rectangular floatation elements for buoyancy, an 18 to 24 inch fabric membrane that acts as a barrier to floating oil, and tension members to transfer longitudinal tensile loads. The Boom Reel Trailer System(s) must consist of a trailer equipped with an ISO twist locking mechanism to securely mount a boom reel skid. The boom reel skid will consist of a hydraulically driven boom reel designed to hold 1000 feet (up to 3000 lbs) of fence boom, mounted on a hydraulic swivel mechanism, and powered by a hydraulic power unit. The Boom Reel Trailer System(s) will be used on highways, secondary roads, gravel and dirt roads, and on grass field terrain throughout Canada.

This Technical Statement of Requirements (TSOR) defines the functional and performance-based requirements for the Boom Reel Trailer System.

The Boom Reel Trailer System(s) will consist of the following **major** components:

- Trailer fitted with ISO locks for boom reel skid and storage box (if applicable);
- Removable boom reel skid complete with a hydraulic boom reel, hydraulic swivel mechanism and hydraulic power unit;
- Bill of Sale and any additional documentation required for licensing and registration in Canada;
- One bilingual hard-copy of the Operation and Maintenance Manual in both of Canada's official languages i.e., English and French; and
- One bilingual hard-copy of the Equipment Operating Illustrations.

1.3. DOCUMENT CONVENTION

The following conventions apply to this TSOR:

- a) Dimensions stated as nominal are treated as approximate dimensions. Nominal dimensions reflect a standard whereby materials or products are generally identified for commercial sale, but differ from the actual dimensions.

- b) Both the Metric system and the Imperial system of measurements may be indicated in this TSOR.

1.4. DEFINITIONS

The following definitions apply to this TSOR:

Canada Motor Vehicle Safety Standards (CMVSS): Transport Canada standards which all vehicles made for sale in Canada and all vehicles imported into Canada must meet.

Curb Weight: The weight of the fully equipped Trailer. The Curb Weight includes the Trailer, all attached, components, accessories, equipment, and lubricants. The Curb Weight does not include the Payload.

Dissimilar Metals: Two metal specimens electrically connected to each other in a conductive solution, and capable of generating an electric current.

Gross Vehicle Weight Rating (GVWR): The maximum operating weight of the Trailer required by the Contract and confirmed by the manufacturer.

Gross Vehicle Weight (GVW): The sum of the Curb Weight and the Payload. The GVW cannot exceed the Gross Vehicle Weight Rating.

$$\text{Gross Vehicle Weight} = \text{Curb Weight} + \text{Payload}$$

Loaded Boom Reel Skid: The Boom Reel Skid loaded with 3000 lbs of boom on the boom reel and 700 lbs of accessories in the storage container on top of all the other skid fitments described in this TSOR.

Marine-grade: A quality of a product specially formulated or treated to withstand use at sea.

Off-the-shelf: Standard articles and materials that are ordinarily produced by manufacturers in the normal course of business.

Payload: The maximum cargo load carrying capacity of the Trailer. The Payload is the calculated difference between the Curb weight and the Gross Vehicle Weight.

$$\text{Payload} = \text{Gross Vehicle Weight} - \text{Curb Weight}$$

Technical Authority: The individual responsible for providing information, guidance and advice on the technical aspect of a product.

2 REFERENCE DOCUMENTATION

2.1. ORDER OF PRECEDENCE

In the event of a discrepancy between this TSOR and the standards and specifications referenced herein, the content of this TSOR must take precedence; however, nothing in this TSOR supersedes any applicable laws and regulations.

2.2. APPLICABLE CANADIAN STANDARDS AND SPECIFICATIONS

The Boom Reel Trailer System must conform to all applicable laws, regulations, and industrial standards governing manufacture, safety, noise levels, and pollution in effect in Canada at the time of manufacture. International equivalent laws, regulations, and industrial standards will be accepted only if certified for equivalency by a Professional Engineer.

To the extent specified herein, the following standards and specifications apply to the Boom Reel Trailer System:

- a) ASTM A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products;
- b) ASTM A413/A413M-07, Standard Specification for Carbon Steel Chain;
- c) ASTM F1166-07 (2013), Standard Practice for Human Engineering Design for Marine Systems, Equipment, and Facilities;
- d) C.R.C., c.1038, Motor Vehicle Safety Regulations;
- e) ISO 1161:1984, Series 1 Freight Containers — Corner fittings — Specification;
- f) ISO 1496-1:2013, Series 1 Freight Containers – Specification and Testing Standards;
- g) ISO 2230:2002, Rubber Products – Guidelines for Storage;
- h) ISO 3874:2017 Series 1 Freight Containers – Handling and securing;
- i) ISO 668 Series 1 Freight Containers - Classification, Dimensions, and Ratings;
- j) ISO 7241:2014, Hydraulic Fluid Power – Dimensions and Requirements of Quick-Action Couplings;
- k) R.S.C., 1985, c.H-3, Hazardous Products Act;
- l) SAE J1527, Marine Fuel Hoses;
- m) SAE J1942, Hose and Hose Assemblies for Marine Applications;
- n) SAE J534 – Lubrication Fittings;
- o) S.C. 1993, c.16, Motor Vehicle Safety Act;
- p) Statutory Orders and Regulations (SOR)/86-304, Canada Occupational Health and Safety Regulations;
- q) SOR/2005-32, Off-Road Compression Ignition Engine Emission Regulations; and
- r) TP 14117, Trailers: Federal Lighting Equipment Location Requirements.

2.3. SUPERSEDEENCE

Unless otherwise specified by Canada, any amendment issued to the documents specified in 2.1 must reflect the version in effect on the date of Contract award.

3 TRAILER REQUIREMENTS

3.1. DESIGN OVERVIEW

3.1.1. GENERAL CONSIDERATIONS

3.1.1.1. The Trailer must:

- a) Have engineering certification and technical documentation supplied for all associated equipment from the original equipment manufacturers (OEM) of all major components for the Trailer, as requested;
- b) Conform to all applicable laws, regulations, and industry standards governing manufacture, safety, noise levels, and pollution in effect in Canada at time of manufacture;
- c) Include all OEM standard equipment package, components, and accessories normally supplied for the intended equipment application, although they may not be specifically described in this TSOR; and
- d) Must be able to be registered and pass a Motor Vehicle Safety (MVS) inspection in any Province or Territory in Canada.

3.1.2. ENVIRONMENTAL CONDITIONS

3.1.2.1. The Trailer must be designed:

- a) For operational use in air temperatures ranging from -20°C to +35°C;
- b) To withstand storage in air temperatures ranging from -40°C to +40°C; and
- c) To be subject to rain, sleet, snow, high winds, and ocean spray during transportation, operation, and storage.

3.1.3. ROAD CONDITIONS

3.1.3.1. The Trailer must be designed to operate:

- a) On highways, secondary roads, gravel and dirt roads; and
- b) Year-round in conditions including rain, snow, mud, sand, and ice.

3.1.4. SAFETY

3.1.4.1. The Trailer must be designed to eliminate or mitigate hazardous conditions using, at a minimum, the following best practices:

- a) Safe configuration and arrangement of equipment;
- b) Identification of hazardous conditions with bilingual labels and placards in;

- c) Appropriate guarding of mechanical, electrical, and thermal hazards; and
- d) Prevention of controls from accidental or inadvertent activation.

3.1.4.2. The Trailer power and electrical systems must be installed in accordance with CSA C22.1, Canadian Electrical Code and UL458 Standard for Power Converters/Inverters and Power Converter/Inverter Systems for Land Vehicles and Marine Crafts.

3.1.4.3. The Trailer floor and all surfaces designed for personnel to stand on must be non-skid.

3.1.4.4. The Trailer must not have system, assembly, or component capacities designed to operate above their published ratings.

3.1.4.5. The Trailer must carry the National Safety Mark (NSM).

3.1.5. MAINTAINABILITY

3.1.5.1. The Contractor must standardize the selection of equipment, fittings, fasteners, hardware, attachments, and fabrication methods used in the Trailer to minimize the number of unique spares.

3.1.5.2. Internal parts that are subject to malfunction or failure due to reverse installation must have mechanical provisions that preclude improper installation.

3.1.5.3. Following Canada's acceptance of the First Article Test results, the Contractor must use identical components in all subsequent Trailer deliveries (unless otherwise specified by Canada).

3.1.5.4. The use of specialized tools and equipment must be restricted to infrequent and complex service work, such as generator maintenance or electrical work.

