

Statement of Work – Appendix A

Design, supply and installation of a new Hydraulic Distribution line For NRC’s Automotive and Surface Transportation Portfolio

This Statement of Work (SOW) covers the requirements to install a new hydraulic distribution line from two new Hydraulic Power Units to six hydraulic actuators to be completed at the NRC AST U-89 building, 2320 Lester Road, located in Ottawa, ON.

1. About Automotive and Surface Transportation Portfolio

NRC Automotive and Surface Transportation (AST) performs research, technology development and demonstration aimed at helping the entire automotive supply chain, providing technology solutions ranging from targeted component development, advanced manufacturing process and prototype development, evaluation and testing, fuel efficiency, aerodynamic performance, power management, vehicle intelligence, climatic challenges, safety, and environmental impact.

2. Project Description

The National Research Council of Canada, Automotive and Surface Transportation Portfolio (NRC-AST), in Ottawa, ON recently installed two MTS 515.180 SilentFlo Hydraulic Power Units that will be used in the U-89 Dynamic’s Bay facility. The two units have been installed in a new building and need to be connected to the main facility. The project includes the necessary hydraulic connections between U89-B to U89 as well as the necessary hydraulic lines to run along the interior wall of the testing facility and allow the pumps to be connected to the existing actuators.

3. Existing Documentation

NRC has received a detailed drawing package from the pump manufactures, MTS Corporate Services. This drawing package is part of this SOW and is the main reference to the development of this package.

Drawings provided as part of this SOW are not for construction. Selected contractor is responsible to review and confirm all site information, dimensions and limitations prior to commence any work.

The following drawings/documents are provided to assist in defining the scope of supply of this project.

Item	Format	Alternate format
MTS Hydraulic line drawings	Soft copy	.dwg
Installation location and future expansion boundaries	Soft copy	-
MTS 515 series catalog	Soft copy	-

MTS 515.180 General Assembly drawings	Soft copy	-
MTS 515 series complete specifications	Soft copy	-

3.1 Installed pump information

NRC purchased and installed two brand new Hydraulic power units. The units have been supplied by MTS Systems Corporation, and are part of the 515 series, model 515.180. A catalog/cut-sheet is provided as part of this statement of work in section E. The General assembly drawings are provided as part of Section G and the complete specification data information is provided as part of section F.

Pumps have been tested on site in March, 2017 for delivery acceptance. After hydraulic line installation a new test will be performed to verify working conditions. This test will be the responsibility of the pump manufacturer/supplier. Contract to provide site support during testing.

4. Proposal for the work

Before submitting a proposal a mandatory site visit is required to verify the details involved in this scope of work. Site visits will be specified in the tender package.

Questions raised during the visitation will be answered in 24 hrs.

Visit shall be confirmed with Mr. Alexander Nitsche via email: alexander.nitsche@nrc-cnrc.gc.ca

4.1 Scope of work

Scope of work shall be in accordance with section A of this Statement of work.

The following items are to be completed as part of this project

1. New Hydraulic distribution line from the Hydraulic power units installed at U-89B to the actuators installed in U-89, including:

- Design of the distribution line, based on the provided drawings, as per local and federal norms and regulations, including any requirements for engineering review and approval;
 - Design shall provide all dimensions, materials, processes to comply with local and federal norms and regulations and to allow easy substitution of materials and components.
- Design of two future hydraulic lines to be connected to the hydraulic line installed, as per NRC drawings, those two lines will not be installed under this scope;
- Fabrication of the main hydraulic line approved design and supply of any appurtenances needed to ensure proper functionality of the installed line, i.e.: valves, supports, manifolds, caps, etc.
- Hydraulic line testing and quality report.

2. Complete concrete drilling between U-89B and U-89 to allow hydraulic line access.

Work will be completed at NRC AST facility building U89 and U-89B located at:

Automotive and Surface Transportation
2320 Lester Road,
Ottawa Ontario.

5. Deliverables

- Assembly drawings including all appurtenances cut sheets and line supports drawings
 - Engineering stamped drawings (as needed)
- Project documents as specified in Section A
- Hydraulic distribution line components, as specified in the attached drawings, including any substitutions and other components identified as needed in the tender proposal.
- Assembly and installation of the hydraulic line at NRC AST U-89 building
- Site testing/commissioning procedure
- Final quality report

6. Project Schedule

The following is a suggested schedule for some tasks involved in this project. Contractor is expected to provide a detailed schedule as part of their response to the tender. This project is part of a larger installation project. Any deviations from the schedule below will need to be reviewed by the project team, prior to start, in order to ensure all schedule impacts have been taken into consideration.

All days below are business days

Contract issued	– Day 0
Drawings and documentation	– 10 to 15 days
Material preparation	– 10 to 15 days
Crew mobilization	– 3 to 5 days
Site installation	– 15 days
Testing and commissioning	– 5 days

Expected duration – 55 days (floating 12 days)

A. STATEMENT OF WORK TECHNICAL SECTION

1. WORK DESCRIPTION

This section cover the installation of two Ø76.2mm I.D. x 33.5 m long (Ø3" I.D. x 110ft) hydraulic pipelines, supply and return, with four (4) distribution assemblies to feed a series of six (6) existing dynamic actuators. Along with a connection branch to connect the new hydraulic line to the existing MTS 515.180 Hydraulic power units.

