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PETERBOROUGH LIFT LOCK 21

PRESS & RAM SEAL PERFORMANCE SPECIFICATION FINAL – REV 01

IMPORTANT

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TECHNICAL REQUIREMENTS

1.0 INTRODUCTION

Parks Canada Agency (PCA) requires a Contractor to design, supply and install new permanent gland seals, packings and supporting materials for the west and east press/ram assemblies at Peterborough Lift Lock 21. The existing gland and packing arrangement in use at the facility have experienced excessive leakage and packing failures at higher frequencies in recent years.

1.1 FACILITY DESCRIPTION

The Central Ontario Waterways Field Unit of Parks Canada Agency (PCA) owns and operates the Peterborough Lift Lock 21 (PLL21) as part of the 386 km long Trent-Severn Waterway system which extends from the Bay of Quinte on Lake Ontario to Port Severn just to the south of Georgian Bay on Lake Huron. The Peterborough Lift Lock is positioned on a manmade portion of the Trent Canal connecting the Otonabee River to Little Lake in the City of Peterborough.

The Peterborough Lift Lock was commissioned in 1904 and was designated a National Historic Site of Canada in 1979. The lift lock operates seasonally from the Friday before Victoria Day in May through to the second Monday in October and is a major local tourist attraction.

The facility in general is made up of three sections, the upper reach, the concrete/steel structure and the lower reach. Maritime vessels are raised and lowered between the upper and lower canal reaches by two boat chambers filled with canal water with gates on each end. The boat chambers are attached to and moved by large vertical press/ram assemblies (one per chamber) which operate by gravity and use water as the hydraulic fluid. The press section of each ram is set within 4.3 m (170") diameter concrete-lined wells dug into the natural bedrock below the structure. The boat chambers are guided by rails mounted externally on the concrete towers and are approximately 39 m long by 10 m wide with an average lift of 19.8 m. Refer to Photo 1-1 on the following page which illustrates the concrete/steel structure with the west boat chamber in the raised position and Photo 1-2 on page 3 which identifies the lifting component arrangement.

PHOTO 1-1: PETERBOROUGH LIFT LOCK 21



Each boat chamber is operated by a single water-operated cylinder that moves the chamber through a travel of 19.8 metres. The boat chamber is connected to the cylinder at the crown. Each cylinder consists of one press, one ram and a gland (stuffing box) type seal. Two water pumps within the structure pressurize a large dead-weight accumulator to bring the service water to its operating range of 36.2 bar (525 psi). The actuation of a cross-over valve linking the two press/ram assemblies causes the water to flow from the upper press (under higher pressure) to the lower press. The upper chamber, filled to the water level of the upper reach contains more water than the lower chamber, making it heavier. The weight difference between the two boat chambers provides the driving force for the operation of the lift lock.

PHOTO 1-2: PRESS, RAM AND CROWN



1.1.1 Applicable Codes

Parks Canada Agency (PCA) is under federal jurisdiction. Given the nature of the structure; the PLL 21 facility is classified as a direct-acting hydraulic elevator applicable under CSA Standard CAN3-B44-M85 – Safety Code for Elevators.

1.2 PRESS/RAM DESCRIPTION

The presses (cylinders) are made from cast steel. They have an outside diameter of 2.51 m (99”), an inside diameter of 2.35 m (92.5”) and an overall length of 20.29 m (66’ - 7”). They are comprised of the following 14 components, plus the gland:

1. One 1.09 m long water inlet section.
2. Twelve 1.60 m long sections with a wall thickness of 89 mm (3.5”).
3. One 3.35 m diameter bottom closure plate.

Each press section is held together with fifty six 1-5/8” diameter bolts at external flange sections. An alignment structure integrated into the concrete well keeps the press vertical. The wells themselves are covered with floor plates and are considered a confined space.

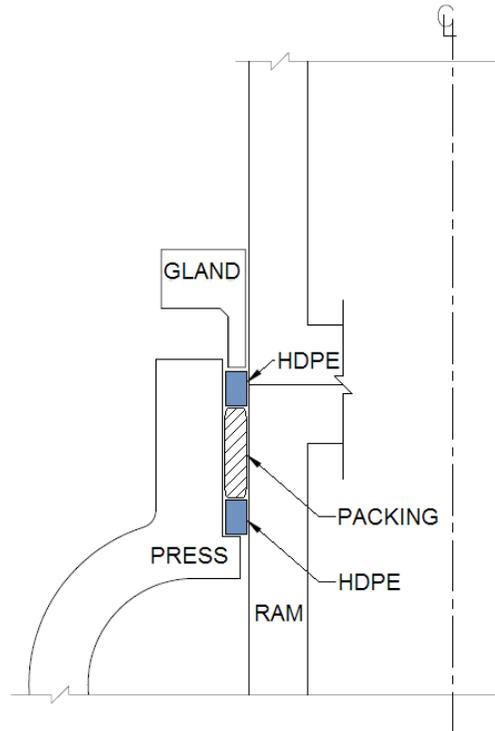
The cast iron rams have an outside diameter of 2.29 m (90”) with internal flange joints and an overall length of 21.51 m (70’ - 7”). They are comprised of the following 14 components:

1. One 1.22 m long by 2.29 m diameter crown.
2. Twelve 1.60 m long by 2.29 m diameter sections with a wall thickness of 82.55 mm (3.25”).
3. One 1.09 m long by 2.29 m diameter cast steel lower dome section that is convex to the fluid pressure with a wall thickness of 82.55 mm (3.25”). This lower hemispherical dome also has a 0.41 m diameter access hatch in the center that provides access into the press, through the ram.

Each ram section is held together with forty two 1-¼” diameter bolts. The interior of the ram is painted, open to atmosphere and can be confined space accessed via a 0.5 m (20”) diameter hole in the support beam on the boat chamber. The exterior of the ram is routinely coated with a mixture of oil and carbon black to provide corrosion resistance and lubrication.

A 0.27 m (10.5”) deep gland (stuffing box) is employed to seal the gap between the ram and the press. Historically, the gland packing was a 1” x 1” flax based packing that is now discontinued. In lieu of this discontinued packing, PCA staff have experimented with a variety of packing arrangements utilizing natural and synthetic fibres, Chevron (V-shaped) packings, and combinations thereof. Rigid HDPE retaining rings are installed at the bottom and the top of the packing stack. Refer to Figure 1-1 on the following page.

FIGURE 1-1: CURRENT PACKING ARRANGEMENT



1.3 CURRENT CONDITIONS

1.3.1 Condition of the Rams

The cast-iron rams now have relatively rough surface with a typical Rockwell Hardness of HRC 35. They are not polished, nor are they plated surfaces and relatively large clearances exist between the components. As such, the gland packing materials are abraded (worn away) relatively quickly and in one instance, several layers of chevron packing were extruded between the ram and the gland.

The rams have surface imperfections and irregular contours ranging from weld repairs, observed pits (which are left over from the original casting defects and/or gouging before weld repairs) up to 4.8 mm deep and longitudinal grooves up to 0.6 mm deep as indicated by Photos 1-3 and 1-4 on the following page. It should also be noted that due to the size and configuration of the press/ram assemblies, removal of the ram for re-surfacing is not practical.

Both rams have been measured with a laser tracker accurate to ± 0.015 mm and have been found that the surface of both rams deviates from a perfect circle by less than 1 mm (0.040”) over the entire length of both rams.

A portion of plate approximately 130 mm x 130 mm exists on the west ram on the south side (facing towards the lower reach) near the bottom of the ram. It is recessed into the surface and appears to have been electric resistance welded or flush riveted to the surface of the ram. The depth of the ram material excavated for this plate, the internal defect which presumably lead to installation of this plate and material of construction of this plate are unknown. There exists at least one other such repair plate on the rams.

PHOTO 1-3: TYPICAL SURFACE PITTING ON MAIN RAM



PHOTO 1-4: 130 MM SQUARE PATCH PLATE ON WEST RAM



On-site inspections have also noted that the packing glands appear to loosen when the rams are retracting and tighten when the rams are extending. This could be indicative of high friction between the packings and the rams.

The presses leak more when they are at, or near, the upper and lower positions (aligned with the reach gates). The height of the chambers is adjusted more often in these zones in order to achieve or maintain alignment with the gates. It is suspected that the more frequent adjustments in these zones may be a contributing factor to the increased leakage. As an example, during the 2018 season, the East press leaked more at a position just before reaching alignment with the gates.

As stated above, PCA staff have been experimenting with different packing combinations and arrangements to reduce leakage and provide extended replacement intervals. Photo 1-5 below illustrates the press packing gland with a typical minor leakage occurring.

PHOTO 1-5: PRESS PACKING GLAND



1.3.2 Clearances

Photo 1-6 below is provided to identify that there is vertical clearance space between the chamber crown/ram connection and the press when the chamber is in the full down position. This may be of assistance to the Contractor in the design and installation of a new seal in accordance with this technical specification.

PHOTO 1-6: CHAMBER/RAM IN FULL DOWN POSITION



Clearance measurements of the gland seal assemblies for both the west and east rams were measured using feeler gauges and bore gauges in October 2018. The tabulated results of the pre-alignment clearance measurements can be found in Appendix A.