3.2. PERFORMANCE REQUIREMENTS

3.2.1. LIFE EXPECTANCY

3.2.1.1. The minimum useful life of the System must be 20 years when maintained and stored per manufacturer's recommendations.

3.2.2. DIESEL ENGINES

3.2.2.1. The brake horsepower (BHP) rating of each diesel engine must correspond to the minimum power input recommended by the paired equipment manufacturer under the conditions specified herein.

3.2.2.2. Each diesel engine must:

- a) Develop its maximum torque at a speed less than the rated operating speed of the paired equipment;
- b) Operate continuously at an angle of inclination up to $\pm 15^\circ$ without damage; and
- c) Operate continuously at the rated load for a minimum of 2 hours without refueling.

3.2.3. HYDRAULIC PUMP

- 3.2.3.1.** The hydraulic pump must operate under continuous, intermittent, and stalled conditions without inflicting damage upon itself or the adjoining hydraulic circuit.

3.2.4. HYDRAULIC DRIVE SYSTEM

- 3.2.4.1.** The Contractor must size the complete hydraulic drive system to optimize performance. At a minimum:
- a) The rated output parameters of the hydraulic pump (e.g., pressure and flowrate) must match the equivalent rated input parameters of the hydraulic motor; and
 - b) The rated input parameters of the hydraulic pump (e.g., power, rotational speed, and direction of rotation) must match the equivalent rated output parameters of the diesel engine.

3.2.5. HYDRAULIC MOTORS

- 3.2.5.1.** The hydraulic motor must be sized to enable the empty boom reel to pull 1000 feet of CCG Fence Boom (approximately 3000 lbs) from the water up to a height of 5 meters.
- 3.2.5.2.** The braking capacity of any hydraulic motor fitted to the Boom Reel must exceed the design pull force of the Boom Reel.
- 3.2.5.3.** The maximum rotational speed of the Boom Reel in each direction must be less than 10 rotations per minute (RPM) at the maximum rated hydraulic flow and include a hydraulic brake designed to halt reel rotation.
- 3.2.5.4.** The rotation speed of any hydraulic motor fitted to the Boom Reel and Swivel Mechanism must be continuously variable (while under power) up to its maximum rotational speed.
- 3.2.5.5.** The hydraulic motor(s) must be capable of operating forward and reverse with speed control.

3.2.6. TOWING

- 3.2.6.1.** The Trailer must:
- a) Be designed to be towed primarily behind a Ford F350;
 - b) Operate with a full payload on highways and secondary roads at speeds of at least 100 kilometres per hour (km/h), and on gravel roads at speeds of at least 40 km/h;
 - c) Follow the towing vehicle without weaving or side sway;
 - d) Provide horizontal articulation up to 60° without interference with the towing vehicle; and
 - e) Have external 12 volt lights and reflectors installed in accordance with CMVSS.

- 3.2.6.2.** All aspects of in-transit power requirements (lights, brakes, etc.) must operate on a separate circuit to the main trailer, must meet CMVSS and be supplied by the towing vehicle using the connector defined in 3.3.6.1.c.

3.3. TRAILER CONSTRUCTION

3.3.1. GENERAL CONSIDERATIONS

- 3.3.1.1.** The Contractor must design and provide the Trailer as both a standard bumper pull trailer and gooseneck trailer. While the Trailer designations specify two different tow vehicle connection types, each designation must comply to the same Trailer requirements described herein.
- 3.3.1.2.** All electrical and electronic systems installations must be marine grade or equivalent, with all electrical components sealed to prevent water intrusion.

3.3.2. PHYSICAL CONSTRAINTS

- 3.3.2.1.** The Trailer must have a minimum payload capacity equal to the entire weight of the loaded boom reel skid.
- 3.3.2.2.** The overall system height must not exceed 4.1 m.
- 3.3.2.3.** The overall system width must not exceed 2.55 m.
- 3.3.2.4.** The overall system length must not exceed 10 m.
- 3.3.2.5.** Removed
- 3.3.2.6.** The Trailer must be designed to produce a tongue weight on the tow vehicle that:
- a) Is limited to a minimum of 10% and maximum of 15% of the Trailer GTW for the bumper pull trailer; and
 - b) Is limited to a minimum of 20% and maximum of 25% of the Trailer GTW for the gooseneck trailer.
- 3.3.2.7.** To determine the tongue weight placed on the tow vehicle, calculations must use a loaded boom reel skid, on top of all other trailer fitments described in this TSOR.
- 3.3.2.8.** The dimensions of the system must be such that it will be towable anywhere in Canada by a CCG operator with a Class 5/Class G driver's licence without the need for any oversize or overweight permits.

3.3.3. FRAME MEMBERS

- 3.3.3.1.** The Trailer frame must be sufficiently rigid to support the full GVWR of the Trailer as well as any live loads that could apply during storage, deployment, or when operating at highway speeds in Canada (e.g. snow, wind, and personnel). The Contractor must brace (or reinforce) all stress points.

3.3.3.2. An aluminum diamond plate filler deck must be fitted over the Trailer tongue where any void spaces remain.

3.3.3.3. There must not be open ends of any of the frame members used in the construction of the Trailer.

3.3.4. SUSPENSION AND AXLES

3.3.4.1. The Trailer must have a tandem axle configuration.

3.3.5. WHEELS, RIMS, AND TIRES

3.3.5.1. The Trailer must be equipped with:

- a) Wheels, rims, and tires that must be appropriately chosen for the environmental and road conditions listed in 3.1.2. and 3.1.3. respectively. The combined capacity of all wheels, rims and tires, must meet or exceed the GVWR of the trailer. Canada must approve the tire selection and markings;
- b) All-season on-/off-road all-terrain type tires or equivalent;
- c) The same model of tires on all wheels;
- d) A spare tire assembly mounted on the Trailer curbside and ready for service, of same size and ply rating as tires furnished with the Trailer. Canada must approve the spare tire mounting location;
- e) Heavy-duty flexible and replaceable front and rear rubber mud flaps; and
- f) Two wheel chocks that are carried in transport and can be installed following deployment or during storage. The chocks must prevent accidental movement of the Trailer.

3.3.5.2. A wheel lug nut wrench must be provided with the spare tire and mounted in a location approved by Canada.

3.3.6. 12 VOLT ELECTRICAL SYSTEM

3.3.6.1. The Trailer must:

- a) Be provided with a 12 volt DC negative ground electrical system in accordance with CMVSS;
- b) Function with a tow vehicle operating with 12 volt electrical systems; and
- c) Be equipped with a 7-way blade electrical connector.

3.3.7. LIGHTING

3.3.7.1. The Trailer must have lights and reflectors installed in accordance with CMVSS.

3.3.7.2. All trailer lights must be LED.

3.3.7.3. All lights must be recessed or otherwise protected from damage by impact, with all components easily accessible for maintenance.

3.3.8. BRAKES

3.3.8.1. The Trailer must be equipped with the manufacturer's standard electric brake system with capacity to handle the GVWR of the Trailer.

3.3.8.2. Removed

3.3.8.3. The Trailer must be equipped with the manufacturer's standard breakaway kit with the capacity to handle the GVWR of the Trailer and interact with the installed brake system as per the manufacturer's instructions.

3.3.9. TONGUE AND LEVELLING JACKS

3.3.9.1. All jacks must be installed per the OEM installation recommendations.

3.3.9.2. A portable bottle jack with a minimum capacity equal to the GVWR of the trailer that fits the bottom of the Trailer frame must be provided.

3.3.9.3. The bumper pull trailer must be fitted a tongue jack that must:

- i. Lift and support the Trailer with a full payload.
- ii. Be fitted with a crank that lifts and lowers the Trailer drawbar so the hitch coupler can rise a minimum of 4 inches above its level height. The jack must be installed in a manner where the crank's movement is not impeded by any part of the trailer.
- iii. Provide at least 8 inches of clearance to the level ground when fully collapsed.
- iv. Be fitted with a footplate.
- v. Have a capacity that is at least 20% of the GVWR of the Trailer.

3.3.9.4. The gooseneck trailer must be fitted landing gear jacks on either side of the front of the trailer. The landing gear must:

- i. Lift and support the Trailer with a full payload.
- ii. Be fitted with a side-wind crank near the front of the Trailer that controls both of the landing gear jacks at the same time and ensure the coupler can rise a minimum of 4 inches above its level height.
- iii. Provide at least 8 inches of clearance to the level ground when fully collapsed.
- iv. Be fitted with a footplate.
- v. Have a combined capacity that is at least 30% of the GVWR of the Trailer.

