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October 27, 2025

Addendum No. 03

File Reference Number: RFP 2025 075

Title: Upgrade of RIP Track and Adjacent Facilities

RE: Clarifications/Questions

Please refer to the following information/clarification:

CLARIFICATIONS

Item 1: Please note that the Performance Specification – Seacan Storage Container and Shelter (Document No. H375313-1000-230-242-00010001) has been attached at the end of this Addendum at Appendix A for your reference.

Item 2: Please note that Compressed Air Piping & Equipment Calculation Sheet (Document No. H375313-1000-240-202-0001) has been attached at the end of this Addendum at Appendix B for your reference.

Item 3: Please refer to the Bill of Quantities (Document No. H375313-1000-100-222-0001) provided with this Addendum as a separate attachment for your reference.

QUESTIONS

Item 1: Would ONTC accept alternate supplier for trench drain?

Answer: As recommended on the submitted drawings, ACO is the recommended supplier but any approved Vendor meeting the design in the final drawings submitted will be acceptable.

Grasspointers in this case does not seem to differ significantly from ACO (although ONTC could not find trenches for lengths greater than 10m from this vendor) Please refer to Trench Drain Table Civil Sheet 220-271-0002.

Item 2: The top view shows an adjustable clip setup, while the side view shows a clamp and filler-style clip setup. Can ONTC clarify which style they want?

Answer: Please refer the Rail drawing for H375313-1000-224-260-0001 included within the RFP. Rail plan detail on Structure drawing is for representation purpose only and will be updated during IFC submission.

Item 3: Does ONTC want any kind of coating on the plates, bolts, etc. (i.e. galvanized)?

Answer: All the track material will be supplied by ONTC.

Item 4: Will imperial measurements be acceptable for fastener components?

Answer: All the track material will be supplied by ONTC.

Item 5: In reviewing the drawings, we see that they call for 90 RA rail throughout the project. They want to reuse the existing 90 RA rails for the ballast track and use new 90 RA rail in the embedded track. From previous experiences. The 90 RA rail that will be recovered from the embedded track will most likely not be reusable once removed from the concrete.

Answer: ONTC will use 115 lb. Rail and replace all 90lb Rails. All the Rail and track material will be supplied by ONTC.

Item 6: Would ONTC consider 115LB rail? It is a stronger rail, and far more readily available on the market. We also have more questions about the rail embedment details on drawing H375313-1000-224-260-0001: is this the spec of a particular fastening system (i.e. Gantrex)?

Answer: Yes, ONTC is ok with using 115 lb Rail. All the Rail and track material will be supplied by ONTC.

- Any more information on the fastening system would be appreciated.

  Answer: The detail to be provided by the Modular building supplier is in their detail design, Refer Performance Specification H375313-1000-290-242-0002 provided within the RFP.

Item 7: Please provide details for the steel decks and stairs at the lunchroom/washroom shed. Material sizing of the steel stairs, grating, and handrails. Please also confirm if it to be galvanized. This information was not provided in the new drawings.

Answer: The detail to be provided by the Modular building supplier in their detail design, Refer Performance Specification H375313-1000-290-242-0002 provided within the RFP.

Item 8: Please provide a detail for foundations for the service posts in RIP track 3 and 4 where there are no concrete platform slabs to fasten to. This information was not provided in the new drawings.

Answer: There will be a concrete slab between track 3 and 4. The drawing will be updated for IFC, The utility posts will be anchored similarly to the ones for track 1 and 2.

Item 9: On civil drawing H375313-1000-220-270-0001, it shows the new sanitary line being installed 0.72 meters off the wheelhouse foundation. Using the inverted elevation of civil drawing H375313-1000-220-271-0005, including the bedding of 150 mm of clear stone and 100mm of A gravel, the bottom of the excavation will be 2.54 meters below the existing grade. Will this cause issues undermining the Wheelhouse Foundation? This information was not provided in the new drawings.

Answer: ONTC to provide Wheel Shop building drawing to determine of any possible undermining issue with wheel shop foundation. Alternate trenchless option can be investigated during the construction phase.

Item 10: Please confirm if any new rail joints require flash-butt or thermite welding, and provide welding spec. This information was not provided in the new drawings.

Answer: Any welded joints are to be Flash butt welds only. Specifications for the same will be shared (As per ONTC Track Manual and AREMA Standards)

Item 11: What model/standard is required (capacity, mounting details) on bumping posts? No product information on the drawings. This information was not provided in the new drawings.

Answer: Product detail provided in the BOQ (Hayes type WG or HD (or equivalent). Bumping post for the embedded track to be fastened to the rail. Contractor to provide shop drawing connection detail in accordance with the supplier's recommendations. Bumping post for the Ballast track installation should follow supplier's manual.

Item 12: Please confirm where the 41m of 5" PVC reinsulated pipe is to be installed. The schedule of prices provided has a 5-inch pre-insulated quantity of 41 meters. Is this intended to be the 200 mm piping identified in the piping table on drawing H375313-1000-220-271-0002? If not, please confirm where the 5-inch PVC piping is to be installed. This information was not provided in the new drawings.

Answer: 5" dia pipe had 125 m length for sanitary main, which has been updated to 8" (200 mm PVC Pre-Insulated Sanitary Pipes (75mm Thick Insulation R7.14)) having length of 118 m. H375313-1000-220-271-0005.

Additionally, there is 22m of 8" (200 mm) PVC Non-Insulated Sanitary Pipes for non-insulated pipe. H375313-1000-220-271-0005.

For the insulated storm pipe 200 mm PVC Pre-Insulated Storm Pipes (75mm Thick Insulation R7.14) the length is 43 m. H375313-1000-220-271-0002. For the Non-insulated storm pipe 300 mm PVC Pipes the length is 50 m. H375313-1000-220-271-0002.

Item 13: Will the ONTC be issuing a new schedule of 1A prices to reflect all the changes associated with the issued for tender drawing package issued by addendum#2?

Answer: Yes.

The below noted RFP Documents have been revised and sections affected are noted below. The revised RFP sections supersede all previous RFP Document versions for the said documents.

Part 4 – Form of Proposal

Delete Document	Replace with Revised Document
Proposal Form 1A- Schedule of Prices	Proposal Form 1A – Schedule of Prices_Rev.01

Item 14: Drawing H375313-1000-230-270-0009 details A, B, and C show the rebar from the concrete track upstands and the upper slabs being poured in the bottom slab. This will create a problem for forming, finishing and pose a safety hazard for walking. Can these bars be post-base slab pour installed by drilling and installing them with Hilti Hit?

Answer: Yes, the Rebar can be doweled with Hilti HY-200.