1.3.3 Alignment

Other than the stuffing box and the gland packings, the ram is unguided inside the press. The only other means of controlling the alignment of the rams as they extend and retract

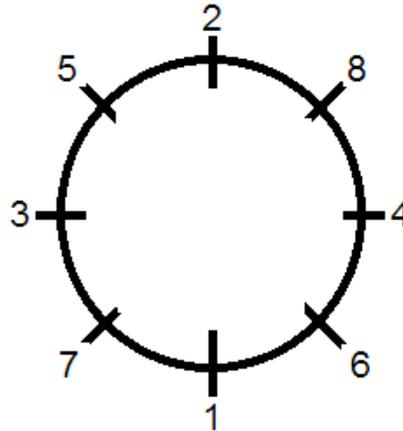
from the presses is by the boat chamber guide rails that run the length of the adjacent towers.

Parks Canada, in conjunction with the design and installation of a new seal in accordance with this technical specification, instigated a program in April of 2019 with KGS Group to realign the presses with the rams. The six wedges that control the position of the presses were removed and readjusted to centre the rams as best as possible within the presses. Measurements of the re-alignments can be found in Appendix B. Furthermore, the alignment of the chambers to the tower guide rails was inspected and it was verified that the chambers had proper engagement with their respective upper and lower reach gates.

Following re-alignment, Parks Canada staff proceeded to pack the gland assemblies in preparation for the navigation season. The following procedure was followed to pack the east and west press/ram assemblies:

- As illustrated in Figure 1-1 above, Parks Canada staff inserted one layer of 15/16" x 1" HDPE plastic around the perimeter of the ram into the bottom of the gland cavity using the 15/16" dimension to take up the width of the gland.
- Inserted eight layers of Robco "Lock-Pack 29 Packing 7/8" x 1-1/8" TFE Impregnated Dense" packing materials fibre packing around the perimeter of the ram into the gland cavity using the 7/8" dimension to take up the width of the gland.
 - Each wrap was cut 2" longer than the circumference of the ram.
 - Butt joints were employed with each layer of packing being offset from the previous layer by 180° as illustrated by the figure below.

FIGURE 1-2: PACKING ARRANGEMENT



- Lowered the gland to provide an initial compaction of the packing arrangement.
- Raised the gland and added one more layer of Robco “Lock-Pack 29 Packing 7/8” x 1-1/8” TFE Impregnated Dense” packing material.
- Completed the packing arrangement by adding one more layer of 15/16” x 1” HDPE plastic on top of the fibre packing around the perimeter of the ram.
- Re-lowered the gland and used an electric impact gun to provide an initial nut tightening to the point where the top HDPE ring was just visible.
- Performed a first “Final Tightening” by hand with wrench and used a caliper to ensure the space between the press and the gland was equal around the circumference.
 - Parks Canada staff indicated that once final tightening was complete, they would water up the facility to 250 psi and check for leaks.
 - Tighten as necessary and increase the pressure to 400 psi and re-inspect.
 - Finally, increase pressure to 600 psi and re-inspect.

1.4 ADDITIONAL REFERENCE INFORMATION

The following Drawings are applicable to the Work and can be found in Appendix C:

<u>Drawing No.</u>	<u>Drawing Name/Title</u>
T20-195129	LONGITUDINAL SECTIONS
T20-195125	TRANSVERSE SECTIONS
T20-195111	PLAN OF PRESS WELLS
T20-164107	PRESS DETAILS
T20-164103	DETAILS OF PRESS AND RAM
T20-180800	PRESS STRUTS - 1962

Additional information provided by Parks Canada staff after the start of the navigation season was that the west press/ram assembly continued to experience fluctuating leakage rates with the above noted packing arrangement.

Parks Canada maintenance staff then proceeded to remove the top layer of HDPE plastic and the top three rows of Robco “Lock-Pack 29 Packing”. They then installed a plastic Chevron packing arrangement before re-tightening the gland. Since this packing arrangement has been employed (HDPE, six Robco and one Chevron (1-5-1)), Parks Canada operations staff have noted no leakage on the west press/ram assembly. Parks Canada staff then repacked the east press/ram assembly using the same configuration and have also reported no further leakage.

END OF SECTION

2.0 DESIGN

2.1 GENERAL

The Scope of Work to be completed in accordance with this technical specification includes the design, supply and installation of new permanent gland seals, packings and supporting materials for the west and east press/ram assemblies at Peterborough Lift Lock 21.

The objective of the Scope of Work is to remediate the excessive seal leakage (by closing up/minimizing the existing clearances so gland material cannot be extruded out between the gland and ram), reduce the frequency of packing failures and maintenance requirements and ensure the ongoing operability of the asset.

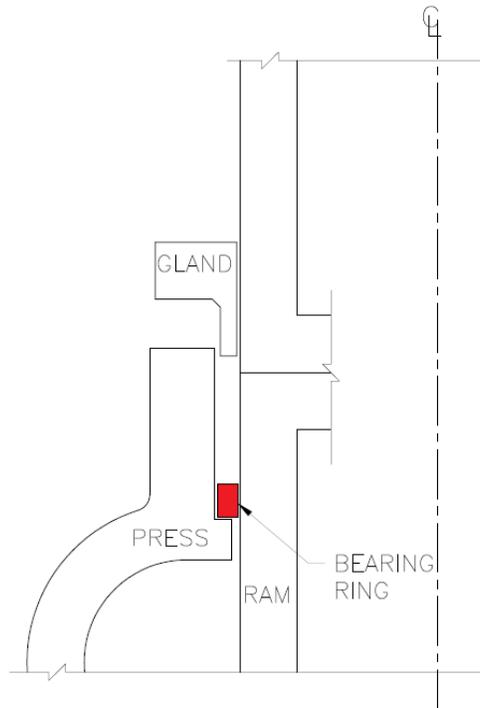
The Contractor shall also provide a complete belt-type oil skimmer package for each press well sump to collect any accumulated floating oil from the sump water surfaces. The belt skimmer shall be of industrial quality sized for the removal of up to 60 litres per hour of free floating liquid hydrocarbons collecting at the surface of the reservoir. The oil skimmer shall utilize a continuous 4 inch wide elastomer belt and Nitrile wipers. The head and tail pulleys shall be constructed of standard carbon steel and the tail pulley shall have a protective cage, yoke and tether. The belt is to be of sufficient length to pick up oil from the sump low water level (7.62 m (25') down from the chamber floor) within the oil/water separator chamber of the drainage sump. The oil skimmer shall be equipped with a fractional HP, 120V, single-phase, 60 Hz TEFC motor. The belt skimmer shall come equipped with a 1219 mm (4') high stand, oil concentrator (suitable for the environment), built-in analog programmable 24 hour timer and a vertical float switch (complete with a box/pil/contactor) for a ¾" bung. One oil skimmer dedicated GFI protected 120V receptacle will be provided in each chamber well by PCA staff to power each oil skimmer assembly.

This specification, including the historical reference drawings, photos and collected clearance measurements provide information to guide the Contractor's design but the design is the responsibility of the Contractor. The Departmental Representative makes no guarantee as to the accuracy or completeness of the existing information provided.

The Contractor shall provide the Departmental Representative a proposal outlining a description of their proposed solution along with associated costs, construction schedule (utilizing a Gantt Chart), materials, availability of consumables (including recommendations for an environmentally friendly ram lubricant) and warranty. Proposals shall include the Contractor’s guaranteed maximum leakage rate and expected seal life.

The Contractor shall take any site measurements needed to confirm the existing conditions and dimensions. If existing clearances are too large for the Contractor’s proposed solution, the Contractor shall consider including one or more bearing rings of a suitable material within the gland cavity to reduce the clearances. Refer to Figure 2-1 below.

FIGURE 2-1: BEARING CLEARANCE RING



2.2 DESIGN FINALIZATION

This performance technical specification describes the Scope of Work for the Contractor’s design of the intended press/ram gland seals/packings, lubrication and oil skimmers. It is anticipated that any new design may include new gland rings, bearing

inserts, packing materials and ram lubrication. Packing materials shall be readily available from multiple suppliers. Ram lubrication shall match packing type. Material selection, special requirements and packing installation procedures are also required.

Upon award, the Contractor shall:

1. Preliminary Works:

- a. Review all background information provided and acquire any additional existing information as required from the Departmental Representative relating to this project. The Departmental Representative will provide any information in its possession. The collection of any further information will be the responsibility of the Contractor.
- b. Conduct site visits as required to identify and carry-out any additional field testing or measurements to confirm the conditions or determine any other requirements for the Contractor to finalize the design. Note that the facility is currently in operation and any required shutdowns will need to be coordinated with the Departmental Representative.

2. Design:

- a. Design and supply all components for new press/ram gland seals.
- b. Design and document all special requirements and packing installation procedures.
- c. Design and supply all components for new oil skimmer packages for the east and west press well sumps.
- d. Prepare design and shop drawings illustrating the gland arrangement and required materials.
- e. Prepare design and shop drawings illustrating the oil skimmer arrangements and equipment.
- f. Develop other standard details as required to facilitate the installation and future maintenance.

The Contractor shall carry out design finalization and provide detailed design information as required to obtain approval of the design prior to fabrication of any components.