- 3.3.9.5.** Both Trailers must be fitted with independently controlled levelling jacks at each corner of the Trailer that stabilize and level the Trailer when it is unhitched with a full payload on an uneven surface. The levelling jacks must be fitted with adjustable droplegs.
- 3.3.9.6.** The droplegs must have a means to be locked in place at various distances from the base of the jack.
- 3.3.9.7.** The rear levelling jacks must have at least 14 inches of clearance to the level ground when fully collapsed.

3.3.10. TOW VEHICLE CONNECTIONS

- 3.3.10.1.** The tow vehicle connection must have a capacity at least equal to the GVWR of the Trailer.
- 3.3.10.2.** The Trailer must be provided with:
 - a) A standard hitch coupler designed to attach to a 2 5/16 inch Trailer ball for the standard bumper pull trailer; and
 - b) A gooseneck hitch coupler designed to attach to a 2 5/16 inch Trailer ball for the gooseneck trailer.
- 3.3.10.3.** The Trailer tongue must be fitted with at least two galvanized steel safety chains to attach to the tow vehicle hitch.
- 3.3.10.4.** There must be one Grade 70 safety chain on each side of the tow vehicle connection.
- 3.3.10.5.** Each safety chain must:
 - a) Be fitted with clevis hook and latch connectors on their free ends; and
 - b) Have a minimum length of 27 inches.
- 3.3.10.6.** Each safety chain and connector must be sized and rated to the GVWR of the Trailer.

3.3.11. ISO TWIST LOCKING SYSTEM

- 3.3.11.1.** The Trailer must be fitted with an ISO twist locking system that satisfies the requirements defined in Annex A of ISO 3874:2017 Series 1 freight containers – Handling and securing. It must be designed to secure the boom reel skid to the bed of the trailer.
- 3.3.11.2.** The ISO twist locking system should be designed to also accept standard 10 and 20 ft ISO containers (1D and 1C respectively) as defined in ISO 668 Series 1 Freight Containers - Classification, Dimensions, and Ratings.
- 3.3.11.3.** The ISO twist locking system must be designed to lock the boom reel skid and containers without the use of tools.

- 3.3.11.4.** The ISO twist locking system must have a redundant locking measure to ensure each lock doesn't come loose or detach during travel at the speeds and in the terrain identified in 3.2.6.1 b) and 3.1.3, respectively.

3.3.12. LICENSE PLATE HOLDER

- 3.3.12.1.** The Trailer must be provided with a rear-mounted license plate holder.
- 3.3.12.2.** The rear-mounted license plate holder must be recessed or otherwise protected from damage.

3.3.13. IDENTIFICATION

- 3.3.13.1.** The following information must be permanently marked in a conspicuous and protected location:
- a) Manufacturer's name, model, and serial number;
 - b) Manufacturer's Vehicle Identification Number (VIN); and
 - c) Trailer Capacity rating must be marked on the drawbar.

3.3.14. TRAILER BODY FLOOR

- 3.3.14.1.** The Trailer body floor must:
- a) Be at the lowest level permitted by the chassis/body;
 - b) Be level throughout the Trailer, not including wheel well protrusions (if applicable).

3.4. TRAILER STORAGE BOX

3.4.1. GENERAL CONSIDERATIONS

- 3.4.1.1.** The Trailer Storage Box must be fabricated from aluminum and designed to be water tight when closed.
- 3.4.1.2.** The Trailer Storage Box must be designed to withstand shifting of the typical equipment stored in the box (described in 3.4.2.2.), as well as dropping of the equipment into the box and normal wear and tear.
- 3.4.1.3.** The Trailer Storage Box must be securely attached to the main Trailer frame or boom reel skid and designed to withstand the live loads (i.e. wind) that will be present when towing the Boom Reel Trailer at highway speeds in Canada.
- 3.4.1.4.** The Trailer Storage Box must be designed to drain any free standing water that accumulates inside, while not allowing any water to enter the box through the drain.

- 3.4.1.5.** To ensure the longevity of the documents that will reside within the storage box (for example, the technical maintenance manual and operations manual as per Section 3.18.1.2.), the interior of the storage box must be fitted with a dedicated aluminum provision to securely and neatly contain documents. The Contractor may propose alternative construction materials for consideration by Canada.

3.4.2. PHYSICAL CONSTRAINTS

- 3.4.2.1.** The Trailer Storage Box must have a minimum volume of 70 cubic feet (ft³).
- 3.4.2.2.** The Trailer Storage Box must be designed to store at a minimum the following components, where design is subject to review and acceptance by Canada:
- a) Four, 100 ft long, 0.75 in diameter towlines;
 - b) Four, 24 in tow paravanes;
 - c) Four, 24 in tow bridles;
 - d) Five, 25 lbs fluke-style anchors;
 - e) Five, 120 ft long rope-chain anchor rodes;
 - f) Five, 100 ft long anchor trip lines;
 - g) Five, inflatable, low-drag buoys; and
 - h) Five, LED anchor lights.

3.4.3. ACCESS

- 3.4.3.1.** The Trailer Storage Box must have doors that are easily accessible and provide access to the contents within.
- 3.4.3.2.** The doors must open outwardly approximately 180 degrees to facilitate loading and unloading.
- 3.4.3.3.** The doors must be designed to lock in place when in a closed position, and be opened by the use of a fitted latch or handle.
- 3.4.3.4.** The doors must be capable of being secured in the fully open position in a manner that prevents accidental closure.
- 3.4.3.5.** The doors must be designed to be permanently locked in place with the use of a padlock with a 7/16 in shackle diameter.
- 3.4.3.6.** Each door must be designed to provide a weather tight seal when closed.
- 3.4.3.7.** Each hinge must be designed and fabricated to be maintenance free and resist binding.

3.4.4. LASHING AND MOUNTING POINTS

- 3.4.4.1.** The Storage Box must be fitted with dedicated mounts, hooks, shelves, or lashing points to secure every item listed in 3.4.2.2. Canada reserves the right to review, and accept the Storage Box configuration proposed by the Contractor.
- 3.4.4.2.** The mounts, hooks, shelves, or lashing points must be fitted with harnesses or another means to completely arrest movement of the stored equipment during transportation and storage.
- 3.4.4.3.** The Trailer Box hooks/lashing points must be designed to withstand all live loads during transportation over the terrain conditions defined in 3.1.3.

3.4.5. VENTILATION

- 3.4.5.1.** The Storage Box must be fitted with a minimum of two, off-the-shelf passive vents. Canada reserves the right to review, and accept or reject the vent sizing proposed by the Contractor.
- 3.4.5.2.** The passive vents must be located in the upper diagonal corners on opposite, fixed walls, such that they provide maximum diagonal cross airflow and exhaust.
- 3.4.5.3.** The passive vents must be designed to deflect rain or spray, and prevent water ingress.
- 3.4.5.4.** The passive vents must be fitted with mesh screens to inhibit ingress of any flying insects.

3.5. BOOM REEL SKID

3.5.1. GENERAL CONSIDERATIONS

- 3.5.1.1.** The Contractor must:
 - a) Supply and furnish a skid to house the boom reel, swivel mechanism, hydraulic power unit, storage box (if applicable), and their associated components specified herein;
 - b) Minimize the weight of the skid, while keeping its centre of mass as low as possible to the ground.
- 3.5.1.2.** The skid must be designed so the center of mass is as close to the center of the skid as possible.
- 3.5.1.3.** The skid must be designed to be locked and detached from the Trailer via the ISO twist locking mechanism defined in 3.3.11.
- 3.5.1.4.** The skid must be fitted with ISO corner fittings that satisfy the requirements defined in ISO 1161:1984, Series 1 freight containers — Corner fittings — Specification. The corner fittings must be designed to be secured to the trailer bed via the ISO twist locking system defined in 3.3.11.

3.5.1.5. Removed

3.5.2. FORKLIFT POCKETS

3.5.2.1. The skid must be fitted with two enclosed forklift pockets.

3.5.2.2. Each forklift pocket must pass completely through the base structure of the skid.

3.5.2.3. The forklift pockets must be perpendicular to the trailers direction of travel.

3.5.2.4. The size and spacing of the forklift pockets must satisfy the dimensional requirements defined in ISO 1496-1:2013, Series 1 Freight Containers – Specification and Testing Standards.

3.5.2.5. The forklift pockets must be spaced so the center of mass of the loaded skid falls right in the middle of the pockets (i.e. equidistant from each pocket).