Item 15: Drawing H375313-1000-230-270-0015 detail C shows the light pole base at 5000mm below grade. Is this the correct dimension below grade?

Answer: Yes that's correct**.**

Item 16: Please confirm the insulation material type and thickness for the air lines.

Answer: There is no insulation on the air piping. The compressed air system is complete with a desiccant dryer with a -40C dew point.

Regards,

Brinda Ranpura
Procurement Contracts Specialist
brinda.ranpura@ontarionorthland.ca

“Appendix A”

Performance Specification
Seacan Storage Container and Shelter

H375313-1000-230-242-00010001

			[p.p] Singh, Harshdeep	Andrew Middleton	Singh, Harshdeep	
2025-10-21	B	Issued for Tender	L. Chen	A. Middleton	H. Singh	Z. Chowdhury
Date	**Rev.**	**Status**	**Prepared By**	**Checked By**	**Approved By**	**Approved By**
HATCH						**Client**

Table of Contents

1. Introduction

1.1 General

This document sets forth the technical and performance specifications for the design, supply, and installation of a tensioned fabric shelter structure, supported by two parallel 40-foot seacan containers, at ONTC facilities in North Bay, Ontario. The solution aims to provide protected exterior parking for vehicles and equipment, with utility accommodations integrated into the seacans.

1.2 Scope of Work

The supplier shall provide two 40-foot seacan containers arranged parallel to one another, with modifications and utilities as specified, and a weather-resistant, tensioned fabric shelter spanning the inter-container space. Deliverables include all engineering, drawings, site-specific load calculations, fabrication, delivery, and (optionally) on-site assembly supervision.

1.3 Definitions

Term	Definition
Owner	The final end user of the building, namely Ontario Northland Transportation Commission (ONTC).
Consultant	The company appointed by the Owner to complete and oversee the project design, namely Hatch Ltd.
Vendor	Modular building company contracted to supply components and services specified in the Package.
Site	The geographical location and geometry of the land upon which the modular building will be built.

1.3.1 Seacan Container: 40-foot ISO steel shipping container, modified as per requirements.

1.3.2 Fabric Shelter: Pretensioned, durable architectural fabric membrane, covering the plan area between seacans, anchored to containers and/or ground.

1.3.3 Parking Area: The covered space between two parallel containers where vehicles and equipment are stationed.

1.4 Abbreviations

Abbreviation	Description
OBC	Ontario Building Code
CSA	Canadian Standards Association
CEC	Canadian Electrical Code
HVAC	Heating, Ventilation, Air Conditioning
ULC	Underwriters Laboratories of Canada1.5 Applicable Codes and Standards

Abbreviation	Description
OBC	Ontario Building Code including Supplementary Standards SB-1, SB-10
CSA S16	Steel Structure Design
CSA A660	Steel Building System Certification
CSA C22.1	Canadian Electrical Code
NBC	National Building Code of Canada

1.5 Applicable Codes and Standards

1.5.1 Ontario Building Code (OBC, current edition), including Supplementary Standards SB-1, SB-10.

1.5.2 CSA S16 (Steel Structure Design); CSA A660 (Steel Building System Certification); CSA C22.1 (Canadian Electrical Code); CAN/ULC fire standards as applicable.

1.5.3 National Building Code of Canada (NBC) for reference and cross-check.

1.5.4 Local municipal and provincial regulations, including snow and wind load requirements for North Bay, ON.

1.5.5 ASHRAE guidelines for insulation and energy efficiency.

1.5.6 Manufacturer’s installation instructions and best practices for tensioned fabric systems.

1.5.7 The Vendor shall be responsible to ensure that the design will meet the standards requirements not limited to above.

1.6 Units of Measure

1.6.1 All calculations, dimensions, and material sizes included in design briefs and on drawings are to be in metric units (SI units) unless specifically noted otherwise.

2. Design Requirements

2.1 Overview

2.1.1 The structure shall operate year-round in North Bay, Ontario, and accommodate extreme temperatures (37°C Summer, -30°C winter), local wind/snow loads, accessibility, and safe operation for Ontario Northland.

2.1.2 Refer General Arrangement Drawing: H375313-1000-230-0006.

2.1.3 The Vendor shall be responsible to validate all the modifications and dimensions in the General Arrangement Drawing - H375313-1000-230-0006.

2.2 Seacan Containers

2.2.1 *Structural Arrangements*

- Vendor shall supply two new, structurally sound 40-foot containers, placed parallel, spaced 6.13 m clear span, and properly leveled and anchored to resist wind uplift and snow drift as per OBC and site conditions.
- Containers shall act as the main lateral and vertical supports for the fabric shelter superstructure.

2.2.2 *Modifications*

Each container shall include:

- Semi-heated internal space: Electric convection or baseboard heaters sized for freeze protection per OBC SB-10 and ASHRAE recommendations, approved by owner.
- Doors and Windows: Roll-up doors and one operable window per long side of each seacan, positioned for cross-ventilation and user access. All windows to be insulated, lockable, and weather sealed.
- Exhaust Fan Opening: Outer wall of each container equipped for exhaust fan (wall sleeve/ducted with insulated dampers) to maintain Seacan areas under negative pressure relative to their surroundings as per ANSI/ASHRAE Standard 62.
- Electrical Service: Refer to electrical requirements section.
- Exterior Finish: Surface protection for northern Ontario weather (industrial enamel or equivalent, anti-corrosive).
- All hardware shall be heavy duty, commercial grade hardware.

2.2.2.1 Compressed Air Connection

Mechanical drawing (H375313-1000-240-270-0001) shows the approximate location of one Utility Post (Details on Drawing H375313-1000-240-260-0002). One container shall include a rigid, labelled, supported pipe consisting of the following:

- DN20 exterior Chicago fitting for hose connection to exterior utility post.
- DN20 interior ball valve for isolation.
- DN20 interior Chicago fitting for hose connection to small, compressed air equipment.

Exact compressed air connection location shall be coordinated with mechanical contractor and client, based on exterior utility post connection. Compressed air connection penetration shall be adequately insulated/flashed.

2.3 Fabric Shelter System

2.3.1 *Structural Fabric Design*

- Membrane: High-tensile PVC-coated polyester fabric, minimum 610 g/m², UV-resistant, flame retardant to CAN/ULC-S109 or equivalent; 15 years pro-rated warranty.
- Support Structure: Hot-dip galvanized or powder-coated steel arch or rigid frame, designed for snow and wind loads per OBC/NBCC for North Bay, Ontario.
- Fabric to be tensioned over/between the seacan roof rails with steel/aluminum extrusion or proprietary attachment system, sealed against water/snow ingress at all connection lines.