2.3 DELIVERABLES

The Contractor shall prepare design deliverables for review by the Departmental Representative or delegate. The Contractor shall implement the Work in accordance with the reviewed and approved design deliverables to provide a new gland/seal solution

and oil skimmers that works as intended. As a minimum, the Contractor shall provide the following deliverables:

1. Design Drawings, Shop Drawings, Specifications and Product Details:
 - a. Design drawings sealed by an engineer licenced to practice in Ontario, and supporting documentation adequate to describe the scope of work, confirmed locations, construction and installation details, and products to be utilized. Approval of the design by the Departmental Representative or delegate is to be obtained by the Contractor prior to proceeding with manufacturing.
 - b. Shop drawings and product information (if information is not captured in the design drawings). This will include detailed dimensions confirmed by site measurements, size and dimensions of all members, strengths of material where applicable, and related technical specifications and materials data sheets as appropriate.
2. Commissioning Plans (C_x):
 - a. The Contractor shall submit a complete commissioning plan. Approval of the commissioning plan by the Departmental Representative or delegate is to be obtained by the Contractor prior to proceeding with the installation.
3. Record Drawings:
 - a. The Contractor shall submit a complete set of sealed record drawings prior to the lock being put into service by the specified date.
 - b. One hardcopy, one electronic copy in .pdf format and one electronic copy in .dwg format reflecting the as-built configuration shall be submitted to PCA prior to completion of the project.
4. Operation and Maintenance (O&M) Manual:
 - a. The Contractor shall provide a complete O&M Manual for the new seal and oil skimmers. The manual shall include at a minimum a complete set of drawings, product data sheets, required maintenance, maintenance intervals, any measurements to be taken, torque values and contact information for the suppliers where additional materials can be purchased.
 - b. The O&M Manual shall include a table of contents and tabs for each section. The manual shall be organized in a clear and intuitive manner.

- c. Provide two hardcopies of the O&M Manual in D-ring binders and one electronic copy in a fully searchable and indexed pdf document.

END OF SECTION

3.0 IMPLEMENTATION

3.1 GENERAL

The Contractor shall implement the Work in accordance with this Specification, the Departmental Representative's reference information and the Contractor's design as reviewed and approved by the Departmental Representative or delegate.

3.2 MOBILIZATION/DEMOBILIZATION

Mobilization shall consist of the delivery to Site of all the Contractor's personnel, materials and tools to complete the Work.

Demobilization shall consist of the removal from Site of all of the Contractor's personnel, materials and tools that were required to complete the Work and to leave the site in its previous or better condition.

3.3 DEMOLITION

The Owner will lock-out all power sources and controls for operation of the press/ram assemblies prior to the start of demolition with the Contractor verifying this lock-out and following their own lock-out/tag-out program while working on the Site.

Prior to the Contractor starting work at the site, the existing press/ram gland rings will be raised and the packing materials will be removed. The Contractor shall dispose of all existing packing materials off site as applicable.

3.4 ASBESTOS

Asbestos Containing Materials (ACM's) are known to be present on site in areas outside the Contractor's work area. The Contractor's scope of work is not expected to disturb any ACM's. Any suspected ACM's encountered by the Contractor shall be treated as

ACM's (i.e. left undisturbed) until proven otherwise by accredited testing. PCA shall be notified of any suspected ACM's discovered by the Contractor.

3.5 SITE CLEANUP

All areas of the site where the Contractor is working shall be kept clean at all times. Upon completion of the Work, the Contractor shall immediately remove all excess material and debris from the site resulting from the Contractor's activities. The Site is to be restored to its pre-existing condition or better as appropriate where affected by the Contractor's activities.

3.6 SITE FACILITIES AND UTILITIES

The PLL 21 facility is serviced with 120V and 600V power. Washroom facilities are not available during the non-navigation season. The contractor shall provide any washroom facilities needed by their staff.

3.7 SITE MAINTENANCE

The Contractor shall be responsible for their own refuse collection and disposal at the Site and removal of all refuse off site.

3.8 INSTALLATION

The Contractor shall supply and install the press/ram gland seals and packing materials and the oil skimmers as set forth in the Contractor's design and as approved by the Department Representative or delegate. Specific installation requirements and procedures will be in accordance with the design documentation.

3.9 COMMISSIONING

The Contractor shall be responsible for all commissioning and testing of the new press/ram gland seals, packing materials and oil skimmers in accordance with their supplied Commissioning Plan.

Commissioning is to occur in the spring and shall include both static (empty chambers) and pressurized (full chambers) testing for a minimum of five (5) complete transfers on the first day and a minimum of five (5) complete transfers per day for an additional four (4) days per press/ram unit (one (1) week total) while monitoring leakage from the new press/ram gland seals. The new press/ram gland seals shall pass commissioning if the chambers hold alignment within a 3 inch vertical range for a period of 1 hour (60 minutes).

The Contractor shall include for a return visit within one month to check leakage rates and re-commission the new press/ram gland seals as required. Re-commissioning shall be coordinated with the Departmental Representative.

3.10 WARRANTY/ENDURANCE

The Contractor shall provide a one year warranty on the new press/ram gland seal components and the oil skimmers.

The Contractor shall provide a one navigation season warranty on the new press/ram gland seal packing materials. During this warranty period, the Contractor shall respond to reports of leakage by Parks Canada staff within two (2) business days to re-tighten the new press/ram gland seals if sufficient leakage occurs following the re-commissioning and shall re-pack the new press/ram glands if the chambers do not hold alignment for the first navigation season. For greater clarity; respond in this case means having staff and materials at site to address/repair leakage. PCA's threshold for repacking the press/ram gland seals is when the chambers hold alignment (within the 3 inch vertical range) for less than 10 minutes.

3.11 EQUIPMENT

The Contractor shall supply, maintain and operate all of the required equipment to implement the Work. Equipment may include but is not limited to manual and power tools.

Any special tools required for the Work will become the property of PCA for future use in performing routine maintenance on the Work.

3.12 MATERIALS

The Contractor shall supply and install all of the materials including packings required as set forth in the Contractor's design as approved by the Departmental Representative or delegate and in accordance with this technical specification. Supplier details, specifications and all information necessary to assist PCA staff in purchasing more materials in the future is also required and shall be included in the O&M Manual.

END OF SECTION

4.0 HEALTH AND SAFETY

4.1 GENERAL

The Contractor will be required to complete a Site Specific Health and Safety Plan (SSHSP) based on a hazard assessment prior to start of field work. The plan shall address emergency response considerations. An optional template is provided in Appendix D.

Provide all required Personal Protective Equipment, equipment and material as required to meet the intent of the SSHSP or as required by the Provincial Occupational Health and Safety Legislation.

4.2 KNOWN HAZARDS

The Contractor may be exposed to the following known hazards while on site:

- Exposure to Heights Greater than 10 feet – Lower gate crossings when downstream reach is at winter water level and when press cover plates around the rams are removed.
- Exposure to Open Water – Lower gate crossings when downstream reach is at operating water level.
- Narrow Spaces – In order to access the ram – gland/seal interface, the Contractor will need to access narrow halls and stair cases.
- Exposure to Overhead Hazards – There are overhead hazards present on the internal staircase at site as well as in the chamber galleries.
- Uneven Surfaces – Due to concrete deterioration, there are sections of uneven concrete floor surrounding the ram – gland seal interface area in the chamber galleries.
- Poor Lighting – Minimal natural light is present in the ram – gland/seal interface area when the overhead chambers are lowered onto the support stands.
- Slip Hazards – The press and ram are wet working environments.

- Confined Space Entry – Confined space entry permits and procedures are required if entering the press well below the press cover plates.

END OF SECTION

5.0 ENVIRONMENTAL

5.1 GENERAL

Parks Canada Agency is the Environment Authority for Trent-Severn Waterway projects. The Contractor is expected to employ Best Practices in terms of Environmental Protection while performing the work.

The Contractor will confirm all operations and procedures within the perimeter of the project site, to allow for PCA to review and comment on environmental mitigation measures, if required. The storage of construction equipment, material and waste must be contained and secured within the project site.

The Contractor is to ensure that all on-site personnel comply with appropriate environmental mitigation measures. Failure to employ best practices and adhere to environmental mitigation measures or other applicable Acts or Regulations may constitute grounds to suspend or cancel work.

Should conditions at the work site indicate that there are unforeseen negative impacts to fish, wildlife, cultural or visitor experience resources, all works shall cease until the problem has been corrected and/or any required input can be obtained from Parks Canada.

Fuel, grease and other mechanical fluids are pollutants and considered a deleterious substance under the Fisheries Act. The proximity of PCA assets to natural areas and fish bearing waterbodies elevates the need to address refueling and routine maintenance through the application of proper environmental controls. Proper refueling procedures, and Spill and Emergency Management procedures are expected to be followed.

5.2 SPILL MANAGEMENT

Contractor staff should be trained and familiar with the Spills and Emergency Management protocol, including roles and responsibilities, locations and contents of spill kits, and use of equipment.

Upon identification of a spill, immediately contain, limit spread, and remediate all affected areas. The Departmental Representative and the Ontario Spills Action Centre (1-800-268-6060) are to be notified immediately.