3.6. BOOM REEL

3.6.1. GENERAL CONSIDERATIONS

3.6.1.1. The Contractor must:

- a) Supply and furnish a support frame for each Boom Reel and its associated components specified herein; and
- b) Minimize the total volume of the support frame, while keeping its centre of mass as low as possible to the ground.
- c) Supply and furnish a swivel mechanism for each Boom Reel that enables it to rotate 20 degrees in each direction about its base.

3.6.1.2. The Boom Reel Trailer System must be fitted with outriggers that stabilize the trailer when the boom reel, and swivel mechanism are operating on the trailer bed.

3.6.1.3. 3.6.1.3. The Boom Reel must enable proper boom deployment (i.e. boom coming from the top of the reel) from either the curb or roadside of the trailer depending on how the boom is loaded. It must also enable improper deployment (i.e. boom coming from underneath the reel) in emergency situations.

3.6.2. PHYSICAL CONSTRAINTS

3.6.2.1. The Boom Reel must be able to store at least 1000 ft. of 24 in Fence Boom within the confines of its end flanges.

3.6.2.2. The Boom Reel must have a minimum storage volume of 360 ft³. This volume equates to the total volume of the reel minus the volume occupied by the spool.

3.6.2.3. The Boom Reel spool must have a minimum diameter of 19 in.

3.6.2.4. The Boom Reel spool must have a minimum length of 7 ft.

- 3.6.2.5. The length of the boom reel spool must be parallel to the length of the trailer when in the neutral position.
- 3.6.2.6. There must be a horizontal axis of rotation for the Boom Reel to deploy and retrieve the Fence Boom.
- 3.6.2.7. The swivel mechanism must not extend outside of the footprint of the Boom Reel Skid in the transit configuration.
- 3.6.2.8. If the boom reel extends outside the footprint of the skid when rotating on the swivel mechanism the trailer must be designed with a transit and operating configuration where it can not be transported in the operating configuration.

3.6.3. SUPPORT FRAME CONSTRUCTION

- 3.6.3.1. Each support frame must be fabricated from welded aluminum extruded (or rolled) tubular frame members.
- 3.6.3.2. Each support frame must be permanently mounted to the swivel mechanism.
- 3.6.3.3. Each support frame must be sufficiently rigid to withstand the loading conditions when operating and transporting the furnished equipment of each delivery. The Contractor must brace (or reinforce) all stress points.
- 3.6.3.4. There must be a square or rectangular footprint for the base structure of each support frame.
- 3.6.3.5. Any open ends of the tubular frame members must be capped with plate to ensure a fully closed construction.
- 3.6.3.6. The support frame must be fitted with tie-down points to securely hold the weather cover specified in 3.6.7.
- 3.6.3.7. Each plate cap must be:
 - a) Cut to an appropriate size to ensure that it does not protrude from the exterior surfaces of the adjoining frame member; and
 - b) Of similar thickness to the wall thickness of the adjoining frame member.

3.6.4. BOOM REEL CONSTRUCTION

- 3.6.4.1. The Boom Reel must comprise the following construction:
 - a) A central, cylindrical hub;
 - b) Two, opposing solid circular end flanges;
 - c) Marine-grade aluminum;
- 3.6.4.2. There must be a smooth, closed construction to eliminate any catch or snag points for the cylindrical central hub and each inner face of the end flanges.

- 3.6.4.3. The cylindrical central hub and both end flanges must be designed to at least support 3000 lbs while under power (which roughly equates to the full wet mass of 1000 ft. of 24-inch CCG Fence Boom)
- 3.6.4.4. The Boom Reel spool must be fitted with recessed flush mounted lugs on each end of the spool for attaching and securing boom to avoid slippage. The lug must be sized to accept 3/8" shackle.
- 3.6.4.5. There must be rolled circumferential edges to eliminate sharp points on the end flanges.

3.6.5. HYDRAULIC DRIVETRAIN

- 3.6.5.1. The Contractor must supply and fit one hydraulic motor (as per Section 3.7) at the Boom Reel and swivel mechanism's axis of rotation. An additional hydraulic motor or alternative means of providing rotation to the swivel mechanism is acceptable provided all requirements herein are met.
- 3.6.5.2. The hydraulic motor or motors must be installed in a manner that facilitates their possible future removal.
- 3.6.5.3. The Boom Reel must only rotate if the lever for the reel on the remote control or HPU has been pushed in either direction, or the manual bypass valve has been activated. Otherwise it must remain in a locked static state, so as not to unknowingly rotate during transit or storage.
- 3.6.5.4. The Boom Reel must be:
 - a) Equipped with a braking mechanism to halt rotation and hold it in a static position;
 - b) Equipped with an emergency bypass valve to allow for manual rotation;
 - c) Coaxially located between two bearing assemblies to facilitate rotation; and
 - d) Properly balanced to preclude unnecessary shaft vibration and wear.
- 3.6.5.5. Any reduction gearbox must be paired directly to the hydraulic motor to ensure a compact drivetrain.
- 3.6.5.6. The output shaft of the drivetrain must:
 - a) Be coaxial with the Boom Reel;
 - b) Connect directly to the Boom Reel. The use of chains, belts, or other non-gear mechanical devices to transmit rotation to the boom reel is prohibited.
- 3.6.5.7. The connection between the output shaft of the drivetrain and the Boom Reel must preclude slippage and facilitate possible future disconnection (e.g., a splined shaft or bolted flange).
- 3.6.5.8. There must be a single female end fitting for the Boom Reel that connects to the inlet port of the hydraulic motor. This female end fitting must be equivalently-sized to accept the supply hydraulic hose assembly from the hydraulic power unit.

- 3.6.5.9.** There must be a single male end fitting for the Boom Reel that connects to the outlet port of the hydraulic motor. This male end fitting must be equivalently-sized to accept the return hydraulic hose assembly to the hydraulic power unit.
- 3.6.5.10.** If applicable, there must be a dedicated male end fitting for the Boom Reel for the hydraulic motor case drain port. The male end fitting must be equivalently-sized to accept a case drain hydraulic hose assembly to the hydraulic power unit.
- 3.6.5.11.** A coaxial shaft must be rigidly attached to the Boom Reel (on the end flange not connected to the drivetrain) to support rotation.
- 3.6.5.12.** One bearing assembly must resist loading in the axial direction.
- 3.6.5.13.** Each bearing assembly must be:
 - a) Lubricated; and
 - b) Sealed to limit the ingress of contaminants.

3.6.6. SWIVEL MECHANISM

- 3.6.6.1.** The Swivel Mechanism must be designed to at least bear the full weight of the reel fully loaded with 1000 ft of fence boom which is approximately 3000 lbs.
- 3.6.6.2.** The Swivel Mechanism must enable proper boom retrieval from both sides of the trailer.
- 3.6.6.3.** The Swivel Mechanism must not rotate faster than 2 RPM.
- 3.6.6.4.** The Swivel Mechanism must have provisions to ensure it doesn't rotate past 20 degrees in each direction from the reel's neutral position.
- 3.6.6.5.** The Swivel Mechanism must only rotate if the lever for the swivel on the remote control or HPU has been pushed in either direction, or the manual bypass valve has been activated. Otherwise it must remain in a locked static state, so as not to unknowingly rotate during transit or storage.
- 3.6.6.6.** The Swivel Mechanism must be fitted with a pin that locks the swivel mechanism in its transit orientation.
- 3.6.6.7.** The Swivel Mechanism must be:
 - a) Equipped with a braking mechanism to hold the swivel mechanism in a static position;
 - b) Equipped with an emergency bypass valve to enable manual rotation;
 - c) Fitted with at least two handles on either side of the swivel mechanism to use for manual rotation
- 3.6.6.8.** For trailers where the boom reel extends outside the footprint of the trailer during operation the following features must be added:

- a) Physical provision to cordon off the area where the boom reel extends outside the footprint of the trailer to ensure no operators stand in the way of the rotating boom reel;
- b) Remove

3.6.7. WEATHER COVER

- 3.6.7.1.** The Contractor must supply a weather cover for each Boom Reel provided to completely protect the Boom Reel from environmental conditions defined in 3.1.2. during transportation and storage.
- 3.6.7.2.** The Weather Cover must be made from synthetic fabrics providing resistance to ultraviolet (UV) degradation and embrittlement.
- 3.6.7.3.** The Weather Cover must be lightweight and compact to store.
- 3.6.7.4.** The Weather Cover must fully enclose the Boom Reel.
- 3.6.7.5.** The Weather Cover must tightly attach to the Boom Reel in a manner that ensures the cover doesn't loosen or cause excessive drag on the trailer at the highway speed identified in 3.2.6.1.a.
- 3.6.7.6.** The Weather Cover must attach and completely detach from the Boom Reel without the use of tools.
- 3.6.7.7.** The weather cover must be reinforced at all points (e.g., grommets) where it attaches to the support frame.
- 3.6.7.8.** The attachment points must be evenly spaced around the perimeter of the weather cover.
- 3.6.7.9.** The attachment points must be situated to align with the tie down points specified in Section 3.6.3.6.