2.3.2 *Doors and Openings*

- Vehicle Access Roll-up Door: One full-width roll-up motorized door.
- Personnel Door: Minimum one lockable man-door in fabric wall or seacan end, clearly marked for egress.
- Back Fabric Wall: Opposite end fully covered with fabric, tensioned and fixed to prevent snow/rain ingress but allow pressure equilibration; sealed to containers/sill.

2.3.3 *Coverage and Weather Protection*

- Shelter footprint to span full clear area between, above, and slightly beyond exterior faces of the containers.
- Integrated water drainage system (gable or arch) to direct runoff away from container sides and parking bay.

2.4 Shelter/Parking Area Requirements

- Minimum unobstructed bay width and length to allow entry, parking, for ONTC's largest equipment/vehicles (supplier to coordinate dimensions).
- Electrical Service: Refer to electrical requirements section.

2.5 Safety and Fire Protection

2.5.1 *Floor Assemblies*

Seacan floor finish: heavy duty non-slip coating.

2.5.2 *Roll up Doors*

2.5.2.1 Metal Finishes: Free from defects, clean and unstained, and of uniform colour.

2.5.2.2 Supply hardware complete with all necessary screws, bolts and other fastening of suitable size and type to anchor the hardware in position neatly and properly in accordance with best practices and to the Owner's approval.

2.5.2.3 Warrant work against defects in materials and quality of performance for a period of 5 years.

2.5.3 *Personnel Door Hardware*

2.5.3.1 Metal Finishes: Free from defects, clean and unstained, and of uniform colour.

2.5.3.2 Supply hardware complete with all necessary screws, bolts and other fastening of suitable size and type to anchor the hardware in position neatly and properly in accordance with best practices and to the Owner's approval.

2.5.3.3 Doors shall have glass view panels.

2.5.3.4 Personnel door shall be heavy duty metal doors.

2.5.3.5 Warrant work against defects in materials and quality of performance for a period of 5 years.

2.5.4 *Windows*

Windows shall be operable triple glazed units in thermally broken vinyl frames, complete with low E argon filled cavities. Frame Colour: White.

2.6 Structural Requirements

2.6.1 *General*

2.6.1.1 The proposed structures shall meet the requirements of the OBC.

2.6.1.2 The structure shall be of modular construction to minimize construction work on site.

2.6.1.3 These structures shall be designed for rigging, lifting, transportation, erection, and installation on a site built permanent foundation.

2.6.1.4 The Vendor shall be responsible for all structural design to be carried out in accordance with the OBC and the related structure design codes and standards and as noted in this specification.

2.6.1.5 The Vendor shall provide all the structural members, connections, fasteners as required to resist all the loads from the occupancies and equipment and other loads based on the OBC. Special loads other than those listed in the OBC will be provided during the design process as required.

2.6.1.6 The Vendor shall be responsible for the rigging, lifting and transportation design of the modular building to ensure that the building structure is capable of resisting all loads during rigging, lifting and transportation.

2.6.1.7 The Vendor will be responsible for the layout planning and anchorage design of the connections of the prefabricated units to the foundations. The Vendor shall provide the structural system between underside seacan to foundation pad. The Vendor shall provide the required foundation layout and the foundation loads for all the structure design loads to the Consultant for pad design. The foundations for the main lateral load resisting systems shall be clearly marked on the foundation layout drawing.

2.6.1.8 The vendor shall provide the proposed design live loads and live load breakdown for all floor and roof areas, for review and agreement prior to the structural design.

2.6.1.9 The structure and components and their anchorages (electrical, mechanical etc.) shall be designed to meet the seismic requirements in the OBC.

2.6.2 *Design Loads*

2.6.2.1 The structure and all parts shall be designed and constructed to support safely all loads and load combinations defined, according to OBC. The buildings shall be designed according, but not limited, to the following loads:

- Importance category: Normal.
- Live loads shall be according to OBC, but not less than following:
  - Equipment loads, including piping and electrical components.
  - Roof Live Load: 1.5 kPa (minimum) and equipment load as applicable.
  - Seacan Container floor occupancy Live Load: 6 kPa.
- Seismic loads: building and components shall be designed for seismic forces as per OBC for Site Class D.
- Snow load shall be according to OBC. If Part 4 snow load is used, then refer to site layout for adjacent roof structures.
- All anticipated forces during load-out, rigging, lifting, and transportation of modules.
- Concrete slab (supplier responsible for specifying all structural load requirements).

2.6.3 *Material*

2.6.3.1 Steel framing members with infills shall be designed as per OBC and CSA-S16.

2.6.3.2 When welded steel structures form part of the structures of these buildings; the manufacturer will be required to obtain certification from the Canadian Welding Bureau (CWB) to the requirements of CSA W47.1 standard.

2.6.3.3 Clean, prepare surface, shop prime and finish coat structural steel in accordance with CAN/CSA-S16.

2.6.3.4 Shelter fabric to meet flame-retardancy requirements per regulatory standard.

2.6.4 *Submission*

2.6.4.1 Construction and manufacturing shop drawings shall be prepared and stamped by engineer registered in the province of Ontario and submitted for approval to the Owner prior to construction or fabrication.

2.6.4.2 Shop drawings shall show all modules in plan, elevation, and section, including details, attachments to other work and joint details to be performed on site.

2.6.4.3 Structural drawings showing details of roof including arrangement of secondary members shall be provided.

2.6.4.4 Structural drawings showing details of columns, truss, joist, anchor bolts, and connections shall be supplied by manufacturer and stamped by an engineer registered in the province of Ontario.

2.6.4.5 Structural drawings shall include a table with reaction forces under ULS and SLS load combinations at support locations to be used for foundation design.

2.7 Fire Protection Requirement

2.7.1 *Fire Suppressions Requirements*

2.7.1.1 Design, supply, installation and testing of fire protection systems shall comply with the requirements of the OBC and NFPA. All equipment shall be ULC listed, and FM approved.

2.7.1.2 The fire protection system, structure, and components shall meet the seismic requirements OBC.

2.7.1.3 Portable fire extinguishers shall be provided for all areas (Seacans and Parking) in accordance with OFC and NFPA 10, Standard for Portable Fire Extinguishers

2.7.2 *Fire Detection and Alarm Requirement*

2.7.2.1 Fire detection and alarm system shall be designed, supplied, and installed in all areas (Seacans and Parking).

2.7.2.2 All components including detectors, pull station and horns and strobes shall be provided.

2.8 Electrical Requirements

2.8.1 Buildings (Seacans and Parking area) within this Package shall be provided with electrical power, lighting, grounding, and services in accordance with Ontario Building Code (OBC), Ontario Electrical Safety Code (OESC), and the Canadian Electrical Code CSA C22.1, Workplace Electrical Safety (CSA Z462), and other applicable codes/standards.