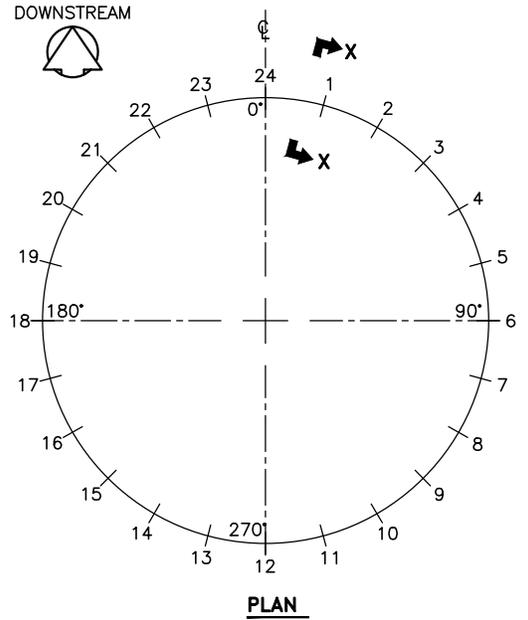
END OF TECHNICAL REQUIREMENTS

APPENDIX A

PRE-ALIGNMENT CLEARANCE MEASUREMENTS

CLEARANCE DIMENSIONS (INCHES)

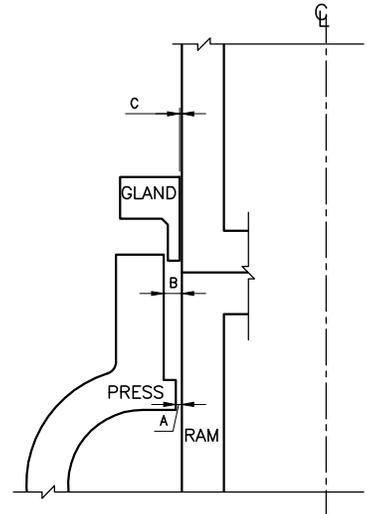
POINT	DIM	A	B	C	REMARKS
3	0.053	1.020	0.057		
6	0.088	1.040	0.066		
9	0.115	1.051	0.078		
12	0.110	1.034	0.100		UPSTREAM
15	0.084	1.001	0.078		
18	0.059	0.996	0.050		
21	0.050	0.987	0.055		
24	0.011	0.995	0.082		DOWNSTREAM



PLAN

TOTAL CLEARANCE ON DIAMETER (INCHES)

POINT	DIM	A	B	C	REMARKS
3 & 15	0.137	2.021	0.135		DIAGONAL - WEST SIDE DOWNSTREAM
6 & 18	0.147	2.036	0.116		EAST - WEST
9 & 21	0.165	2.038	0.133		DIAGONAL - EAST SIDE DOWNSTREAM
12 & 24	0.121	2.029	0.182		UPSTREAM - DOWNSTREAM



PARTIAL SECTION X-X
TYPICAL 24 LOCATIONS

LEGEND:

- A BOTTOM OF GLAND CLEARANCE
- B PACKING CLEARANCE. DUE TO ROUGHNESS OF THE RAM AND GLAND, AND VARIATIONS IN LOCAL GAPS, THIS MEASUREMENT IS PROBABLY +/- 0.010 INCHES.
- C GLAND RING AND RAM CLEARANCE.

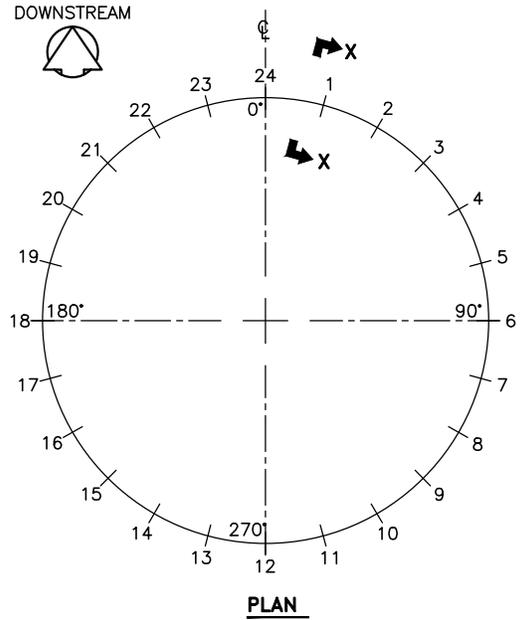
NOTES:

1. AT TIME OF MEASUREMENTS, BOAT CHAMBERS WERE SITTING ON THE MAINTENANCE STANDS.
2. WEATHER WAS BETWEEN 7 AND 10°C.

A	18/12/03	ISSUED FOR INFORMATION	BAS	JCL
NO.	YY/MM/DD	DESCRIPTION	ISSUED BY	CHECK BY
REVISIONS / ISSUE				
KGS GROUP CONSULTING ENGINEERS		PETERBOROUGH		
		PETERBOROUGH LIFT LOCK		
HYDRAULIC RAM GLAND CLEARANCE DIMENSIONS WEST RAM				
DECEMBER 2018			REV: A	

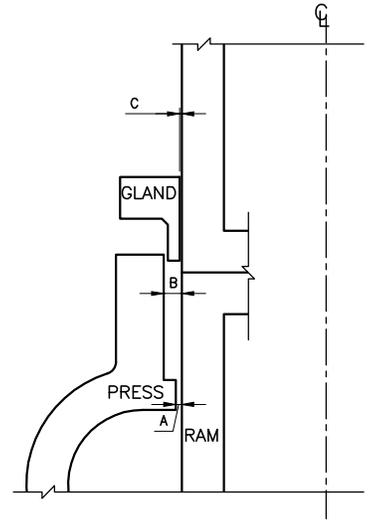
CLEARANCE DIMENSIONS (INCHES)

POINT	DIM	A	B	C	REMARKS
3		0.006	0.936	0.019	
6		0.065	0.951	0.063	
9		0.115	1.010	0.113	
12		0.131	1.075	0.131	UPSTREAM
15		0.130	1.079	0.106	
18		0.082	1.048	0.067	
21		0.035	1.009	0.030	
24		0.005	0.956	0.014	DOWNSTREAM



TOTAL CLEARANCE ON DIAMETER (INCHES)

POINT	DIM	A	B	C	REMARKS
3 & 15		0.136	2.015	0.125	DIAGONAL - WEST SIDE DOWNSTREAM
6 & 18		0.147	1.999	0.130	EAST - WEST
9 & 21		0.150	2.019	0.143	DIAGONAL - EAST SIDE DOWNSTREAM
12 & 24		0.136	2.031	0.145	UPSTREAM - DOWNSTREAM



PARTIAL SECTION X-X
TYPICAL 24 LOCATIONS

LEGEND:

- A BOTTOM OF GLAND CLEARANCE
- B PACKING CLEARANCE. DUE TO ROUGHNESS OF THE RAM AND GLAND, AND VARIATIONS IN LOCAL GAPS, THIS MEASUREMENT IS PROBABLY +/- 0.010 INCHES.
- C GLAND RING AND RAM CLEARANCE.

NOTES:

1. AT TIME OF MEASUREMENTS, BOAT CHAMBERS WERE SITTING ON THE MAINTENANCE STANDS.
2. WEATHER WAS BETWEEN 7 AND 10°C.

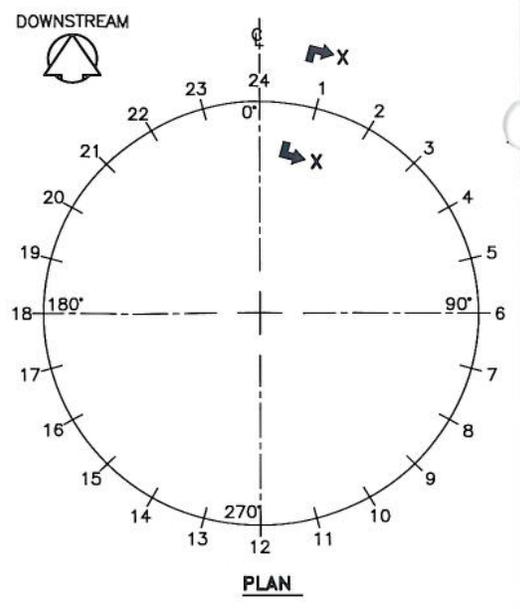
A	18/12/03	ISSUED FOR INFORMATION	BAS	JCL
NO.	YY/MM/DD	DESCRIPTION	ISSUED BY	CHECK BY
REVISIONS / ISSUE				
KGS GROUP CONSULTING ENGINEERS		PETERBOROUGH		
		PETERBOROUGH LIFT LOCK		
HYDRAULIC RAM GLAND CLEARANCE DIMENSIONS EAST RAM				
DECEMBER 2018			REV: A	

APPENDIX B

POST-ALIGNMENT CLEARANCE MEASUREMENTS

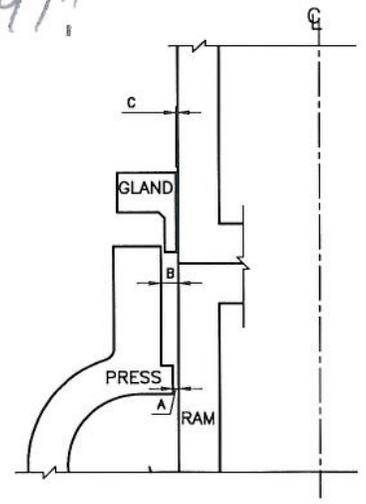
KGSBK11P

CLEARANCE DIMENSIONS (INCHES)					
POINT	DIM	A	B	C	REMARKS
24		0.053	1.012	0.086	"C" measurements
3		0.067	1.007	0.081	taken for
6		0.108	1.004	0.079	full depth
9		0.095	1.001	0.066	at gland
12		0.077	1.009	0.055	seal
15		0.057	1.001	0.042	
18		0.051	1.004	0.045	
21		0.047	1.014	0.068	



Note: Steel flag used to assist in measuring "B" dimension had a diameter of 0.997"

TOTAL CLEARANCE ON DIAMETER (INCHES)					
POINT	DIM	A	B	C	REMARKS



PARTIAL SECTION X-X
TYPICAL 24 LOCATIONS

LEGEND:

- A BOTTOM OF GLAND CLEARANCE
- B PACKING CLEARANCE. DUE TO ROUGHNESS OF THE RAM AND GLAND, AND VARIATIONS IN LOCAL GAPS, THIS MEASUREMENT IS PROBABLY +/- 0.010 INCHES.
- C GLAND RING AND RAM CLEARANCE.