3.7. HYDRAULIC POWER UNIT

3.7.1. GENERAL CONSIDERATIONS

- 3.7.1.1.** The Contractor must supply and furnish one hydraulic power unit with each Boom Reel Trailer System.
- 3.7.1.2.** The hydraulic power unit must be designed to rotate the reel in a clockwise and counter clockwise direction as well as rotate the swivel mechanism 20 degrees in each direction from its neutral position.
- 3.7.1.3.** The operating pressure necessary to operate any and all hydraulic systems on the trailer (simultaneously if possible) must be no greater than 75% of the max operating pressure of the hydraulic power unit.
- 3.7.1.4.** The hydraulic power unit must be provided with a stand alone support frame.

- 3.7.1.5. The support frame must have an integral means to be secured to the skid without additional tie-down equipment while under transit and removable from the Boom Reel Skid.
- 3.7.1.6. The hydraulic power unit must be fitted with the opposing, equivalent-sized fitting to accept each hydraulic hose assembly. The Contractor must group these fittings in a single location on the HPU that is easily accessible to the operator.
- 3.7.1.7. At a minimum, the hydraulic power unit must comprise the following components or systems:
 - a) A diesel engine to serve as the prime mover;
 - b) A positive displacement, hydraulic pump to pair with the diesel engine;
 - c) A planetary gear drive for maximum torque;
 - d) A hydraulic oil reservoir, complete with suction and return filtration;

All flexible hoses, valves, and fittings required to form closed circuits and protect against undue damage (e.g., over-pressurization); and

 - e) All instrumentation needed to monitor the diesel engine, and control and monitor the output of the hydraulic pump.

3.7.2. SUPPORT FRAME CONSTRUCTION

- 3.7.2.1. Each support frame must be fabricated from welded aluminum extruded (or rolled) tubular frame members.
- 3.7.2.2. There must be a square or rectangular footprint for the base structure of each support frame.
- 3.7.2.3. Any open ends of the tubular frame members must be capped with plate to ensure a fully closed construction.
- 3.7.2.4. The support frame must be fitted with tie-down points to securely hold the weather cover specified in 3.7.6.
- 3.7.2.5. Each plate cap must be:
 - a) Cut to an appropriate size to ensure that it does not protrude from the exterior surfaces of the adjoining frame member; and
 - b) Of similar thickness to the wall thickness of the adjoining frame member.

3.7.3. HYDRAULIC RESERVOIR AND SUPPORTING SYSTEMS

- 3.7.3.1. The hydraulic oil reservoir must be fitted to the hydraulic power unit in a readily accessible location for the operator.
- 3.7.3.2. The volume of the hydraulic oil reservoir must be sized such to meet the rated flow demands of the hydraulic pump and sufficiently dissipate heat from the hydraulic oil.

- 3.7.3.3. The hydraulic oil reservoir must be fabricated from aluminium or stainless steel.
- 3.7.3.4. The hydraulic oil reservoir must be fitted with a replenishment port (complete with cap) to facilitate filling.
- 3.7.3.5. The hydraulic oil reservoir must be fitted with a dedicated female end fitting (if applicable) (as per 3.9.1.2.) to accept each case drain hydraulic hose assembly from the Boom Reel.
- 3.7.3.6. The hydraulic oil reservoir must be fitted with a sight glass to monitor the hydraulic oil level and temperature.
- 3.7.3.7. The supply line of the hydraulic oil reservoir must be fitted with a suction strainer to remove sediment.
- 3.7.3.8. The return line of the hydraulic oil reservoir must be fitted with a replaceable filter.

3.7.4. CONTROL PANEL

- 3.7.4.1. The Contractor must fit the hydraulic power unit with a dedicated control panel, in a location that is readily accessible to an operator standing at ground level.
- 3.7.4.2. The control panel must be configured in accordance with the relevant best practices identified in ASTM F1166-07 (2013), Standard Practice for Human Engineering Design for Marine Systems, Equipment, and Facilities.
- 3.7.4.3. The control panel must be properly isolated from vibration.
- 3.7.4.4. The control panel must have a means to be illuminated to ensure legibility of instrumentation and controls when operating in complete darkness.
- 3.7.4.5. At a minimum, the Contractor must supply and furnish the control panel with the following instrumentation and controls:
 - a) An analog gauge to monitor the pressure of the hydraulic oil;
 - b) A throttling valve (or equivalent) to regulate the flow of hydraulic oil to the hydraulic motor; and
 - c) A three-position start switch (i.e., OFF-RUN-START) to activate the diesel engine.
 - d) An analog, running hour meter for the diesel engine;
 - e) An analog gauge to monitor the pressure of the diesel engine lubricating oil;
 - f) A redundant set of Boom Reel and Swivel Mechanism controls as described in 3.7.5.4a) and 3.7.5.4b) respectfully; and
 - g) A mechanical stop system that immediately halts all boom reel and swivel mechanism rotation and shuts down the HPU.
- 3.7.4.6. Unless otherwise specified, each valve must be marked with an arrow which indicates the direction of movement that will result in a change of rotational direction or an increased response.

3.7.4.7. The dial size of each gauge must be at least 2 in.

3.7.4.8. Each gauge must be designed with a contrasting background and marking(s) to ensure legibility.

3.7.5. REMOTE CONTROL

3.7.5.1. The Contractor must provide a remote control to control reel speed and direction of rotation for the Boom Reel, as well as swivel speed and direction of rotation for the swivel mechanism.

3.7.5.2. Remove

3.7.5.3. There must be a housing on the HPU of the skid to secure the remote control while it is not in use.

3.7.5.4. At a minimum, the Contractor must supply and furnish the remote control with the following instrumentation and controls:

- a) A lever that controls the clockwise and counter clockwise rotation of the reel. The reel rotational speed must be continuously variable until the lever is in its furthest position from neutral causing the reel to rotate at its maximum speed;
- b) A lever that controls the clockwise and counter clockwise rotation of the swivel mechanism. The swivel mechanism's rotational speed must be continuously variable until the lever is in its furthest position from neutral causing the swivel mechanism to rotate at its maximum speed;
- c) A mechanical or electrical stop system that immediately halts all reel and swivel rotation and shuts down the hydraulic power unit.;
- d) Remove
- e) Remove

3.7.5.5. Both levers for the remote control must be designed so that when they are in the neutral position rotational movement for the reel and swivel mechanism is suspended, and can only be turned if the manual bypass valves have been opened.

3.7.5.6. The Remote Control must have a means to be illuminated to ensure the legibility of the levers when operating in complete darkness.

3.7.5.7. For a wired remote control, the lines that connect to the remote control must:

- a) Allow its operation at a safe distance away from the reel.
- b) Be bundled together to facilitate handling and minimize hose contamination (if applicable).
- c) Remove

3.7.6. WEATHER COVER

- 3.7.6.1. The Contractor must supply a weather cover for each HPU provided to completely protect the HPU from environmental conditions defined in 3.1.2.
- 3.7.6.2. The Weather Cover must be made from synthetic fabrics providing resistance to ultraviolet (UV) degradation and embrittlement.
- 3.7.6.3. The Weather Cover must be lightweight and compact to store.
- 3.7.6.4. The Weather Cover must fully enclose the HPU.
- 3.7.6.5. The Weather Cover must tightly attach to the HPU in a manner that ensures the cover doesn't loosen or cause excessive drag on the trailer at the highway speed identified in 3.2.6.1.b.
- 3.7.6.6. The Weather Cover must attach and completely detach from the HPU without the use of tools.
- 3.7.6.7. The weather cover must be reinforced at all points (e.g., grommets) where it attaches to the support frame.
- 3.7.6.8. The attachment points must be evenly spaced around the perimeter of the weather cover.
- 3.7.6.9. The attachment points must be situated to align with the tie down points specified in Section 3.7.2.4.