2.8.2 The building shall contain 480/277V panel board, and all services downstream, supplied by others, as indicated on the Site Layout drawing. The vendor shall be responsible for providing load calculations for the building to assist with sizing the transformer. The vendor shall provide all power services except the content defined on the Site Layout drawing and provide electrical connections (120/208V and 480/277V) to the associated panels in the building.

2.8.3 The building shall comply with Ontario Building Code (OBC) requirements for life safety emergency exiting, including but not limited to:

- Exit signage.
- Emergency lights.

2.8.4 A sufficient number of electrical services and process receptacles shall be provided in all areas where applicable.

2.8.5 The Vendor shall include the details of the proposed lighting system (lighting fixtures, lighting switches, conduits/wiring, etc.) and illuminance in each building area for review by the Owner, the lighting requirements to comply with Illuminating Engineering Society of North America Lighting Handbook (IESNA). Lighting fixtures shall be LED throughout.

2.8.6 A grounding system and a means of protection for the Structure shall be provided for personnel, equipment, and the electrical power system inside the Seacan.

2.8.7 All equipment provided shall be CSA approved, and large equipment shall bear the CSA label.

3. Execution

3.1 Design and Drawings

3.1.1 Supplier must provide stamped engineering drawings and site-specific load/calculation data for approval by ONTC or their consultant prior to manufacture.

3.2 Fabrication

3.2.1 The buildings in this Package shall consist of prefabricated, modular units, complete with finishes, fixtures, as necessary.

3.2.2 The prefabricated, modular units shall be constructed and delivered to allow for suitable access to building areas, including ceiling space, where significant Site installation work is required.

3.2.3 Preassembly at factory (if feasible); site works include final anchoring, tensioning, and fit-up.

3.2.4 All fittings, mechanical equipment, electrical devices, fixtures, and equipment used shall be CSA approved.

3.3 Painting and Surface Protection

3.3.1 The Vendor shall provide surface preparation and painting systems including all labour, supervision, tools, equipment, cleaning and paint materials and all other materials required to provide an effective protection against corrosion of all supplied equipment.

3.3.2 The Vendor shall submit to the Owner, for approval, a painting specification for all components, including sub-supplied equipment.

3.4 Inspection and Testing

3.4.1 *General*

3.4.1.1 The Vendor shall supply their standard inspection and test plan (ITP), according to the relevant construction codes, to the Owner for review and approval. ITPs shall be provided for all key activities and tasks.

3.4.1.2 The Owner and Vendor shall jointly develop and agree on the acceptance criteria for the factory acceptance test (FAT).

3.4.1.3 The Vendor shall perform all tests and inspections necessary to ensure that the material and workmanship conform to Owner’s requirements, design, and codes of construction. The Vendor is responsible for ITP on all equipment, including sub-supplied equipment. All inspection reports shall be made available to the Owner for review, if requested.

3.4.1.4 Acceptance of shop tests shall not constitute a waiver of requirements to meet the field performance under specified conditions, nor does inspection in any way relieve the Vendor of his responsibility.

3.4.1.5 Vendor shall carefully and continuously control and test the quality of the materials and the manufacturing operations during the production of the equipment, in order to ensure that the equipment will comply with the requirements of the purchase order and code of construction.

3.4.1.6 The Owner’s inspector shall have the right to request additional inspection or examination if required to ensure that the equipment complies with the relevant specification and codes.

3.4.1.7 The Vendor is responsible for notifying all sub-suppliers of the inspection and testing requirements. No material or equipment shall be sent to the Site until the Owner has issued a release note for shipment.

3.4.2 *Rejection*

3.4.2.1 The Owner’s inspector has the authority to request repairs or alterations, if in his/her opinion the materials or workmanship do not meet the required specifications.

3.4.2.2 Equipment, parts, or materials indicating a defect originating in Vendor design, materials, and workmanship, or being in conflict with requirements of this document, will be subject to rejection.

3.4.2.3 The Vendor shall not prepare the rejected equipment for shipment until approval has been granted by the Owner.

3.5 Marking, Packaging and Shipping

3.5.1 The building components shall be delivered in the minimum economic number of assemblies. Each assembly shall be complete, tested, and pre-commissioned in accordance with the requirements in the contract document, taking due account of preservation and transport requirements.

3.5.2 The Vendor shall be responsible for prevention of any possible damage of the structure components during shipment.

3.5.3 It is the Vendor's responsibility to ensure that proper transport is utilized to deliver the building components to Site.

3.5.4 The Vendor shall provide marking, packing, and shipping procedure(s), including sample packing slip, for Owner review and approval.

3.5.5 The building components may be stored outside in northern winter conditions. It is the Vendor's responsibility to ensure it's packed for that, cover all opening to stop dust and dirt from entering and snow from entering if transported in winter months. cap all electrical in a way that it can be reconnected. ensure all door, windows are locked. send pictures once shipment is ready for being loaded and once loaded for approval.

3.5.6 The modules dimensions and structural loads shall comply with the Truck Weight Classifications and Restrictions in Ontario.

END OF SECTION

"Appendix B"

Calculation Cover Sheet

Client:	Ontario Northland Rail	**Project No:**	H375313
Project Title:	North Bay Yard RIP Track Project	**Discipline:**	Mechanical
Calculation No:	H375313-1000-240-202-0001	**EWP No:**	240/0001
Number of sheets: (incl. cover sheet)	12		
Calculation Title:	Compressed Air Piping & Equipment Calculation		

Category of calculation checking required ✓(tick box) ☑ Full ☐ Spot ☐ Self

Prepared By: K. Piro *(Print Name)* Date: 2024-05-14 (YYYY-MM-DD)

Review By: B. Nolan *(Print Name)* Date: 2024-05-14 (YYYY-MM-DD)

Can the calculation now be released for work? ☐ Yes ☑ No **To the Client?** ☑ Yes ☑ No

General Notes:
The goal of this calculation is to determine the compressed air requirements and equipment sizing for the North Bay Yard RIP Track & Charging Station.
From these requirements, equipment selections will be made.

DATE	REV	STATUS	PREPARED BY	CHECKED BY	APPROVED BY DISCIPLINE LEAD
2024-05-14	0	Approved for Use	K. Piro	B. Nolan	B. Nolan

Superseded by Calculation No: **Date:** (YYYY-MM-DD)

Reason Voided:

Calculation Sheet

		Sheet 2 of 12	
H375313-1000-240-202-0001	Rev. 0	Prepared by:	Reviewed by:
Compressed Air Piping & Equipment Calculation		K. Piro	B. Nolan
		5/14/2024	5/14/2024

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Appendices

HATCH

Calculation Sheet

		Sheet 3 of 12	
H375313-1000-240-202-0001	Rev. 0	Prepared by:	Reviewed by:
Compressed Air Piping & Equipment Calculation		K. Piro 5/14/2024	B. Nolan 5/14/2024

1. Introduction

This calculation covers the compressed air piping and equipment sizing for the North Bay Yard RIP Track.