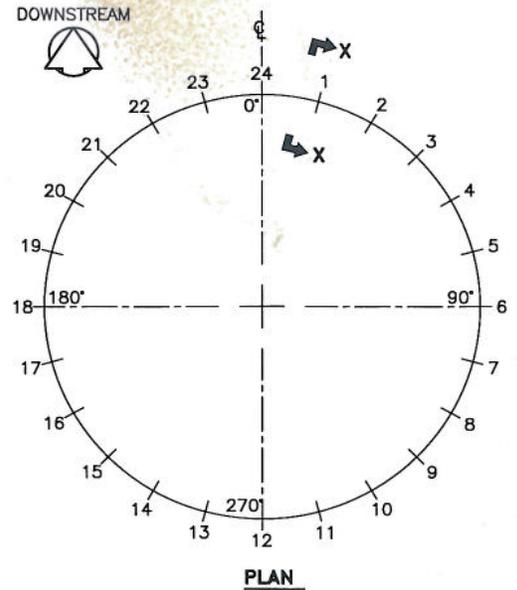
NOTES:

1. AT TIME OF MEASUREMENTS, BOAT CHAMBERS WERE SITTING ON THE MAINTENANCE STANDS.
2. WEATHER WAS BETWEEN 7 AND 10°C.

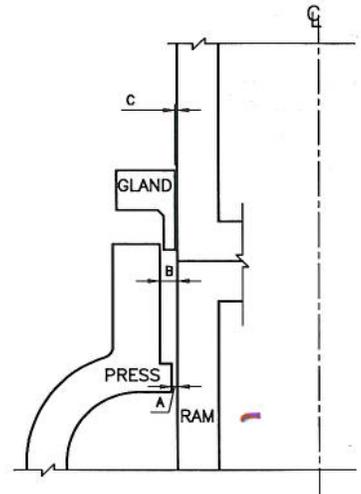
A	18/12/03	ISSUED FOR INFORMATION	BAS	JCL
NO.	YY/MM/DD	DESCRIPTION	ISSUED BY	CHECK BY
REVISIONS / ISSUE				
		PETERBOROUGH		
		PETERBOROUGH LIFT LOCK		
HYDRAULIC RAM GLAND CLEARANCE DIMENSIONS EAST RAM				
DECEMBER 2018			REV:	A

File name: U:\FMS\15-1538-002\15-1538-002_Fig02 - Tab:East Ram Template Plotted By: Caballeroso 19/04/10 [Wed 5:01pm]
 8.5 x 11" PLOT SCALE: 1"=2"

CLEARANCE DIMENSIONS (INCHES)					
POINT	DIM	A	B	C	REMARKS
24		0.048	1.020	0.044	"C" measurements
3		0.048	1.015	0.045	taken for
6		0.078	1.009	0.067	full depth
9		0.087	1.007	0.080	of gland
12		0.090	1.018	0.091	seat.
15		0.086	1.018	0.071	
18		0.080	1.016	0.053	
21		0.067	1.019	0.045	



TOTAL CLEARANCE ON DIAMETER (INCHES)					
POINT	DIM	A	B	C	REMARKS



PARTIAL SECTION X-X
TYPICAL 24 LOCATIONS

LEGEND:

- A BOTTOM OF GLAND CLEARANCE
- B PACKING CLEARANCE. DUE TO ROUGHNESS OF THE RAM AND GLAND, AND VARIATIONS IN LOCAL GAPS, THIS MEASUREMENT IS PROBABLY +/- 0.010 INCHES.
- C GLAND RING AND RAM CLEARANCE.

NOTES:

1. AT TIME OF MEASUREMENTS, BOAT CHAMBERS WERE SITTING ON THE MAINTENANCE STANDS.
2. WEATHER WAS BETWEEN 7 AND 10°C.

A	18/12/03	ISSUED FOR INFORMATION	BAS	JCL
NO.	YY/MM/DD	DESCRIPTION	ISSUED BY	CHECK BY
REVISIONS / ISSUE				
		PETERBOROUGH		
PETERBOROUGH LIFT LOCK				
HYDRAULIC RAM GLAND CLEARANCE DIMENSIONS WEST RAM				
DECEMBER 2018			REV	A