3.8. HYDRAULIC PUMPS AND MOTORS

3.8.1. GENERAL CONSIDERATIONS

- 3.8.1.1. Any fitted hydraulic pump and hydraulic motor must be an off-the-shelf product.
- 3.8.1.2. Any fitted hydraulic pump and hydraulic motor must be a fixed-displacement type. The Contractor may propose a variable-displacement hydraulic pump for consideration by Canada. **The use of a back-driven hydraulic motor to serve as a pump (and the converse) is prohibited.**
- 3.8.1.3. The hydraulic motors must support clockwise and counter-clockwise rotation.
- 3.8.1.4. Any fitted hydraulic pump and hydraulic motor must be as compact as possible.
- 3.8.1.5. The hydraulic pump must operate under continuous, intermittent, and stalled conditions without inflicting damage upon itself or the adjoining hydraulic circuit.
- 3.8.1.6. The hydraulic motor must operate under continuous, intermittent, reversing, and stalled conditions without inflicting damage upon itself or the adjoining hydraulic circuit.
- 3.8.1.7. Any fitted hydraulic pump and hydraulic motor must be self-lubricating, with no provision other than the circulating hydraulic oil.

- 3.8.1.8.** Any fitted hydraulic pump must be equipped with an integral means to protect against over-pressurization, if a separate pressure relief device is not fitted to the adjoining hydraulic circuit.
- 3.8.1.9.** The rotating components of any fitted hydraulic pump and hydraulic motor must be inherently balanced such to minimize vibratory forces.
- 3.8.1.10.** Any fitted hydraulic pump and hydraulic motor must be equipped with integral flanges or mounts to facilitate attachment to a support structure.
- 3.8.1.11.** The inlet, outlet, and case drain (if applicable) ports of any fitted hydraulic pump and hydraulic motor must terminate in bosses integral to its casing.
- 3.8.1.12.** The inlet, outlet, and case drain (if applicable) ports must be identified with clear and permanent markings.

3.8.2. HYDRAULIC DRIVE SYSTEM

- 3.8.2.1.** The Contractor must size the complete hydraulic drive system to optimize performance. At a minimum:
 - a) The rated output parameters of the hydraulic pump (e.g., pressure and flowrate) must match the equivalent rated input parameters of the hydraulic motor; and
 - b) The rated input parameters of the hydraulic pump (e.g., power, rotational speed, and direction of rotation) must match the equivalent rated output parameters of the prime mover.

3.9. HYDRAULIC HOSE ASSEMBLIES

3.9.1. GENERAL CONSIDERATIONS

- 3.9.1.1.** All hydraulic hose assemblies must conform to the applicable requirements defined in SAE J1942, Hose and Hose Assemblies for Marine Applications.
- 3.9.1.2.** Hydraulic hose assemblies that require frequent removal and reattachment must use end fittings that conform to the requirements defined in ISO 7241:2014, Hydraulic Fluid Power – Dimensions and Requirements of Quick-Action Couplings.
- 3.9.1.3.** All hydraulic end fittings must conform to those requirements defined in SAE J1475, Hydraulic Hose Fitting for Marine Applications.
- 3.9.1.4.** All hydraulic end fittings must be fabricated from stainless steel.
- 3.9.1.5.** The length of all fitted, flexible hose assemblies must be sized to minimize response lag and pressure losses while still allowing for hose contraction.
- 3.9.1.6.** The bend radius of all fitted, flexible hose assemblies must be greater than the minimum value recommended by the OEM.

- 3.9.1.7.** The minimum rated pressure of all fitted, flexible hose assemblies must exceed the working pressure that it may be subjected to while in service. All hydraulic hose assemblies must be static pressure tested at 1.5 times their rated working pressure for a minimum of 30 minutes to confirm no leakage.
- 3.9.1.8.** Additional mechanical protection must be provided for all fitted, flexible hose assemblies susceptible to chafing.
- 3.9.1.9.** A reusable dust cap or plug must be attached to any free ends of those hydraulic hose assemblies with the fittings.

3.9.2. HYDRAULIC POWER UNIT TO BOOM REEL AND SWIVEL MECHANISM CONNECTIONS

- 3.9.2.1.** The Contractor must supply all hydraulic hose assemblies needed to connect the hydraulic power unit to the Boom Reel, Swivel Mechanism, and remote control (if applicable).
- 3.9.2.2.** To preclude misconnections, the hydraulic hose assemblies that connect the hydraulic power unit to the Boom Reel, Swivel Mechanism and remote control (if applicable) must conform to the following requirements:
 - a) The nominal diameter of the supply and return hydraulic hose assemblies must be the same.
 - b) The nominal diameter of the case drain hydraulic hose assembly (if applicable) must be smaller than the supply and return hydraulic assemblies.

Following Canada's acceptance of the First Article Test results (as per the SOW, Annex A, DID-SE-03 - First Article Test Report), the Contractor must use identical hydraulic hose assemblies in all subsequent Boom Reel Trailer System deliveries (unless otherwise specified by Canada).

- 3.9.2.3.** Each hydraulic hose assembly that connects the hydraulic power unit to the Boom Reel, Swivel Mechanism and remote control (if applicable) must be equipped with a male end fitting (as per 3.9.1.2) on one free end, and a female end fitting (as per 3.9.1.2) on the opposing free end.
- 3.9.2.4.** All hydraulic end fittings (as per 3.9.1.23.9.1.2) must be consistent with the hose sizes determined by the Contractor to safely connect the hydraulic power unit to the Boom Reel.

- 3.9.2.5.** The hydraulic hose assemblies that connect the hydraulic power unit to the Boom Reel, Swivel Mechanism, and remote control (if applicable) must be bundled together to facilitate handling and minimize hose contamination.
- 3.9.2.6.** The Contractor must supply an off-the-shelf tool to relieve built-up pressure in the disconnected hydraulic hose assemblies and facilitate their re-connection to the hydraulic power unit and boom reel.

3.10. DIESEL ENGINE

3.10.1. GENERAL CONSIDERATIONS

- 3.10.1.1.** The Contractor must supply an off-the-shelf, 4-stroke, diesel engine to serve as the prime mover where specified herein. For example, a Yanmar L-series engine is acceptable.
- 3.10.1.2.** All diesel engines supplied by the Contractor must be of the same make and model to simplify maintenance and minimize the number of unique spares.
- 3.10.1.3.** Each diesel engine must be furnished with fuel hoses that conform to the requirements prescribed in SAE J1527, Marine Fuel Hoses.
- 3.10.1.4.** The Contractor must adhere to the diesel engine break-in procedure prescribed by the engine manufacturer.
- 3.10.1.5.** Each diesel engine supplied in the Boom Reel Trailer System must satisfy the pertinent Tier 4 emission standards referenced in SOR/2005-32, Off-Road Compression-Ignition Engine Emission Regulations.

3.10.2. DIESEL ENGINE ACCESSORIES

- 3.10.2.1.** All diesel engine accessories must be furnished (or approved) by the engine manufacturer or an authorized representative.
- 3.10.2.2.** At a minimum, each diesel engine must be furnished with the following accessories:
 - a) A dry-type air cleaner to remove dust and abrasives from the combustion air;
 - b) A direct current, electric starting motor, complete with storage battery, charging dynamo or alternator, and voltage regulator;
 - c) A back-up, recoil starting system, complete with a decompression valve to facilitate engine cranking;
 - d) One or more aids to facilitate engine starting at low temperatures;
 - e) A fuel tank of sufficient capacity to satisfy the endurance requirements specified herein;
 - f) A replaceable fuel filter and fuel strainer;
 - g) A manual fuel shut-off valve;
 - h) A mechanical governing system to regulate engine speed; and
 - i) A spark arrestor.

3.10.2.3. The Contractor may supplement the furnished fuel tank with a larger sized tank, subject to the approval of Canada.

3.10.2.4. The fuel tank must be fitted with a means to manually monitor the diesel fuel level.

3.10.3. DRIVE COUPLING

3.10.3.1. The driveshaft of each diesel engine must be directly coupled to the driveshaft of any piece of equipment requiring a rotational, mechanical input.

3.10.3.2. The drive coupling must be sized in accordance with the rated power output of the diesel engine.

3.10.3.3. The drive coupling must minimize any misalignment between the driveshafts in running operation to ensure an efficient transmission of power.

3.10.3.4. A shear section should be interposed between the driveshafts to protect the driven equipment from overload and possible damage.

3.11. RIGGING AND HOISTING

3.11.1. GENERAL CONSIDERATIONS

3.11.1.1. The Boom Reel Skid must be designed to be lifted off the trailer bed when fully loaded with 3000 lbs of fence boom and used independently of the rest of the system.