2. EXISTING DRAWINGS

The Hydraulic distribution assembly line and its components design are to be based on the drawing package provided as part of section D. The following drawings are part of this package.

It	Title	Number	Rev	Pages
1	Hydraulic distribution assy-55867	100-342-836	A	9
2	Manifold-97mm w/(4) 2" C61 outlets	100-338-759	A	1
3	Manifold-90mm w/(4) 2" C61 outlets	100-338-760	A	1
4	Manifold, -32(2) with -12(4) outlets	100-338-769	A	1
5	Manifold, 90mm x 2" C61(2)	100-338-780	A	1
6	Manifold-line end, 97mm/2x 2" C61 outlets	100-338-781	A	1
7	Manifold-drain -20 (2), -32	100-338-782	A	1
8	Manifold-line end, 97mm/2x 2" C61 outlets	100-339-200	A	1
9	Manifold-offset, 90mm (2) x 2" C61(2)	100-339-202	A	1
10	Bracket-assy, hardline support 55867	100-342-776	A	1
11	Bracket-angle, hardline support 55867	100-342-778	A	1
12	Channel-support "C" channel 55867	100-342-779	A	1
13	Plate-bracket, hardline support 55687	100-342-780	A	1
14	Manifold-elbow 97 mm alum	100-166-276	A	1
15	Manifold-elbow 90 mm alum	100-166-277	A	1
16	Elbow-pipe weldment, 2" C61 sched 80	100-207-308	A	1
17	Hose Assy-drain, 1 1/4 nom, petro, base hydr. oil	068917-xx	E	1
18	Tubing-304 sst xxx 00 x xxx wall	100371-XX	D	3
19	Plug-port, 4 bolt flange	326985-xx	C	1
20	Adapter-4 Bolt to boss	351958-xx	A	1
21	Hose assy-pressure, 2" nom straight split flange, xx	439240-xx	H	2
22	Hose assy-return, 2" nom straight split flange, xx	439241-xx	J	2
23	Valve check 2 in	475732-xx	F	1
24	Flange kit-sae, with o-ring	527984-xx	C	1
25	Pipe assy-return, straight, 90mm O.D.	571371-xx	C	1
26	Accumulator-piston, T seal crn, 7" dia	575811-xx	F	2
27	Clamp assy-weld, 97/90/2.00"	579774-xx	A	1
28	Pipe assy-press, 97mm x 12 mm	579820-xx	D	1
29	Plate-blocking, pressure 97mm flange	545520-01	A	1
30	Hose assy-pressure, 2" nom straight split flange, xx"	439240-xx	H	2

31	Bill of Material ASSY 55867	n/a	n/a	1
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Drawings and cut sheets provided as part of this package are for reference only (Not for construction). Supplier is expected to provide a set of construction drawings for approval prior to start of work and a set of as built drawing prior to project completion.

3. PROJECT MANAGEMENT REQUIREMENTS

After award of the contract, the selected supplier will assign a Project Manager as a single point of contact for all matters related to the project. The supplier Project Manager will be responsible to communicate any project information to the NRC Project Manager, including but not limited to: Status Reports, Meeting agendas and minutes, Change Orders, design drawings, design reviews, etc.

Potential suppliers are expected to provide the following project documentation

Document	Type/format	Due date	Purpose	Notes
List of references	PDF	With proposal	Review supplier experience	
Certificate of compliance	PDF	KOM	Control	Supplier shall identify all compliant and non-compliant items (if any), as well as all proposed substitutions in the certificate.
Project schedule with Milestone list	PDF	KOM	Review	Critical Path Method shall be used
Risk/issue Register	XLS/PDF	5 days after KOM	Control and review	Template to be issued by NRC
Design drawings and cut sheets	DWG/PDF	5 days After KOM	Approval	Mechanical drawings P&ID drawings (if applicable) Installation drawings Cut sheets as needed
Approved equals / alternates list	PDF	15 days after KOM	Approval	List all approved equals for pre-approval by NRC prior to commence fabrication
Health and safety plan	PDF	15 days prior to commence work on site	Review	NRC will provide comments, but is not responsible for the Health and Safety plan contents.
Site acceptance testing template	PDF	30 days prior to SCG	Review and control	Specify all steps required to complete the test.
Site acceptance testing Report	PDF	10 days after SCG	Control and documentation	The document used during test shall be signed and send to NRC for record purposes.
As built final drawings	DWG/PDF	10 days After SCG	Control and documentation	(same as design drawings) One hard copy + soft copy
KOM – Kick off meeting SCG – Site commissioning				

4. PROJECT MEETINGS

Four (4) meetings are expected as part of this contract

- .1 Project kick off meeting;
- .2 Site pre-installation meeting;

- .3 Pre-testing meeting
- .4 Project close-out meeting
- .1 Contractor is responsible to schedule the meeting dates. NRC will support the contractor to identify a meeting location on site.
- .2 Contractor is responsible to prepare meeting agenda and minutes for each meeting as specified below.
 - .1 Project close-out meeting will be NRC's Project Manager responsibility.
- .3 Project kick off meeting

No longer than 5 days after award of Contract, request a meeting of parties in Contract to discuss and resolve administrative procedures and responsibilities prior to the commencement of the work.