The design outputs, conclusions, and recommendations will be used to develop technical drawings, specifications and datasheets.

2. Objectives

1 Determine the compressed air requirements for the RIP Yard.

2 Determine the compressed air requirments for the charging shack.

3 Size the compressor based on established requirments.

4 Size the wet air reciever based on established requirements.

5 Size the air dryer based on established requirements.

6 Size the dry reciever based on established requirements.

7 Size the filters based on established requirements.

8 Size the compressed air piping based on established requirements.

3. References

1 AREMA manual for railway engineering, 2011, Part 17 - Other yard and Terminal Facilities
KIRC - 3_06P17.pdf - All Documents

2 CFM Calculator for Compressed Air
https://fluidairedynamics.com/pages/cfm-calculator-for-compressed-air

3 H373090-0000-200-210-0001, Design Basis Memo
https://hatcheim.sharepoint.com/sites/H375313/WIPUncontrolled/WOP_1000_%20RIP%20Rehab/240%20-%20Mechanical/Arrow%20Calc/H373090-0000-200-210-

4 PPI Handbook, 2nd Edition, Chapter 6, Design of PE Piping Systems
https://hatcheim.sharepoint.com/sites/H375313/WIPUncontrolled/WOP_1000_%20RIP%20Rehab/240%20-%20Mechanical/Arrow%20Calc/Chapter%206%20-%20Design%20of%20PE%20Piping%20Systems.pdf?csf=1&web=1&e=3BGIf9

5 PLP-250-020-0001, HDPE Piping Design, User Guide
https://hatcheim.sharepoint.com/sites/H375313/WIPUncontrolled/WOP_1000_%20RIP%20Rehab/240%20-%20Mechanical/Arrow%20Calc/PLP-250-020-0001.pdf?csf=1&web=1&e=TDC00O

6 Hard Rock Miner's Handbook,
https://www.stantec.com/content/dam/stantec/files/PDFAssets/2014/Hard%20Rock%20Miner's%20Handbook%20Edition%205_3.pdf

7 PLP-250-086-0004, Piping Design Criteria
https://hatcheim.sharepoint.com/sites/H375313/WIPUncontrolled/WOP_1000_%20RIP%20Rehab/240%20-%20Mechanical/Arrow%20Calc/PLP-250-086-0004.docx?d=wf807375ab40f47fc9efc4502747f545b&csf=1&web=1&e=Ysabnq

8 PLP-250-020-0015, Hydraulic Analysis User Guide
https://hatcheim.sharepoint.com/sites/H375313/WIPUncontrolled/WOP_1000_%20RIP%20Rehab/240%20-%20Mechanical/Arrow%20Calc/PLP-250-020-0015.pdf?csf=1&web=1&e=vIRGHO

9 H375313-1000-240-276-0001, Compressed Air P&ID, Rev. A

10 Compressed Air System Arrow Model
https://hatcheim.sharepoint.com/sites/H375313/WIPUncontrolled/WOP_1000_%20RIP%20Rehab/240%20-%20Mechanical/Arrow%20Calc/Compressed%20Air%20Calculation_Rev.%20A.6.aro?csf=1&web=1&e=c2njP0

11 Ontario Building Code, MMAH Supplementary Standard SB-1, Climatic and Seismic Data

12 Atlas Copco Manual, 8th Edition, Atlas Copco
https://www.atlascopco.com/content/dam/atlas-copco/local-countries/united-kingdom/documents/Atlas-Copco-Compressed-Air-Manual-8th-edition.pdf

13 Canadian Climate Normals, 1991-2020
https://climate.weather.gc.ca/climate_normals/results_1991_2020_e.html?searchType=stnName_1991&txtStationName_1991=north+bay&searchMethod=contains&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=189000000&dispBack=1

14 Air - SCFM versus ACFM and ICFM
https://www.engineeringtoolbox.com/scfm-acfm-icfm-d_1012.html

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4. Design Assumptions

1 The compressed air system will be sized based on the following usage:
i. 4 cars present in RIP Track Area all needing to be charged to 90 psi for a brake test in 30 minutes.
ii. Air tools being used to perform repairs on the 4 cars in the RIP Track Area.
iii. 120 car train is at the Air Brake Charging Shack and needs to be charged up to 80 psi in 30 minutes.

2 Each train car is assumed to be 100ft (30.5) m long.

3 Train car brake pipe is assumed to be 1.25" (32mm) inner diameter pipe.

4 Each car has a 20 Gallon (75.7 L) emergency/auxiliary air reservoir.

5 Assume hose length of 5 m between cars.

6 Assume worst case indoor design temperature of 5 deg. C in winter months.
Mechanical shack will be heated to this temperature.

7 As per OBC SB-1 (Ref. 11), assume an ambient design temperature of 28 degrees in summer months for North Bay.

8 Assume compressor has an aftercooler and the maximum temperature differential is 6.7 deg. C.

5. Calculation Methodology

1 AFT 8 Arrow Fathom software was used to determine the head loss and velocities for the Compressed air system. This software allows the user to create a representative two-dimensional model, then computes the total head loss, pressures and the velocity of the gas through a given pipe, for a chosen scenario.

2 Pressure loss and velocities for pipe will be verified using hand calculations.

3 The charging shack and rip tracks used simultaneously shall be the design case.
Two additional scenarios will be used with the charging shack and rip track as individual users respectively. These scenarios will ensure that the compressor pressure is adequate when only one user is consuming compressed air.

6. Inputs and Known Values

1 Per Hatch PLP Piping Design Criteria Template, Section 3.1.11 for line sizing:

Table 3-4: Fluid Velocity in Pump Discharge and General Piping

Fluid	Velocity (m/s)
Water and other liquid	2-4
Air, Gas	15-20

The recommended velocity for the compressed air service is 15-20 m/s (49-66 fps)

2 Arrow standard air density and viscosity shall be used for this calculation.

3 Buried Pipe shall be HDPE DR7.3 per pipe specifications for project.

4 Above ground pipe shall be Carbon Steel pipe per pipe specifications for the project.

5 Arrow default absolute roughness of 0.018 inches for carbon steel and 6.0 x 10^-5 inches shall be used.

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Calculation Sheet

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7. Compressed Air Consumption Calculation

Train Car Volume

	Value	Unit
Train Car Brake Pipe Length	30.5	m
Brake Pipe Inner Diameter	32	mm
	0.032	m
Brake Pipe Cross Sectional Area	0.0008	m3
Brake Pipe Volume per Car	0.0245	m3
	24.5	L
Emergency Resevoir Volume	76	L
Connecting Hose Length	5	m
Connecting Hose Inner Diameter	0.025	m
Connecting Hose Volume	0.0025	m3
	2.45	L
Total Volume per Train Car	103.0	L
	3.64	ft3

Quantity of Cars

Location	Value
RIP Track Cars	4
Charging Shack Cars	120
Total Number of Cars	124

(Note: See reference 3 for train car dimensions used above, as provided by Ontario Northland.)