APPENDIX C

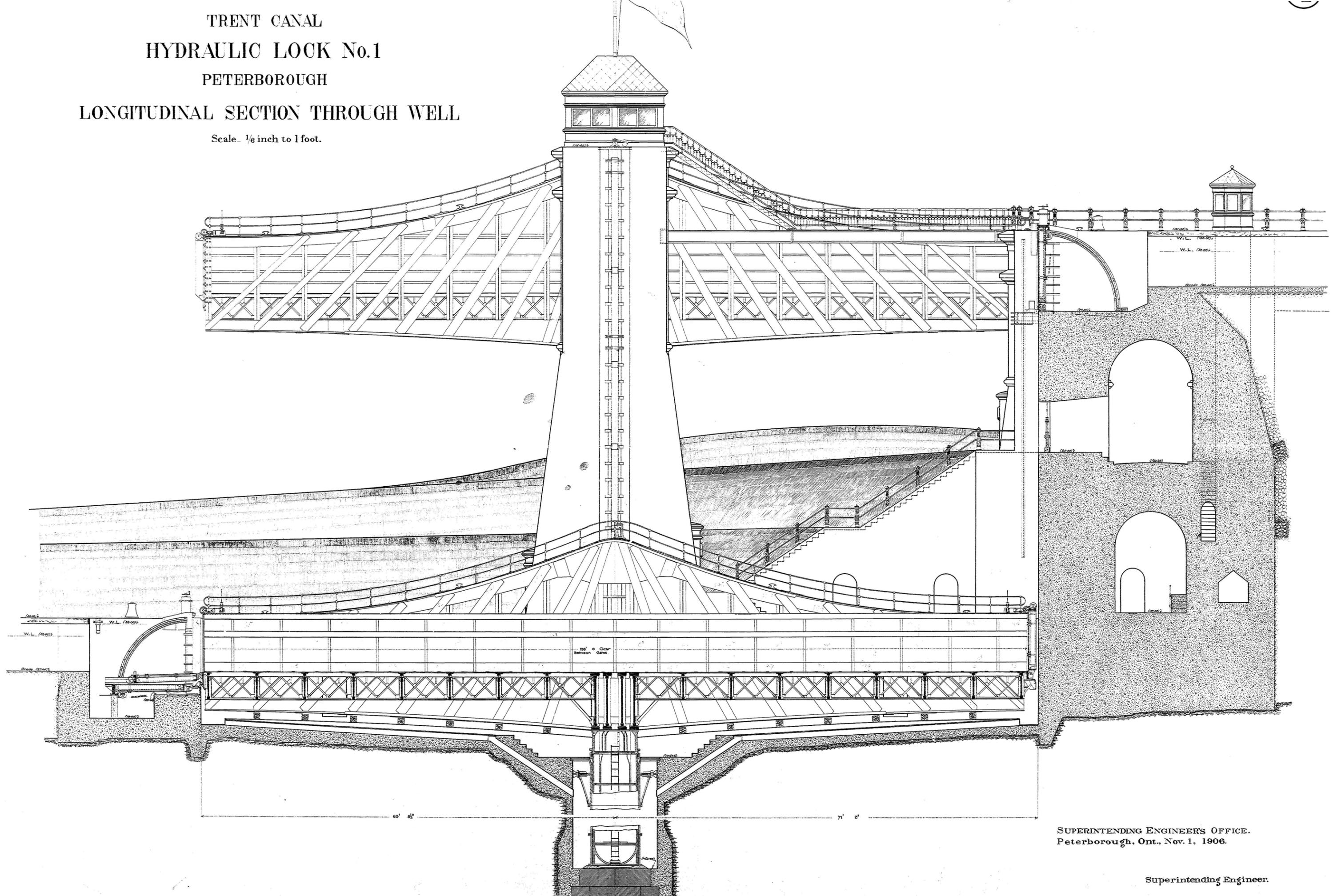
REFERENCE DRAWINGS

TRENT CANAL
HYDRAULIC LOCK No.1

PETERBOROUGH

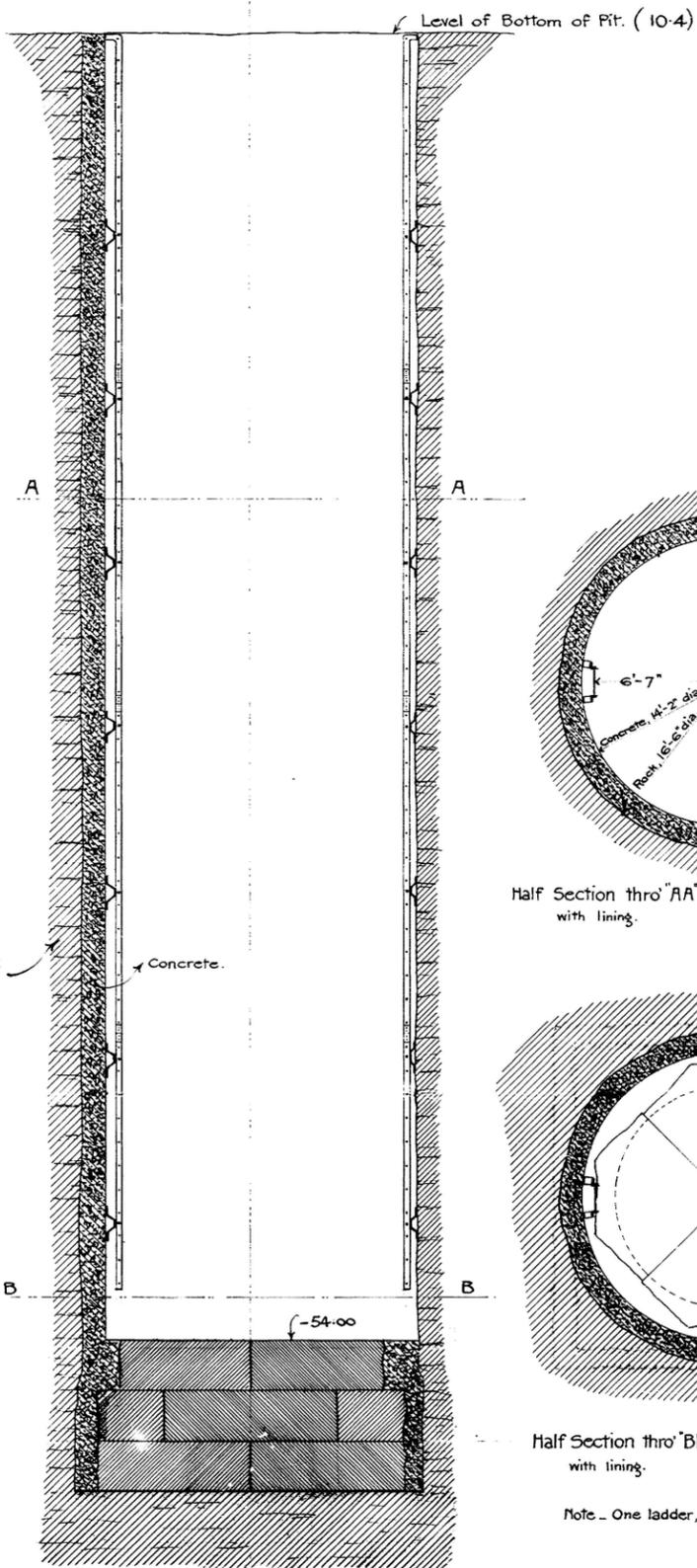
LONGITUDINAL SECTION THROUGH WELL

Scale. 1/8 inch to 1 foot.



SUPERINTENDING ENGINEER'S OFFICE.
Peterborough, Ont., Nov. 1, 1906.

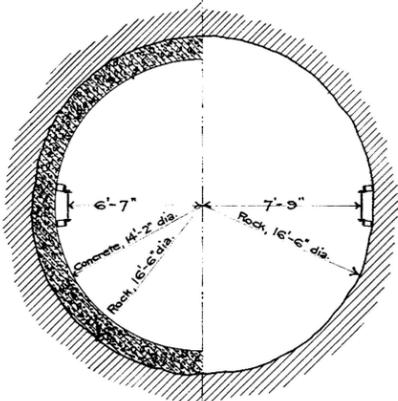
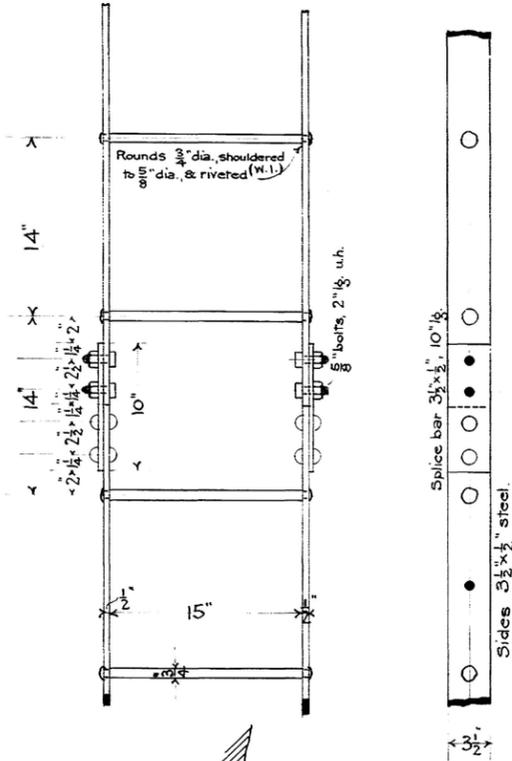
Superintending Engineer.



Details of Ladder,

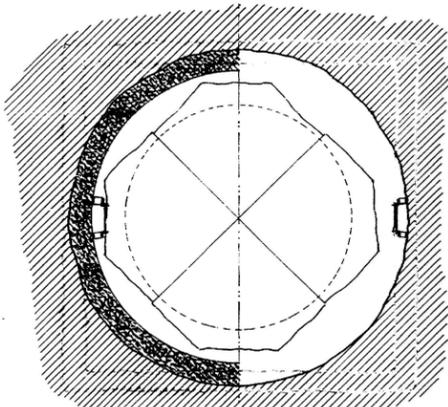
Rivets, $\frac{5}{16}$ " dia.

Rounds are wrought iron; all other parts are mild steel.



Half Section thro' AA with lining.

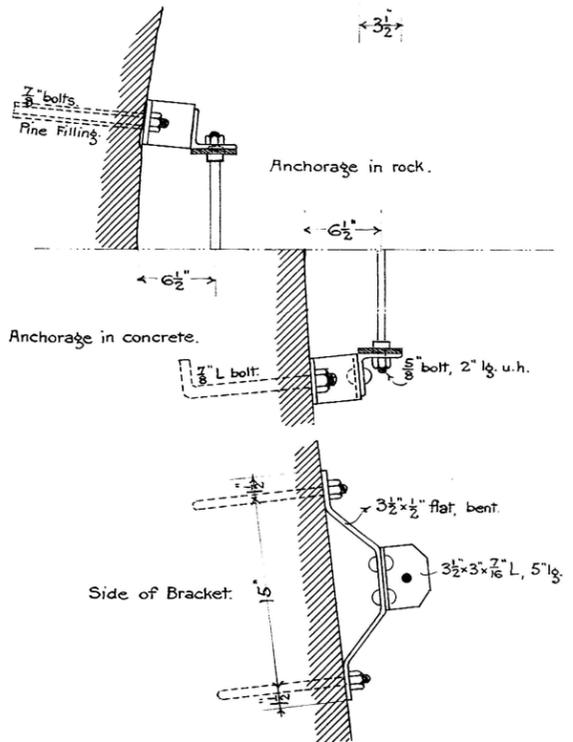
Half Section thro' AA without lining.



Half Section thro' BB with lining.

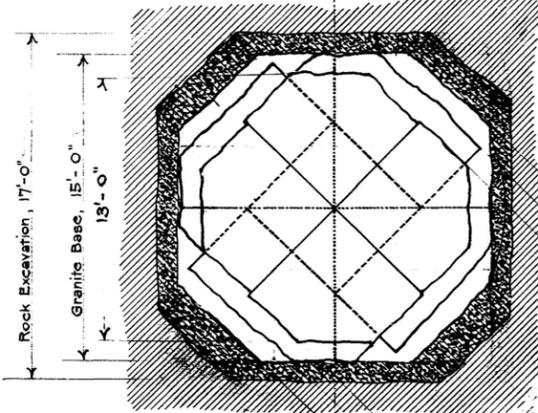
Half Section thro' BB without lining.

Note - One ladder, only, in each well.



Half Vertical Section thro' centre, with lining.

Half Vertical Section thro' centre, without lining.