- .2 Attendees at Contract start-up meeting shall include the following:
 - .1 Contractor's project authority.
 - .2 NRC Departmental Representative(s).
 - .3 Inspection and testing company (as applicable).
 - .4 Manufacturer's representatives (as applicable).
- .3 Agenda to include the following:
 - .1 Owner's guidelines and policies.
 - .2 Appointment of official representative of participants in this phase.
 - .3 Review of security clearances and procedures and review of hours of work at the NRC facility.
 - .4 Progress reporting and schedule review.
 - .5 Requirements for temporary facilities, signs, offices, storage sheds, utilities, fences.
 - .6 Security requirements at and for the site.
 - .7 Progress claims, administrative procedures, holdbacks.
 - .8 Insurances, transcripts of policies.
 - .9 Contractor's safety procedures.
 - .10 Workplace Safety.
- .4 Pre-Installation Meetings

During the course of the work prior to substantial performance, schedule pre-installation meetings as required by the contract documents or as directed by the NRC Departmental Representative.

- .1 Attendees at pre-installation meetings shall include the following:
 - .1 Contractor.
 - .2 Subcontractors affected by the work for which the pre-installation meeting is being conducted.
 - .3 NRC Departmental Representative(s).
 - .4 Manufacturer's representatives (as applicable).
 - .5 Inspection and testing company (as applicable).
- .2 Agenda to include the following
 - .1 Owner's guidelines and policies.
 - .2 Appointment of official representatives of participants in this phase.
 - .3 Review of existing conditions and affected work, and testing thereof as required.
 - .4 Review of installation procedures and requirements.

- .5 Review of environmental and site condition requirements.
 - .6 Schedule of the applicable portions of the work.
 - .7 Schedule of submissions for NRC Departmental Representative's consideration.
 - .8 Requirements for temporary facilities, site sign, offices, storage shed, utilities, fences.
 - .9 Requirements for inspections and tests, as applicable. Schedule and undertake inspections and tests.
 - .10 Delivery schedule of specified equipment.
 - .11 Special safety requirements and procedures.
- .5 Pre-testing meetings

After site installation has been completed, or nearly completed, and prior to site testing, schedule a pre-testing meeting as required by the contract documents or as directed by the NRC Departmental Representative.

- .1 Attendees at pre-installation meetings shall include the following:
 - .1 Contractor.
 - .2 Subcontractors affected by the work for which the pre-installation meeting is being conducted.
 - .3 NRC Departmental Representative.
 - .4 Manufacturer's representatives, as applicable.
 - .5 Inspection and testing company, as applicable.
 - .2 Agenda to include the following:
 - .1 Owner's guidelines and policies.
 - .2 Appointment of official representatives of participants in the project.
 - .3 Review of completed work
 - .4 Review of testing procedures and requirements.
 - .5 Schedule of the applicable portions of the work.
 - .6 Special safety requirements and procedures.
- .6 Special Meetings

NRC Departmental Representative reserve the right to require special meetings which may be held on short notice and at which attendance by Contractor and representatives of affected subcontractors and suppliers is mandatory. Contractor shall keep detailed and accurate meeting notes and distribute copies promptly to all in attendance and those affected by agreements made at such meetings.

5. PROJECT SUBMITTALS

Submit submittals as requested by the contract documents, as specified herein, and in accordance with the conditions of the Contract

5.1 NRC Departmental Representative's review of submittals:

- .1 Review of submittals by NRC Departmental Representative is for the sole purpose of ascertaining conformance with the general design concepts and the general intent of the contract documents. This review shall not mean that NRC Departmental Representative approves the detail design inherent in the submittals, responsibility for which shall remain with the Contractor. Such review shall not relieve the Contractor of responsibility for errors or omissions in the submittals, or

responsibility for meeting requirements of contract documents and federal and provincial standards and regulations.

- .2 Contractor shall be responsible for dimensions to be confirmed and correlated at the site for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work.
- .3 NRC Departmental Representative's review and markings on submittals do not authorize changes in the work or the contract time, and will be accommodated at no additional cost to NRC. If, in the opinion of the Contractor, the NRC Departmental Representative's markings on submittals constitute a change in the work or will effect a change in the contract time, then the Contractor shall so notify the NRC Departmental Representative in writing and request an interpretation. If the NRC Departmental Representative finds that the NRC Departmental Representative's markings on submittals do constitute a change in the work or will effect a change in the contract time, then a change order will be prepared therefore. The time taken to process such a request for interpretation shall not, in and of itself, constitute a change in the work nor increase the contract time.
- .4 Prepare submittals using SI (metric) units.