Per reference 2, the following formula can be utilized to determine the required flow.

$$CFM = (V \times \Delta P) \div (T \times 14.7)$$

- **CFM:** Cubic Feet per Minute (output of the air compressor)
- **V:** Volume of the air receiver (tank) in cubic feet
- **ΔP:** Change in pressure during the pump-up time (ending pressure - starting pressure) in PSI
- **T:** Time it takes for the air compressor to fill the tank from the starting pressure to the ending pressure, in seconds
- **14.7:** Atmospheric pressure in PSI at sea level

	RIP Track	Charging Shack	Units
Volume per Car	3.64	3.64	ft3
Number of Cars	4.00	120	ea.
Total Volume	14.55	436.42	ft3
Pending	104.7	104.7	psia
Pstarting	14.70	14.70	psia
Delta P	90	90	psia
Time	30.00	30.00	mins
CFM	2.97	89.07	CFM

Therefore the total required airflow required for the train brake charging is:
92.03 CFM.
with a 10% Safety Factor:
101.24 CFM.

Comparing to Ref. 1, AREMA Manual For Railway Engineering, example for Pressurization time calculations:

c. Overall system pressurization time from 0 to 80 psig.

(1) In order to raise the pressure from 0 – 80 psig, (for a yard at sea level) amount of free air to be pressurized in the system.

$$\frac{\text{960 CF (total car volume)} \times \text{14.7 (one atmosphere)} + \text{80 psia}}{\text{14.7 psia (one atmosphere)}} = 6184.49 \text{ CF}$$

	RIP Track	Charging Shack	Unit
Volume per Car	3.64	3.64	ft3
Number of Cars	4.00	120	ea.
Total Volume	14.55	436.42	ft3
Pressure	90	90	psia
CF	103.61	3108.39	ft3
Time	30	30	mins
Flow	3.45	103.61	cfm

Therefore the total required airflow required for the train brake charging is:
107.07 CFM.
The design case for the system sizing will carry a 10% safety factor.
The flow required then becomes:
117.77 CFM.

As per reference 7, Table 19-2, a typical surface shop has an operating consumption of 60 CFM.
Assuming that the two RIP tracks and Expedited Tracks are each equivalent to one surface shop and using a utilization of 50%, the required airflow would be equivalent to one shop or: 60 cfm.

The table below summarizes the airflow required for the site.

User	Required Flow (cfm)
Charging Shack	103.61
RIP Track - Brake Testing	3.45
RIP Track - Shop (Tools)	60
Total	167.1
10% Safety Factor	16.7
Total	184.0

7.1 Conversion to SCFM for Arrow Model

The conversion from SCFM to ACFM can be expressed

$$ACFM = SCFM\,(P_{std} / (P_{act} - P_{sat}\,\Phi))\,(T_{act} / T_{std})$$

where

ACFM = Actual Cubic Feet per Minute

SCFM = Standard Cubic Feet per Minute

P_{std} = standard absolute air pressure (psia)

P_{act} = absolute pressure at the actual level (psia)

P_{sat} = saturation pressure at the actual temperature (psi)

Φ = Actual relative humidity

T_{act} = Actual ambient air temperature (°R)

T_{std} = Standard temperature (°R)

(REF. 14)

The following is the conversion from SCFM to ACFM for input into the Arrow model.

From OBC, SB-1 for North Bay (REF. 11), the temperatures are:
January = -28 deg. C and July = 28 deg. C

From Canadian Climate Normals Data (REF. 13) for North Bay:
Pressure
January = 97.0 kPa and July = 97.0 kPa
Humidity
January = 79.9 % and July = 86.6 %
Sat. Pressure
January = 0.3 kPa and July = 1.6 kPa

		Total Flow		Charging Shack		RIP Tracks	
		Jan	July	Jan	July	Jan	July
ACFM	acfm	185.00	185.00	113.96	113.96	69.80	69.80
Pstd	psi	14.70	14.70	14.70	14.70	14.70	14.70
Pact	psi	14.07	14.07	14.07	14.07	14.07	14.07
Psat	psi	0.04	0.23	0.04	0.23	0.04	0.23
Humidity	%	0.80	0.87	0.80	0.87	0.80	0.87
Tact	Rankine	441.27	542.07	441.27	542.07	441.27	542.07
Tstd	Rankine	527.67	527.67	527.67	527.67	527.67	527.67
SCFM	cfm	211.20	169.89	130.10	104.65	79.68	64.09

		Compressor Flow		Train Brakes	
		Jan	July	Jan	July
ACFM	acfm	218.60	218.60	3.80	3.80
Pstd	psi	14.70	14.70	14.70	14.70
Pact	psi	14.07	14.07	14.07	14.07
Psat	psi	0.04	0.23	0.04	0.23
Humidity	%	0.80	0.87	0.80	0.87
Tact	Rankine	441.27	542.07	441.27	542.07
Tstd	Rankine	527.67	527.67	527.67	527.67
SCFM	cfm	249.56	200.74	4.33	3.49

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8. HDPE Internal Pressure Check

As per references 4 and 5, the allowable internal pressure for the pipe can be determined using the following formula:

$$\text{(1-1)} \quad PR = \frac{2\ HDS\ F_T\ A_F}{(DR\text{-}1)}$$

The HDS for the PE4710 per Table 1-1 (Ref. 4) is 1000 psi. The temperature multiplier is as per Table B2.2 (Ref. 4). Due to the high efficiency coalescing filters, the compressed air is assumed to have an oil concentration of less then 2% and therefore would have an environmental application factor of 1 per Table 1-2.

TABLE 1-1
Hydrostatic Design Stress and Service Temperatures

Property	Standard	PE 2606, PE2706	PE 2708, PE 3608, PE 3708, PE 4608	PE 3710, PE 4710
Hydrostatic Design Stress, HDS at 73°F (23°C)	ASTM D2837 & PPI TR-3	630 psi (4.6 MPa)	800 psi (5.5 MPa)	1000 psi (6.9 MPa)
Maximum recommended operating temperature for Pressure Service*	-	140°F (60°C)	140°F (60°C)	140°F (60°C)
Maximum recommended operating temperature for Non-Pressure Service	-	180°F (82°C)	180°F (82°C)	180°F (82°C)

* Some PE piping materials are stress rated at temperatures as high as 180°F. For more information regarding these materials and their use, the reader is referred to PPI, TR-4.