3.11.1.2. The minimum safety factor of all hoisting points and the adjacent support structure must be at least 6-to-1; i.e., the ratio of the minimum breaking strength (MBS) to the working load limit (WLL). Design calculations supporting the safety factor of all rigging attachments must be stamped by a licensed Canadian engineer in good standing.

3.11.1.3. The fully loaded Boom Reel Skid (skid + 3000 lbs of fence boom) must be designed to be lifted off the trailer bed with the HPU attached and without the HPU attached.

3.11.1.4. All lifting slings and equipment necessary to lift the Boom Reel Skid from a single, overhead lifting point must be provided for each system.

3.11.2. HOISTING POINTS

3.11.2.1. The Boom Reel Skid must be fitted with a minimum of two, integral hoisting points to facilitate overhead lifting or use the ISO corner fittings on the Boom Reel Skid as hoisting points.

3.11.2.2. For a given piece of an equipment, the Contractor must position each hoisting point:

- a) To uniformly distribute loading amongst all hoisting points; and
- b) To give an unobstructed pathway to a single, overhead lifting point.

3.11.2.3. All hoisting points on a given piece of equipment must be of equivalent size.

- 3.11.2.4. All hoisting points must be tested and certified with a hard copy of the certifications provided with the operations and maintenance manual.
- 3.11.2.5. The HPU must be fitted with a minimum of two, integral hoisting points to facilitate overhead lifting.

3.12. FABRICATION

3.12.1. WORKMANSHIP

- 3.12.1.1. Each Boom Reel Trailer System must be constructed and finished with a high degree of workmanship:
 - a) Surfaces must be free from blemishes, burrs, defects, irregularities, sharp edges, and other conditions that would be deleterious to the finished component;
 - b) Parts must be properly aligned to preclude any binding and deformation as a result of assembly or operation; and
 - c) All welds and coatings must be uniform, complete, and free of cracks, porosity, and scratches.

3.12.2. METAL WELDING

- 3.12.2.1. All welds performed as part of this contract, and all entities performing welding, must meet all the requirements in Appendix A.

3.12.3. EQUIPMENT CARE AND PROTECTION

- 3.12.3.1. All parts and equipment must be kept clean and protected against dust, moisture, rapid temperature changes, and foreign matter during manufacture, storage, pre-installation staging, assembly, installation, and post-installation.
- 3.12.3.2. The Contractor must store, use and install all items as per manufacturer's requirements and recommendations.

3.13. MATERIALS

3.13.1. GENERAL CONSIDERATIONS

- 3.13.1.1. All materials used in the System must:
 - a) Be of marine-grade quality, unless otherwise specified, and inherently resist corrosion under the environmental conditions specified herein;
 - b) Limit the absorption of water and recovered oil products to facilitate cleaning after use;
 - c) Be chemically compatible with recovered oil products;
 - d) Be resistant to ultraviolet (UV) degradation;

- e) Be selected to comply with the performance requirements specified herein;
- f) Conform to the requirements defined in an internationally recognized standard, such as ASTM, ISO, or SAE Standards. Canada may request samples of any proposed material;
- g) Be sized to withstand the loading conditions that will be experienced during transportation, operation, and storage; and
- h) Not adversely affect the health of personnel when used for its intended purpose.

3.13.2. METAL ALLOYS

- 3.13.2.1.** Any chain supplied with the System must meet Grade 70 designation as per ASTM A413/A413M-07, Standard Specification for Carbon Steel Chain or an equivalent NACM standard.
- 3.13.2.2.** All carbon steel used in the System must be hot-dip galvanized as per ASTM A123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- 3.13.2.3.** Prior to hot-dip galvanizing any carbon steel, the material to be galvanized must be thoroughly cleaned of any foreign matter, debris, or slag from welding to ensure a clean galvanized finish. Unless otherwise specified, the Contractor must eliminate welding of parts to carbon steel that has already been galvanized.

3.13.3. ELASTOMERS

- 3.13.3.1.** All elastomeric materials in unassembled components and assemblies (including, but not limited to, gaskets and O-rings) must contain at least 90% of the authorized shelf-life as listed in ISO 2230:2002, Rubber Products – Guidelines for Storage, at the date of delivery to Canada, unless otherwise specified by Canada.

3.13.4. DISSIMILAR METALS

- 3.13.4.1.** Direct contact between dissimilar metals expected to cause galvanic corrosion must be avoided. If such contact cannot be avoided, an insulating material must be installed between the dissimilar metals to minimize the corrosive effect. The Contractor may propose alternative methods to minimize galvanic corrosion for consideration by Canada.

3.13.5. HAZARDOUS MATERIALS

- 3.13.5.1.** The Contractor must comply with the current version of the Hazardous Products Act of Canada concerning the use of hazardous materials, ozone depleting substances, polychlorinated biphenyls, asbestos, and heavy metals used in the manufacture and assembly of the product supplied.

3.14. FASTENERS, HARDWARE, AND LUBRICANTS

3.14.1. GENERAL CONSIDERATIONS

- 3.14.1.1.** Unless otherwise specified by Canada:

- a) All fasteners, nuts, and similar hardware used by the Contractor must be galvanized carbon grade steel. The Contractor may propose high alloy or stainless steel(s) for consideration by Canada; and
- b) All threaded fasteners must be paired with a corresponding nylon-insert, lock nut to resist loosening due to shock and vibration loading.

3.14.1.2. Fasteners must be easily removable if the adjoining component requires removal or permits access for maintenance.

3.14.1.3. All threaded fasteners and associated hardware must conform to the dimensions and tolerances defined in an internationally recognized Standards, such as, but not limited to ASME, ASTM, ISO, or SAE Standards.

3.14.1.4. Threaded connections by tapping aluminum structural components are not permitted. Similarly, threaded connections by tapping steel structural components whose thickness is less than one bolt diameter, are not permitted. Where direct threading is required in these circumstances, helical coil, galvanically-compatible, threaded inserts must be used.

3.14.1.5. All nuts that will become inaccessible after fabrication must be captured (or anchored) to prevent them from backing off if the threaded fastener is later removed.

3.14.1.6. All threaded connections must be correctly torqued.

3.14.2. LUBRICANTS

3.14.2.1. The Trailer must be serviced with manufacturer's standard synthetic non-proprietary lubricants and fluids.

3.14.2.2. Lubrication fittings must conform to SAE J534 – Lubrication Fittings, or an equivalent North American Standard.

3.15. LABEL PLATES

3.15.1. GENERAL CONSIDERATIONS

3.15.1.1. The Contractor must supply and fit label plates to identify each control, switch, gauge, and display. Label plates must also be used to indicate safe working limits, maximum capacities, and masses, as applicable, of equipment.

3.15.1.2. Unless otherwise specified by Canada, all label plates must be made from aluminum. Label plates must be secured with reusable fasteners.

3.15.1.3. All label plates must:

- a) Be engraved to a suitable depth or using a suitable technique that will last a minimum of 15 years under typical use; and
- b) Be bilingual.

- 3.15.1.4.** The content and arrangement of all label plates must be approved by the Technical Authority prior to installation.

3.15.2. PRODUCT IDENTIFIERS

- 3.15.2.1.** The Contractor must supply and fit the following components of the System with a product identifier:

- a) Boom Reel Skid
- b) Trailer frame, near the Trailer capacity marked on the drawbar.

- 3.15.2.2.** Each product identifier must:

- a) Use alphanumeric characters to indicate the name of the manufacturer, date of manufacture, and manufacturer serial number;
- b) Contain no spaces between the individual elements that compose the identifier; and
- c) Adhere to the following convention:
 - i. Use four uppercase letters that best represent the name of the manufacturer as the first element of the product identifier. Canada reserves the right to review, and accept or reject the first element proposed by the Contractor for self-identification.
 - ii. Use eight numeric digits that correspond to the following format for the second element of the product identifier: DDMMYYYY (where DD represents the two-digit day, MM represents the two-digit month, and YYYY represents the four-digit year.
 - iii. Use the full, alphanumeric serial number assigned by the manufacturer for the last element of the product identifier.

3.16. PAINTINGS AND COATINGS

3.16.1. GENERAL CONSIDERATIONS

- 3.16.1.1.** The Trailer must be finished in a manner that is designed to protect the exterior surfaces from the environmental conditions specified in 3.1.2.

- 3.16.1.2.** Unless otherwise specified by Canada:

- a) All metallic surfaces of the System must be cleaned and left unpainted (i.e., raw aluminum, stainless steel); and
- b) Any coating(s) on off-the-shelf products must be applied by the OEM.