5.2 Engineered submittals:

- .1 It is the contractor responsibility to identify any items, within this project scope, that required engineering sealed drawings/calculations to comply with municipal and federal codes and regulations.
- .2 If any items are identified to be designed and stamped by a professional engineer the following should be observed
 - .1 Submittals for items required to be sealed by professional engineer (engineered) shall be duly prepared, sealed, and signed under the direct control and supervision of a qualified professional engineer licensed in the jurisdiction in which the site is located, having in force, and professional liability insurance with minimum coverage limit of \$1,000,000 per claim and annual aggregate.
 - .2 Include with engineered submittal, proof of insurance identifying insurer, policy number, policy term, and limit of liability, on duly signed letterhead and / or certificates of insurance.
 - .3 Engineered submittals shall include design calculations, complete with references to codes and standards used in such calculations, supporting the proposed design represented by the submittal.

5.3 Submission procedures

- .1 Submittals included all relevant information and/or documentation that need to be review by NRC and its consultants such as, but not limited to: drawings, cut-sheets, and testing procedures.
- .2 Submittals are to be sent electronically, via email, to NRC project authority.
- .3 Submittals shall be sequentially numbered, number format to be specified by contractor.
- .4 Files are to be submitted in PDF format, unless specified by NRC project authority.
- .5 Accompany submittals with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each submittal.
 - .5 Other pertinent data.

- .6 Make provisions in schedule for at least two (2) working days for NRC Departmental Representative's review of submittals. When submittals have to be reviewed by one or more of NRC Departmental Representative's consultants, add 3 more working days for a total five (5) working day review period.
- .7 If the NRC Departmental Representative requires resubmission of submittals, allow for an additional two (2) working days review for each resubmission.
- .8 If, at any time, the Contractor submits a large enough number of submittals such that the NRC Departmental Representative cannot process these submittals within two (2) working days, the NRC Departmental Representative, in consultation with the Contractor within 24 hours of receipt of such submittal, will provide the Contractor with an estimate of the time necessary for processing same. The Contractor shall accommodate such necessary time at no increase in the contract time and at no additional cost to NRC.

5.4 Shop drawings and cut-sheet submittals

- .1 Submit shop drawings as follows:
 - .1 One (1) copy digitally in pdf format to NRC Departmental Representative using the NRC Departmental Representative's document management system.
 - .2 NRC to provide drawing files templates for design and as built drawings submission.
- .2 NRC Departmental Representative markings and resulting action required:
 - .3 Shop drawings requiring no changes will be marked 'REVIEWED', and shall be submitted for as-built drawings purposes.
 - .4 Shop drawings requiring several changes will be marked 'REVIEWED as NOTED' and shall be revised and submitted for as-built drawings purposes.
 - .5 Shop drawings requiring substantial changes will be marked 'REVISE AND RESUBMIT' and shall be revised and resubmitted until NRC Departmental Representative stamps drawings with 'REVIEWED' or 'REVIEWED as NOTED'.
- .3 Shop drawing size shall be multiple of 213 mm and 275 mm excluding 38 mm binding margin and not larger than 838 mm x 1117 mm. Leave minimum 150 mm x100 mm clear space for NRC Departmental Representative's comments.
- .4 Upon completion of review by NRC Departmental Representative, 1 marked set of shop drawings will be returned to Contractor in digital format for reproduction and distribution.
- .5 Submit copies of reviewed shop drawings to authorities having jurisdiction as required.
- .6 Shop drawings shall include:
 - .1 Fabrication and erection dimensions.
 - .2 Design calculations prepared by professional engineer, as required.
 - .3 Location and type of anchors, attachments and locations and types of fasteners, including concealed reinforcements to accept mounted fasteners. Assumed design loadings, dimensions of elements and material specifications for load-bearing components.
 - .4 Adhesives, joinery methods and bonding agents.
 - .5 Kinds, grades and dimensions of components and materials, their characteristics relative to their purpose, detailed description of finishes and other fabrication information.
 - .6 A detailed bill of material identifying all components used and their part numbers.
 - i. Where third party items have been used, identify manufacturer part number as well as contractor part number.
 - .7 Configurations, types and sizes required; identify each unit type on drawing and on product.
 - .8 Descriptive names of equipment and mechanical and electrical characteristics when applicable.

5.5 Certificates and Certification Submittals

Certificates and certifications submittals: When applicable, provide a statement that includes signature of entity responsible for preparing certification.

6. APPROVED ALTERNATES AND APPROVED EQUALS

The following shall be observed when proposing an alternative or approved equals

- .1 Submit a list of all identified equals or alternates being suggested in the submitted document(s).
- .2 When document is submitted for review, proposed substitutions should be named products alternates or equals, indicated by the phrases "or approved alternate by XYZ Manufacturing" or "or approved equal by XYZ Manufacturing".
- .3 When items are "approved alternate by XYZ Manufacturing" or "or approved equal by XYZ Manufacturing" it shall be interpreted to mean that named product alternate or equal, if selected for use in lieu of indicated or specified product, meets or exceeds performance, appearance, general arrangement, dimensions, availability, code and standards compliance, and colour of specified product.
- .4 Contractor to be responsible for costs and modifications associated with the inclusion of named product alternate or equal at no additional cost to NRC.