TABLE B.2.2
Dynamic Modulus, Temperature Compensating Multipliers

Temperature , °F (°C)	Multiplier
40 (4)	1.78
50 (10)	1.52
60 (16)	1.28
73.4 (23)	1.00
80 (27)	0.86
90 (32)	0.69
100 (38)	0.53
110 (43)	0.40
120 (49)	0.29

TABLE 1-2
PE Pipe Environmental Application Factors (A_F)*

Pipe Environment	Environmental Application Factor (A_F) at 73°F (23°C)
Water: Aqueous solutions of salts, acids and bases; Sewage; Wastewater; Alcohols; Glycols (anti-freeze solutions)	1.0
Nitrogen; Carbon dioxide; Methane; Hydrogen sulfide; Non-Federally regulated applications involving dry natural gas or other non-reactive gases	1.0
Fluids such as solvating/permeating chemicals in pipe or soil (typically hydrocarbons) in 2% or greater concentration, natural or other fuel-gas liquids condensates, crude oil, fuel oil, gasoline, diesel, kerosene, hydrocarbon fuels, wet gas gathering, multiphase oilfield fluids, LVP liquid hydrocarbons, oilfield water containing >2% hydrocarbons.	0.5

* Certain codes and standards include prohibitions and/or strength reduction factors relating to the presence of certain constituents in the fluid being transported. In a code controlled application the designer must ensure compliance with all code requirements.

Variable	Winter	Standard	Summer	
Temperature	4	23	38	Deg. C
HDS	1000	1000	1000	psi
Ft	1	1	0.53	-
Af	1	1	1	-
DR	7.3	7.3	7.3	-
PR	317.46	317.46	168.25	psi
	2188	2188	1160	kPa

9. Pressure Loss/Velocity Hand Calculation Verification

The pressure drop in a pipe can be determined by the following equation:

$$\Delta p = \frac{450 l {q_c}^{1.85}}{d^5 p}$$

(Ref. 12 - Atlas Copco Manual, 8th Edition, Atlas Copco, p. 91)

Δp = pressure drop (bar)
q_c = volume rate of flow at free air condition (l/s)
l = pipe length (m)
d = pipe inner diameter (mm)
p = initial absolute pressure (bar absolute)

Pressure at user 100 psi
The pipe distribution network will be sized to ensure a maximum of 25 psi drop from supply to the furthest user.
Supply pressure: 115 psi Assume that the air dryer/filters drops the supply pressure 13 psig.

Location	Pipe L (feet)	Flow (scfm) Avg	NPS	Pipe ID (mm)	ΔP (bar)	P2 (psig)	Velocity (ft/s)
Supply Line	50	210	2.00	42.67	0.029	101.58	20.0
Line to Charging Shack	1665	130.10	2.00	42.67	0.409	95.65	13.1
Charging Shack Ex. Pipe	40	130.10	1.00	25.40	0.139	93.63	37.6
Line to RIP Tracks	315	79.68	2.00	42.67	0.031	101.13	7.6
Line to RIP Track #1	580	79.68	2.00	42.67	0.058	100.29	7.7
Line to RIP Track #2	255	79.68	2.00	42.67	0.025	100.76	7.7
RIP Track Utility Post	15	3.80	1.25	31.75	0.000	100.29	0.7
RIP Track Utility Post	15	25.00	1.25	31.75	0.001	100.75	4.3

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10. Hydraulic Model

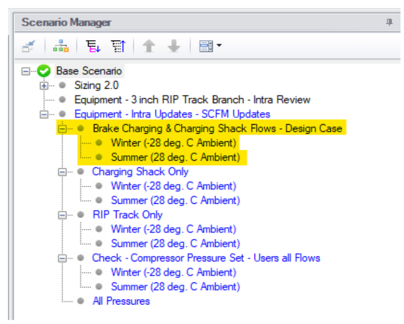
The hydraulic model was set-up assuming the worst case scenario of the charging shack and the two most remote RIP tracks requiring air simultaneously. Each RIP track has an allowance for the two most remote utility posts being used for brake charging and one post utilized for pnuematic repair tools.

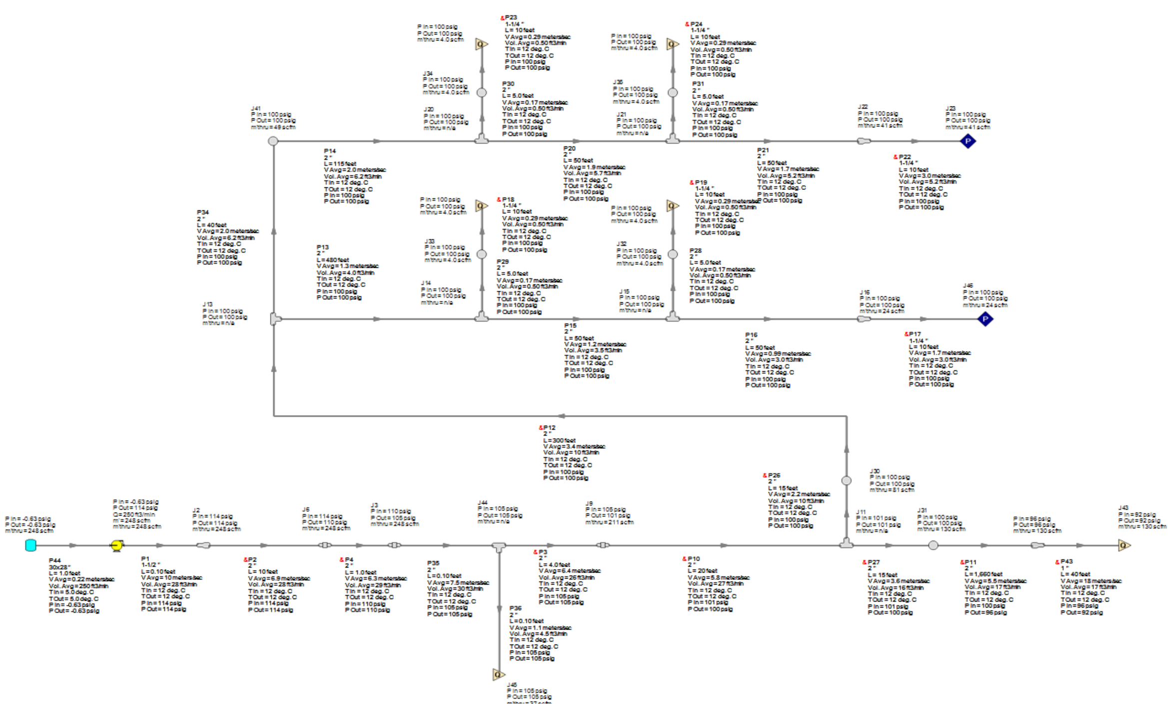
11. Calculation Results

Scenario	Flow Rate		Pressure Required
-	ACFM	SCFM	PSIG
Summer - Charging Shack & RIP Tracks	184	170	114.3
Winter - Charging Shack & RIP Tracks	184	211	114.6

11.1 Arrow Results

The scenario shown below is for the summer sizing for the Charging Shack and RIP Tracks requiring compressed air simultaneously.