Granite, One base,
 Top Course - 4 Stones, 6'-0" x 6'-0", Thickness as specified.
 Middle Course - 1 Stone, 6'-0" x 6'-0"
 Bottom Course - 4 Stones, 7'-6" x 7'-6"

Full lines show upper course, _____
 Dotted lines show lower course,
 Dashed lines show middle course, - - - - -

Sectional Plan showing Granite, (Concrete removed)

TRENT CANAL
 HYDRAULIC LIFT LOCK
 AT PETERBOROUGH
 PLAN OF PRESS WELLS.

Scales; $\frac{1}{5}'' = 1'$, for Plan of Wells; $\frac{1}{2}'' = 1'$, for Details.

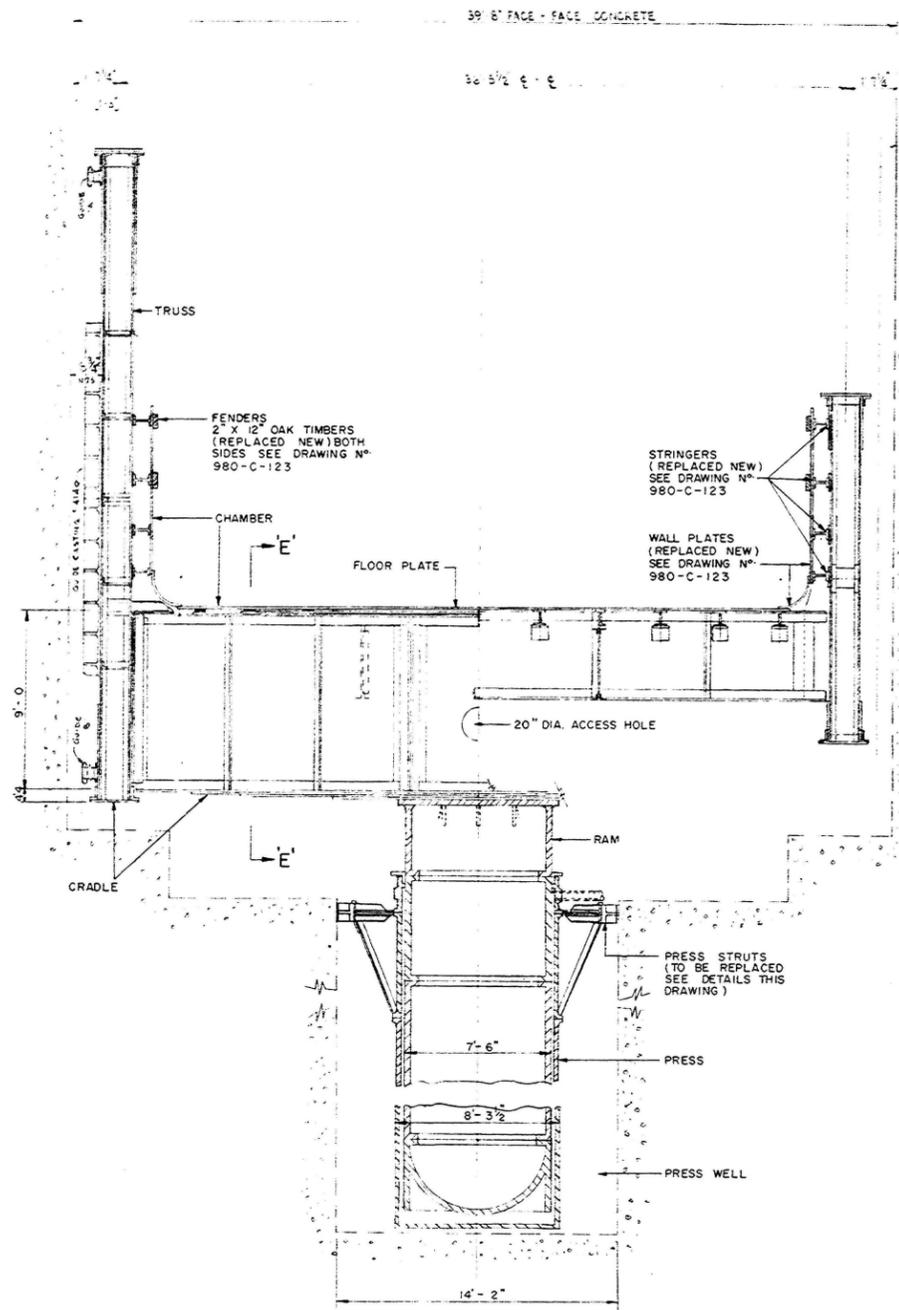
Richard P. Rogers
 Superintending Engineer.

Peterborough, Ont., Jan. 25, 1898.