6.1 Submission of substitutions: approved alternate or approved equal

Proposals for substitutions of products and materials must be submitted in accordance with procedures specified in this section.

NRC Departmental Representative may review submissions with the understanding that the contract time will not be altered due to the time required by the NRC Departmental Representative to review the submission and by the Contractor to implement the substitution in the work.

- .1 Submission requirements:
 - .1 Description of proposed substitution, including detailed comparative specification of proposed substitution with the specified product.
 - .2 Manufacturer's product data sheets for proposed products.
 - .3 Confirm compliance with the building codes and requirements of authorities having jurisdiction.
 - .4 Effect on contract time.
 - .5 Reasons for the request.
 - .6 Substitutions submitted on shop drawings without following requirements of this section
 - .7 Proposed substitutions shall include costs associated with modifications necessary to other adjacent and connecting portions of the work, if applicable.
 - .8 NRC Departmental Representative's decision concerning acceptance or rejection of proposed substitutions is final.

7. Quality control

- .1 Before starting any installation procedures, contractors are required to schedule a site pre-installation meeting to review details related to site work.

- .2 Inspection and testing services will be used to verify compliance with requirements of the contract documents. These services do not relieve the Contractor of responsibility for compliance with the contract documents.
- .3 Before starting any testing procedures, contractors are required to schedule a pre-testing meeting to review details related of the work to be completed
- .4 Inspection and testing required by codes or ordinances, or by an authority having jurisdiction, and made by a legally constituted authority, shall be the responsibility of the Contractor and shall be paid for by the Contractor and not be paid by NRC, unless otherwise specified in the contract documents.
- .5 Inspection or testing performed exclusively for Contractor's convenience shall be sole responsibility of Contractor, and will not be paid by NRC.
- .6 Final Inspection and testing, if required by NRC, shall be performed by a company qualified to perform the inspections or site tests specified or required.
 - .1 NRC will be responsible for the third party testing company to accompany the test.
- .7 Where evidence exists that defective workmanship may have occurred, or that the work may have been carried out incorporating defective materials, or tests demonstrate that installed conditions do not comply with the requirements of the contract documents, the NRC Departmental Representative reserves the right to have appropriate inspections, tests, and surveys performed, analytical calculation of structural strength made and the like in order to help determine the extent of defect and whether such work must be replaced. Inspections, tests, and surveys carried out under these circumstances will be made at the Contractor's expense, and will not be paid by NRC, unless the results indicate that the work so tested, inspected or surveyed is not defective or that, in NRC Departmental Representative's opinion, the work so tested, inspected, or surveyed may be accepted, in which case tests, inspections or surveys will be paid by NRC.

7.1 Reports and documents

- .1 Inspection and testing company shall submit site inspection reports within five (5) working days of each inspection.
- .2 Inspection and testing companies shall submit a written report for each inspection or test, including pertinent data such as conditions at the site, dates, test references, locations of tested materials, actual product identification, testing methodology, procedures, and descriptions, site instructions given, recommendations and/or any other information required by standard applicable to reporting of tests and inspections.
- .3 Report shall clearly indicate failure of product or procedures to meet applicable standards, give recommendations for retesting or correction. Inspector shall contact Contractor and NRC Departmental Representative immediately when product or product assembly fails to meet requirements of the contract documents.
- .4 Upon completion of portions of the work subject to independent inspection and testing, submit to the NRC Departmental Representative duplicate certificates of acceptance of
- .5 Contractor is responsible to receive and distribute the final testing reports as part of the project final quality control point.

7.2 Hydraulic Oil Cleanliness Verification

- .1 Hydraulic oil cleanliness is critical to the safe operation of this equipment. Ensure that proper actions are taken to ensure clean oil, piping, and keep proper documentation of results.

- .2 The aim of flushing is to remove contamination from the inside of pipes and components, which are introduced during system assembly or maintenance. This is accomplished by passing fluid through the system, usually at a velocity higher than that during normal operation.
 - .1 It is the responsibility of the contractor to provide all necessary equipment needed to complete the oil cleanliness procedure.
- .3 Omission or curtailment of flushing will inevitably lead to rapid wear of components, malfunction and breakdown.
- .4 The following steps pertain to the supplied piping – the essence is that we have clean piping. It is the contractor responsibility to send a final flushing procedure, based on the list below, for NRC approval.
- .5 Contractor is responsible to all cost related to the flushing set-up.
 - .1 Connect the fluid transfer pump to the return line low point ball valve and the nearest available HPU drain port
 - .2 Pump the fluid from the return hardline to the HPU reservoir
 - .3 Connect the fluid transfer pump to the drain line low point ball valve and the nearest available HPU drain port
 - .4 Pump the fluid from the drain hardline to the HPU reservoir
 - .5 Check for adherence to drawings and ECN's.
 - .6 Inspect basic assembly.
 - ii. free flow direction of check valves.
 - iii. critical bolt lengths and torque.
 - iv. check for missing plugs, caps, and proper torque.
 - .7 Connect pressure, return and drain hoses to flush/prove assemblies.