3.17. SHIPPING AND DELIVERY

3.17.1. GENERAL CONSIDERATIONS

3.17.1.1. Prior to shipping, the Contractor must:

- a) Thoroughly clean all items to remove foreign matter;
- b) Thoroughly dry all items to remove residual cleaning solution(s) or moisture;
- c) Clean, dry, and preserve items in a manner that does not damage the item, impair its function, or void the implied or expressed manufacturer warranty; and
- d) Cushion, brace, and block (as required) all items within the System to prevent possible damage during shipment, with the use of loose fill materials (e.g., shredded paper) for cushioning, fill, stuffing, and dunnage prohibited.

3.17.1.2. The System must only be delivered under tow if the total distance doesn't exceed 800 kilometres (km). If the distance exceeds 800 km the Contractor must find other means of transportation.

3.17.2. MAJOR EQUIPMENT

3.17.2.1. Each diesel engine, hydraulic pump, and hydraulic motor must be preserved (in accordance with OEM recommendations) for storage up to one year in an environment that will be subjected to temperatures below 0°C. For each Boom Reel Trailer System, this one year period commences upon delivery.

3.17.2.2. Each fuel tank must be full and treated with an off-the-shelf fuel stabilizer.

3.17.2.3. Battery cables must be disconnected from their terminals and secured to prevent accidental re-contact with the battery terminals during shipping. All battery terminals must be coated in di-electric grease.

3.17.2.4. Each inlet and outlet opening of all major equipment defined in 3.17.2.1 must be appropriately sealed to protect against the ingress of foreign matter.

3.17.3. HOSE ASSEMBLIES AND FITTINGS

3.17.3.1. All hose assemblies must be neatly coiled.

3.17.3.2. Each coil must be uniform, compact, and of a diameter that prevents deformation or kinking of the hose.

3.17.3.3. Each coil must be secured approximately equidistance in a minimum of three places.

3.17.3.4. The free ends of each hose assembly must be sealed with the appropriate plug or cap to protect against the ingress of foreign matter.

3.18. DOCUMENTATION

3.18.1. GENERAL CONSIDERATIONS

- 3.18.1.1.** The Equipment Operating Illustrations as per DID-TM-04 supplied with the Boom Reel Trailer System must be secured to the inside of the storage box and be waterproof to withstand a marine environment (for example, laminated pages or specialized paper). The Contractor may propose various waterproofing solutions for consideration by Canada.
- 3.18.1.2.** At a minimum, the Operation and Maintenance Manual as per DID-TM-01 must be stored in the dedicated aluminum provision (as per Section 3.4.1.5) within the storage box following acceptance by Canada.

Appendix A - Welding and Weld Examination

Steel – Weld Procedure and Welding Personnel Qualification Requirements

The contractor or subcontractors performing the welding of steel must meet one of the following requirements for qualification of welding procedures and welding personnel – welding supervisors, welders and tack welders:

1. Certification by the Canadian Welding Bureau (CWB) to CSA Standard W47.1-2019 Division 1, 2 or 3.
2. Certification by an International Institute of Welding (IIW) Authorized National Body for Company Certification (ANBCC) to ISO Standard 3834 – 1, 2 or 3.
3. Third party accredited organization administration of American Welding Society (AWS) D1.1: 2015– Structural Welding Code Steel

Aluminum – Weld Procedure and Welding Personnel Qualification Requirements

The contractor or subcontractors performing the welding of aluminum must meet one of the following requirements for qualification of welding procedures and welding personnel – welding supervisors, welders and tack welders:

1. Certification by the Canadian Welding Bureau (CWB) to CSA Standard W47.2-2011 (R2015) Division 1, 2 or 3.
2. Certification by an International Institute of Welding (IIW) Authorized National Body for Company Certification (ANBCC) to ISO Standard 3834 – 1, 2 or 3.
3. Third party accredited organization administration of American Welding Society (AWS) D1.2: 2014 – Structural Welding Code Aluminum

Welding Engineer – Steel and Aluminum

The contractor or subcontractors performing the welding of steel and/or aluminum must employ or retain the services of a Welding Engineer responsible for weld design, procedures, workmanship and technique. The individual must be accredited as a Welding Engineer by one of the following authorized third party administrative organizations:

1. Canadian Welding Bureau (CWB).
2. International Institute of Welding (IIW) Authorized National Body for Company Certification (ANBCC).

Weld Design – Steel and Aluminum

The design of welded connections must be included in the fabrication drawings and display the Contractor's accredited Welding Engineer's stamp of acceptance.

Unless otherwise agreed to by the Canadian Coast Guard Technical Authority (CCG TA), all welds in butt joints must be complete joint penetration and all fillet welds must be double continuous.

Weld design, effective throat for butt joints and throat and leg length for fillet welds, will be as indicated on the stamped fabrication drawing (s).

Welding must only be carried out following the Welding Engineer's approved design of welded connections.

Welding Procedures – Steel and Aluminum

Welding must only be carried out following welding specifications and supporting weld procedure data sheets displaying the acceptance stamp of the Contractor's accredited Welding Engineer. In addition the weld procedure data sheets must display the stamp of the CWB's procedures department where required by the CSA Standards for company certification by the CWB.

The welding specifications and weld procedure data sheets planned to be used in production must be given to the CCG TA at the kick-off meeting. Welding specifications and weld procedure data sheets developed after the kick-off meeting must be submitted to the CCG TA a minimum of one (1) week prior to their use for welding operations.

Welding specifications and weld procedure data sheets only containing the stamp of the Contractor's Welding Engineer and not containing the stamp of the CWB's procedures department must be supported by Procedure Qualification Records (PQRs).

Welding Personnel – Steel and Aluminum

Welding must only be conducted by currently qualified individuals.

Welder performance qualification cards and government issued photo ID must be filed with the CCG TA prior to performing any welding work.

Workmanship – Steel and Aluminum

Fitted tolerances, preheat and other related workmanship and technique items must meet the requirements of Clause 5 of CSA Standards W59-2018 for steel and W59.2-2018 for aluminum.

Weld Inspection Requirements – Steel and Aluminum

All welds must be visually examined their entire length by an independent 3rd party supplied by the CCG. CCG supplied 3rd party inspectors will be certified Level 2 or 3 to CSA Standard W178.2:18 or AWS QC1.

Safe access must be given to the CCG TA and third party inspector (s) by the Contractor. Visual examination of welds must follow procedures that are generally compliant with the established requirements of ASME BPVC-V-2019, Article 9. Where the lighting, viewing distance and viewing angle requirements for direct visual examination can't be met, then remote or translucent visual examination following the requirements of ASME BPVC-V-2019, Article 9 must be used by the third party inspector with the express consent of the CCG TA.

Visual examination of welds must occur in the as-welded condition after removing slag, spatter, magnesium oxide smut and wire brushing. Weld profiles must not be altered by any means prior to visual examination and fairing compounds, fillers, primers and/or paints must not be applied to the visible surfaces of welds prior to visual examination.

The acceptance standards for visual examination is as follows:

- Weld toes must blend smoothly into the base metal at each side of the weld.
- There must be no overlap, no undercut, no visible porosity, no cracks, no visible fusion faults.
- Welds must not have undersized leg lengths or throat sizes
- Fillet welds must not have leg lengths or throat sizes greater than 2 mm of the required amount.
- Convexity for fillet welds must not exceed 2 mm.
- Excess weld metal for groove welds in butt joints must not exceed 3 mm.

- Craters must be filled with weld metal.

A copy of the visual inspector's qualification card as well as the written visual examination procedure to be followed must be filed with the CCG TA prior to any examinations taking place.

A formal report must be provided by the third party inspector to the CCG TA indicating acceptance or rejection of the welds to the acceptance criterion herein prior to scheduling CCG TA acceptance examinations.

Welds not meeting the acceptance standards for visual examination specified herein must not be repaired without the express consent of the CCG TA.

The contractor is solely responsible for the repair of welds not meeting the acceptance standards for visual examination specified herein.

A weld that is found to be unacceptable in accordance with the acceptance criterion herein, must not be repaired more than twice.

If the second repair attempt fails, the affected material and welds must be removed and new material fitted and welded to the original requirements of this Specification.

The CCG TA will at its discretion engage the CWB to perform welding audits of the Contractor at the place where welding work takes place at a frequency deemed necessary by the CCG TA. As a minimum, welding audits will take place prior to the start of welding, during welding and on the completion of welding.