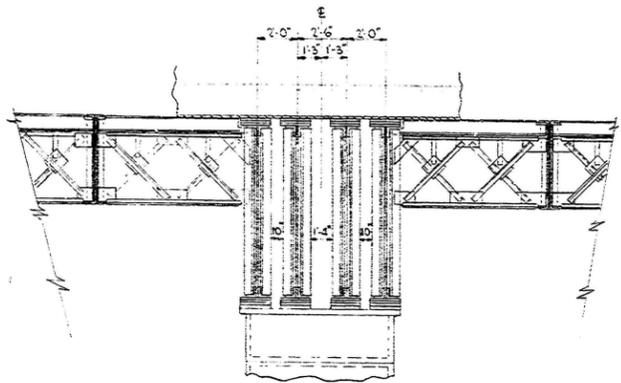
A-13-1030

A-13-1030

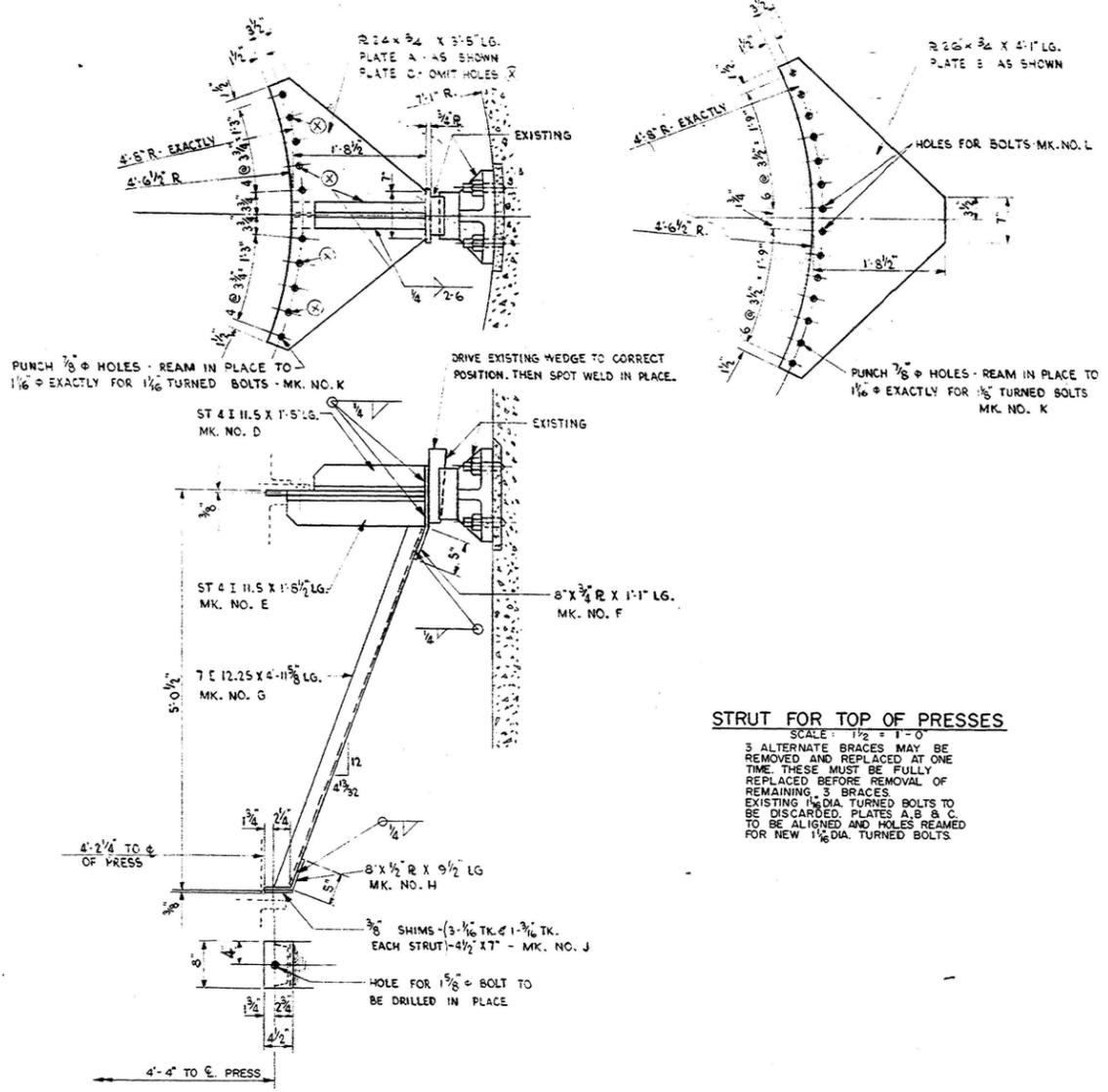
T-20-195-111



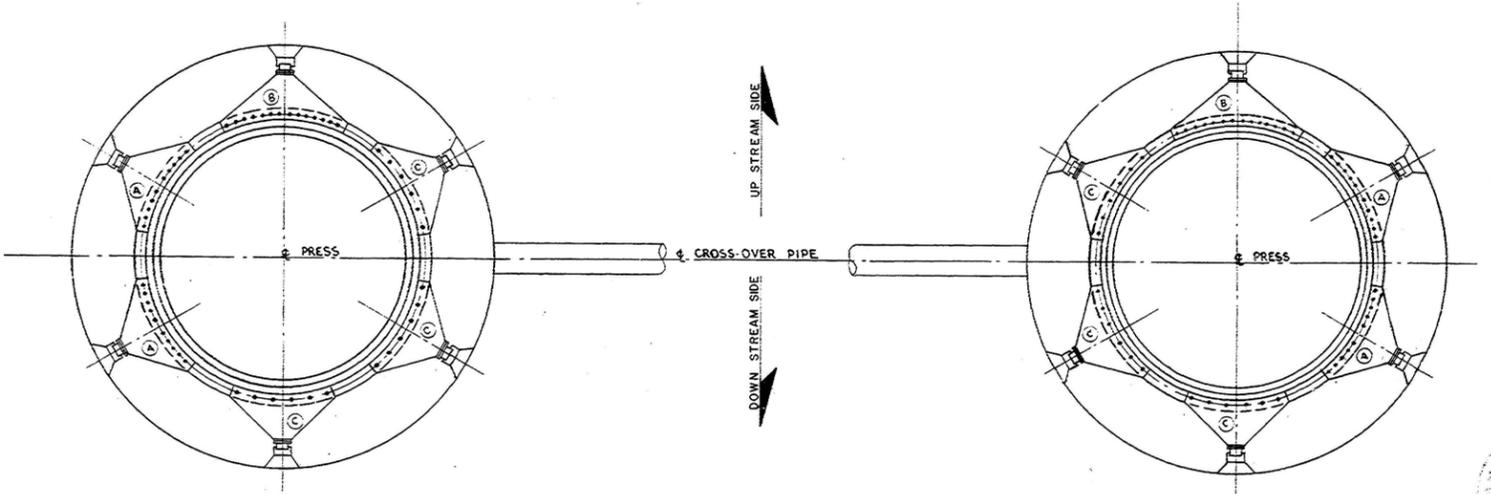
SECTION D-D
SEE DRAWING No. 980-C-120
SCALE 1/4" = 1'-0"



SECTION E-E
SCALE 1/4" = 1'-0"



STRUT FOR TOP OF PRESSES
SCALE: 1/2" = 1'-0"
3 ALTERNATE BRACES MAY BE REMOVED AND REPLACED AT ONE TIME. THESE MUST BE FULLY REPLACED BEFORE REMOVAL OF REMAINING 3 BRACES. EXISTING 1 1/2\"/>



PLAN SHOWING POSITION OF PRESS STRUTS
SCALE: 3/8" = 1'-0"

MARK	QTY	DESCRIPTION
A	2	R 24" X 3/4" X 3'-5" LG
B	1	R 26" X 3/4" X 4'-1" LG
C	3	R 24" X 3/4" X 3'-5" LG
D	6	ST 4 I 11.5 X 1'-5" LG
E	6	ST 4 I 11.5 X 1'-5" LG
F	6	8" X 3/4" R X 1'-1" LG
G	6	7" C 12.25 X 4'-11 1/2" LG
H	6	8" X 1/2" R X 9 1/2" LG
J	6	4 1/2 X 7" SHIMS - EACH CONSISTING OF 3-1/8 TK. AND 1-3/8 TK
K	50	1 1/2 DIA TURNED BOLTS - 2" GRIP - 3 1/2 LG
L	2	1 1/2 DIA TURNED BOLTS - 2 1/2 GRIP - 4" LG
QUANTITIES SHOWN ARE FOR ONE PRESS		
2		REQUIRED AT PETERBOROUGH
2		REQUIRED AT KIRKFIELD



DATE	No.	REVISIONS	CH.	APP.	H. G. ACRES & COMPANY LIMITED CONSULTING ENGINEERS
					DEPARTMENT OF TRANSPORT MARINE SERVICES CANALS DIVISION - TRENT CANAL SYSTEM
					REHABILITATION OF HYDRAULIC LIFT LOCKS - STAGE I
					CONTRACTS P & K PETERBOROUGH LIFT LOCK AND KIRKFIELD LIFT LOCK SECTIONS THROUGH LOCK AND DETAILS OF PRESS STRUTS
					SCALE AS SHOWN MATERIAL LIST NO.
					DATE SEPTEMBER 1962 INDEX NO.

T-20-180.8

APPENDIX D
SITE SPECIFIC SAFETY PLAN

SITE SPECIFIC SAFETY PLAN

General Contractor Name: _____

Project Name: _____

Project Location: _____

Date: _____

1. General Contractor Health and Safety Personnel

Position	Name	Cell Phone

2. Main Site Activities or Tasks

Number	Description
1	
2	
3	
4	
5	

3. Activity Hazards and Mitigation Measures

Activity No.	Activity Description	Hazards	Control Measures to Mitigate Identified Hazards	Required Training/Certification and Equipment
1				
2				
3				

Activity No.	Activity Description	Hazards	Controls Measures to Mitigate Identified Hazards	Training/Certification Required
4				
5				
6				

SITE SPECIFIC EMERGENCY RESPONSE PLAN

1. Emergency Contact List

Fire: 9-1-1
Ambulance: 9-1-1
Police: 9-1-1

Contractor Name: _____ Phone: () _____

Main Office Address:

Site Superintendent: _____ Cell Phone¹: () _____

Site Foreman: _____ Cell Phone¹: () _____

Safety Representative: _____ Phone: () _____

¹ On-Site personnel listed as emergency contacts are to be readily available by cell phone at all times while job site is active.

Parks Canada Project Manager: _____ Cell Phone: () _____

Parks Canada Site Manager: _____ Cell Phone: () _____

2. Emergency Response

In the event of an injury on the site the following emergency procedure shall be followed:

- 1) Secure the area and make the casualty safe from further injury.
- 2) Administer first aid immediately.
(NOTE: First Aid kits are located in the _____.)
- 3) Have the nature and severity of the injury assessed by a person qualified in first aid.
(NOTE: The following personnel are qualified in first aide: _____.)
- 4) Transport the casualty to receive medical attention immediately.

Minor Injury: The casualty will be transported by company vehicle to the nearest hospital ².

² Map and/or directions to nearest hospital emergency room is attached.

Major (Life or Non - Life Threatening Injury): Dial 9 - 1 - 1 to dispatch an ambulance.

Direct the ambulance to the project site: _____
(list address of the project site)

- 5) Report the incident to the site foreman, site supervisor and Parks Canada Project Manager.
- 6) Assign a worker to meet the ambulance at the main entrance to the facility and direct them to the work area.

SITE SPECIFIC SAFETY HAZARDS REVIEW AND SAFETY PLAN POLICY

Project Name: _____

We, _____ are committed to identifying and controlling safety hazards on the project. By completing the Site Specific Safety Plan and the Emergency Response Plan and following applicable Health and Safety Regulation requirements, we accept responsibility to enforce the hazard control measures to protect the general health and safety of all persons on the job site and surrounding areas that may become affected as a result of the work.

Responsibilities

Management (Prior to Commencement of Work and Ongoing)

1. Initialize development of Site Specific Safety Plan and Emergency Response Plan.
2. Designate site supervisor responsible for job safety.
3. Review and identify with supervisor all foreseeable safety hazards and indicate controls to eliminate or mitigate consequences of each.
4. Provide a signed copy of the completed Safety Hazard Review to the Parks Canada Departmental Representative for approval.
5. Provide all required training as part of methods of control.
6. Ensure actions are taken by supervisor and workers to address all hazards identified.

Supervisor (Ongoing)

1. Identify all foreseeable hazards to Management and provide recommendations on how to eliminate or control said hazards.
2. Discuss hazards and controls with workers and collect concerns. Ensure all workers read the Site Specific safety plan and understand its requirements. Keep a copy at the work site.
3. Respond to workers' concerns immediately.
4. Ensure the form addresses the concern(s) and the actions to be taken. Revise form accordingly.
5. Provide any revised copies of the completed Safety Hazard Review Form to Parks Canada Departmental Representative for approval.

Worker (Ongoing)

1. Inspect workplace for perceived hazards prior to work.
2. Report any perceived hazards that may be un-addressed verbally to the site supervisor.

3. Provide recommendations to the supervisor on how to eliminate or control the hazards.
4. Inform management immediately if the supervisor does not respond to concerns.

Contractor Agreement

I, _____, on behalf of _____, confirm our commitment to health and safety on the job site. Methods of hazards control as identified in this Safety Hazards Review and applicable safety regulations will be enforced for the duration of work.

Signature Company Representative

Date

Site Specific Safety Plan Received By:

Parks Canada Departmental
Representative

The Departmental Representative, on behalf of Parks Canada, reserves the right to stop work at any time if it is deemed that methods of control are not being properly enforced and/or do not adequately address the needs of the hazards as identified in this Safety Hazards Review, as well as if any unforeseen hazards arising during work are being overlooked.