NOTE: all ball valves, should remain open during flushing unless noted.

- .8 Prefill pressure, return and drain circuit:

NOTE: maximum drain proof pressure is 300 psi, do not over pressurize.

- i. Start an HPU and adjust pressure to 300 psi setting.
 - ii. Run pump to fill hardline and hose assemblies with oil.
 - iii. Monitor fluid level in HPU reservoirs.
- .9 Turn on the HPU's and flush the hardline until a cleanliness level of ISO 4406(c) 16/13/9 at the HPU is achieved.
- .10 Close the pressure ball valves at the HSM's and adjust HPU pressure settings to operational pressures per system schematic.
- .11 Shut HPU down and relieve pressure.
- .12 Connect the fluid transfer pump to the pressure line low point ball valve and the nearest available HPU drain port
- .13 Open the drain down breather ball valve along with all other hardline flushing ball valves
- .14 Pump the fluid from the pressure hardline to the HPU reservoir
- .15 Connect the fluid transfer pump to the return line low point ball valve and the nearest available HPU drain port
- .16 Pump the fluid from the return hardline to the HPU reservoir
- .17 Connect the fluid transfer pump to the drain line low point ball valve and the nearest available HPU drain port
- .18 Pump the fluid from the drain hardline to the HPU reservoir

- .19 Disconnect pressure, return and drain hoses from flush/proof assemblies and seal open ports and hoses.
- .6 Components that can be damaged by high fluid velocity or by fluids containing moisture, particles or flushing chemicals should be isolated from the flushing circuit and cleaned individually.
- .7 Manifolds, blocks, pump stations, motors, reservoirs, assemblies and components should be delivered clean according to a specific procedure. If not clean, they must be flushed separately.

7.3 Hardline quality testing procedure

The following steps pertain to the supplied piping. It is the contractor responsibility to send a final testing procedure, based on the list below, for NRC approval prior to commence the test.

- .1 Contractor is responsible to all cost related to the testing set-up.
 - .1 Install hardline, HSM connection hoses and connect single HPU.
 - i. It is the responsibility of the contractor to provide all necessary equipment, including the HPU, needed to complete the pressure testing.
 - .2 Check for adherence to drawings and ECN's.
 - .3 Inspect basic assembly.
 - i. Free flow direction of check valves.
 - ii. Critical bolt lengths and torque.
 - iii. Check for missing plugs, caps, and proper torque.
 - .4 Connect pressure, return and drain hoses to flush/proof assemblies.

NOTE

- i. a) all ball valves should remain open during the proof test unless noted.
- ii. b) drain pressure accumulator pre-charge from HPU assembly being used for test.
- iii. c) install pressure gauge on HPU pressure output

NOTE: if a leak is detected at any time the test must be stopped. All residual pressure must be depleted and the system must be drained to the appropriate level to facilitate repairs. The leak must be repaired with the appropriate approved materials and procedures as necessary. The system should be prefilled again, slowly pressurized to one half of the leak occurrence pressure and held for five minutes. Then pressure should be increased to the leak occurrence pressure and the test resumed and completed.

- .5 prefill pressure, return and drain circuit:

NOTE:

- i. Adjust compensator pressure and pressure relief valve to lowest setting, start supply HPU.
- ii. Run pump to fill hardline and hose assemblies with oil.
- iii. Monitor fluid level in HPU reservoirs.
- .6 Proof pressure check for drain circuit:

NOTE: maximum drain proof pressure is 300 psi +50, do not over pressurize.

- i. Block d & r at supply HPU. adjust (1) pump volume to lowest setting, use (1) motor/pump for H.S. test.

- ii. Start supply HPU and adjust pressure to 100 psi. connect p & r at (1) outlet station.
- iii. Increase pressure at 100 psi increments while observing for leaks.
- iv. Hold pressure at 300 psi for 5 minutes.
- v. Shut HPU down and relieve pressure.
- vi. Validate test.

.7 Proof pressure check for return circuit:

NOTE: maximum return proof pressure is 1090 psi +100, do not over pressurize.

- i. Connect p & r at (1) outlet station. block r at supply HPU.
- ii. Start supply HPU and adjust pressure to 500 psi.
- iii. Increase pressure at 500 psi increments while observing for leaks.
- iv. Hold pressure at 1090 psi for 5 minutes.
- v. Shut HPU down and relieve pressure.
- vi. Validate test.

.8 Proof pressure check for pressure circuit.

NOTE: Maximum proof pressure is 4500 psi +200, do not over pressurize.

- vii. Block p at all outlet stations
- viii. Start supply HPU and adjust pressure to 500 psi.
- ix. Increase pressure at 500 psi increments from 500 psi to 4500 psi while observing for leaks.
- x. Hold pressure at 4500 psi for 5 minutes.
- xi. Shut HPU down and relieve pressure.
- xii. Adjust pump volume and pressure controls to standard setting.
- xiii. Validate test.

7.4 Hydraulic power unit testing

- .1 After installation is completed, NRC along with MTS, will perform a system functionality testing with the hydraulic power units.
- .2 Hydraulic power unit testing is responsibility of MTS technical team
- .3 The contractor is expected to have a technician on site to support the team during testing. Technician is expected to resolve minor technical issues, related to the hydraulic line installed under this scope, in order to ensure the testing can proceed
 - .1 Any minor technical issues originating for installation workmanship from the contractor work shall be fully covered under the contractor warranty
 - .2 Any minor technical issues originating from incorrect operation, incorrect parameters and/or instructions not related to the contractor's installation workmanship shall not be covered by the contractor.
 - .3 Major technical issues will be discussed by the parties involved and a plan will be developed with all parts in agreement on how to correct the issue.

8. Site conditions and work requirements

- .1 Prior to start site work, contractor is responsible to obtain security clearance to their team. Time to obtain security clearances shall be clear identified in the project schedule.

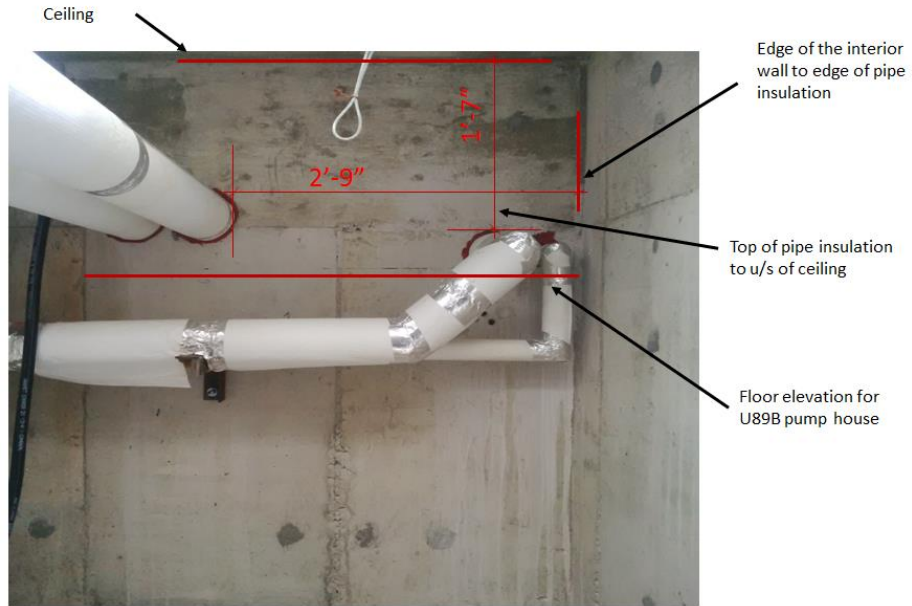
- .2 Contractor is responsible to set-up all temporary facilities needed for the work to be completed on site. The location of temporary facilities at site is to be discussed and approved by NRC team.
 - .1 A source of temporary power will be made available from building U89B. U89B has available 600V, 3 phase circuit, 1000 Amps. Contractor to bear all costs to make connections to the power source and perform distribution on site.
 - .2 Contractor to provide all load centres, breakers, conduit, wiring, disconnects, extension cords, transformers, as required from the source of power.
 - .3 Contractor to provide their own source of power if available source does not meet their equipment requirements.
- .3 Contractor is expected to have all materials available and ready for installation prior to start as part of the mobilization scope. Storage location for any material needed for this project to be discussed and approved by NRC team.
 - .1 Contractor is expected to be able to replace any material damage during installation in 48hrs during installation to avoid delays.
- .4 Contractor is responsible to visit the site prior to installation and review with NRC the minimum work area required.
 - .1 It is recommended that the contractor verifies the work interference during site visit and properly identify all major interferences prior to response to this SOW.
 - .2 Interferences shall be listed in the response to this SOW.
 - .3 If existing interferences have not been listed in the interference list, the contractor will be responsible to work with NRC to resolve them, without impacting the installation schedule.
 - .4 NRC is responsible to clean up installation area, to the extent possible, to allow contractor to perform the work in the proposed time frame.
- .5 Any shutdowns shall be properly coordinate with NRC Departmental Representative and the ASPM authority on site. Contractor to provide 48hrs notice.
- .6 Contractor is responsible to submit a Health and Safety plan to work in the area, which will be reviewed and approved by NRC.
- .7 The access between building U-89 and U-89B is currently blocked by a concrete wall; contractor is expected to drill the necessary holes for the new hydraulic installation. Contractor to remove weather proofing membrane, and concrete caps to access the duct bank between the buildings. Once the piping is installed, contractor to re-install concrete caps, weather proofing membrane and brown finishing cap to match existing. Section B shows some images of the area where the drilling shall take place. Contractor is responsible to visit the site and make all measurements necessary to evaluate the costing.

*** END OF SECTION ***

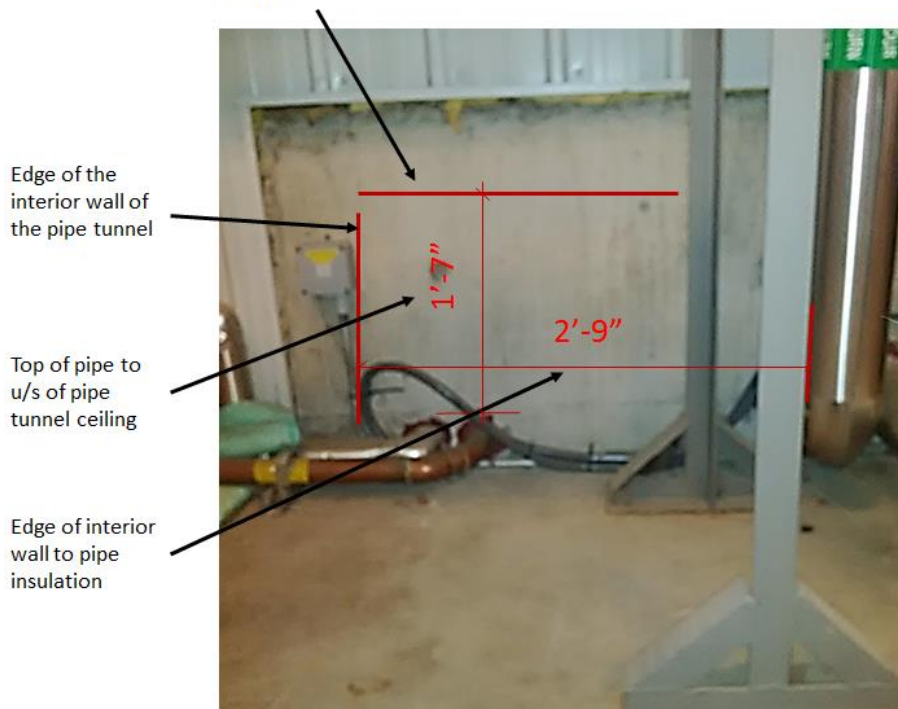
Section B: Site conditions Division between building U-89 and U-89B

The intent of this section is to give contractors a base understanding and a general overview of the work need to be completed between building U-89 and U-89B. It is the contractor responsibility to perform all measurements on site for costing purposes.

South Wall of Pipe Tunnel @ U-89B Pump House



Pipe tunnel ceiling



North Wall of Pipe Tunnel @ U-89

Ceiling

Pipe support, location measures 5'-10" from the floor



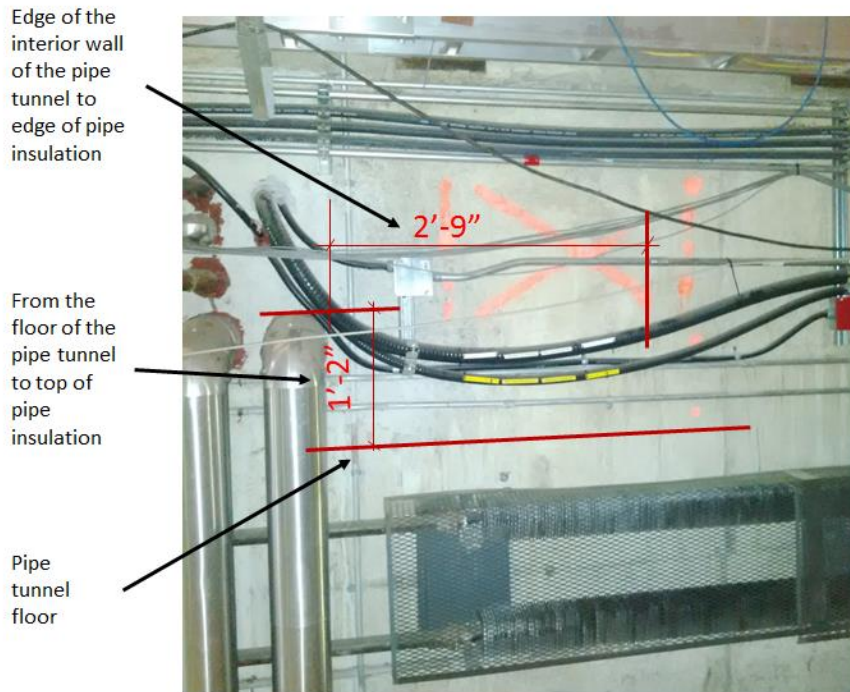
North Wall of Pipe Tunnel @ U-89

Floor to u/s of ceiling

Edge of the interior wall to edge of pipe insulation



South Wall of U-89



*** END OF SECTION ***

Section C: NRC Facility overview