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12. Conclusions and Recommendations

12.1 Compressor Capacity

Per the results listed in the Table above, the recommended compressor sizing is
220 CFM and 115 PSIG (note, allowance in flow rate for 15% loss through dessicant dryer.

12.2 Recommended Pipe Sizes

As per Input 1, The recommended velocity for the compressed air service is 15-20 m/s (49-66 fps)
Due to the recommended minimum size for buried pipes recommended of 2" the velocities will be lower.
This results in lower pressure losses in the system.

Pipe	Size	Velocity (Winter)		Comments
		fps	m/s	
P1	2	33.0	10.1	-
P10	2	18.9	5.8	Minimum recommended size for buried pipe is 2"
P27	2	11.7	3.6	
P11	2	17.6	5.4	
P26	2	7.3	2.2	
P12	2	11.0	3.4	
P34	2	6.7	2.0	

.

13. Equipment Selection

The following equipment has been selected based on the system requirements.

Equipment Type	Make	Model	Capacity (USG)	Flow Rate (ACFM)	Pressure (PSI)
Air Compressor	Gardner Denver	L37	-	219	125
Wet Reciever	Manchester Tank	-	240	-	200
Desiccant Dryer	Gardner Denver	DGH260	-	281	120
Pre-Particulate Filter	Gardner Denver	Grade C			-
High Eff. Oil Filter	Gardner Denver	Grade E			-
Dry Reciever	Manchester Tank	-	240	-	200

Receiver Sizing

The following formula is used to size the dry reciever for the compressed air system.
The total flow emptying time will be the driver for the reciever size. Charging shack and RIP track flows are shown to determine the retention time of the reciever size selected for the total flow.

$$V = \frac{q \times t}{p_1 - p_2} = \frac{L}{p_1 - p_2}$$

V = air receiver volume (l)
q = air flow during emptying phase (l/s)
t = length of the emptying phase (s)
p_1 = normal working pressure in the network (bar)
p_2 = minimum pressure for the consumer's function (bar)
L = filling phase air requirement (l/work cycle)

(ref. 12)

	Total Flow	Charging Shack	Rip Track	RIP Track Tool	
P1 (psi)	115	115	115	115	
P2(psi)	100	100	100	100	
deltaP(psi)	15	15	15	15	
deltaP(bar)	1.03	1.03	1.03	1.03	
Q (CFM)	184	114.0	69.8	20.0	
Q(L/s)	86.84	53.79	32.94	9.44	
V (USG)	240.00	240.00	240.00	240.00	
V (ft3)	32.08	32.08	32.08	32.08	
V (L)	908.50	908.50	908.50	908.50	
t (s)	**11**	**17**	**29**	**100**	

Appendix A - Air Dryer Cutsheet

DGH Desiccant Dryers

Customizable Performance

Gardner Denver DGH Series Heatless Desiccant Dryers were designed to help you meet your goals. Customizable performance technology is integrated into our standard product so it can be tailored to benefit your specific critical compressed air drying application. Now, you have the liberty to personalize the performance of the standard product to adapt to your specific needs. Variations in demand, pressure dew point, compressed air purity and hours of operation have often forced engineers to compromise energy efficiency and system performance for an "off-the-shelf" product. Not anymore. The DGH series offers three controller styles to meet every application.

Basic Controller

- The basic controller presents traditional heatless drying system
- Using a simple timer based controller, it offers a reliable fixed cycle operation
- Automatic time controlled bed regeneration cycles offer consistent performance
- The controller LEDs reflect: power on, left tower drying, right tower drying

Standard Controller

- Four Dew Point choices from fixed cycle operating modes
- Eight levels of Purge Air Energy Savings to match to your specific air demand profile
- Controlled purge air shut-down when your air compressor unloads or is turned off

Energy Saving Controller

- Demand driven operating cycles to maximize your return-on investment
- Automatic Purge Air Control means exact matching to changing system load dynamics
- Complete sensitivity to actual operating conditions minimizes your cost of operation
- Simplicity: less moving parts for maximum reliability

TABLE 1 — SIZING INFORMATION

MODEL SCFM	INLET FLOW @ 100 PSIG, (7 BAR)	DIMENSIONS - INCHES			CONNEC-TIONS INCHES	WEIGHT LBS.
		HEIGHT	WIDTH	DEPTH		
DGH40	40	46	32	32	1" NPT	365
DGH60	60	61	32	32	1" NPT	445
DGH90	90	78	32	32	1" NPT	575
DGH115	115	54	44	38	1" NPT	685
DGH165	165	54	44	38	1" NPT	685
DGH260	260	72	48	38	2" NPT	1010
DGH370	370	63	55	38	2" NPT	1215
DGH450	450	71	55	38	2" NPT	1350
DGH590	590	101	52	48	2" NPT	1473
DGH750	750	104	54	48	2" NPT	2134
DGH930	930	109	59	56	2" NPT	2414
DGH1130	1130	112	63	56	3" ANSI Fig.	2875
DGH1350	1350	117	65	56	3" ANSI Fig.	3722
DGH1550	1550	115	71	56	4" ANSI Fig.	4167
DGH2100	2100	116	79	56	4" ANSI Fig.	4417
DGH3000	3000	122	78	65	4" ANSI Fig.	9010
DGH4100	4100	122	93	85	6" ANSI Fig.	9900
DGH5400	5400	122	102	86	6" ANSI Fig.	12000

TABLE 1 NOTE

* BSP connections and DN Flg available. Dimensions and weights are for reference only. Request certified drawings for construction purposes.

TABLE 2 NOTE

To determine inlet flow at pressures other than 100 psig (7 kgf/cm²) multiply inlet flow at 100 psig from Table 1 by the multiplier that corresponds to your operating pressure from Table 2.

TABLE 2 – SIZING INFORMATION

OPERATING PRESSURE															
	PSIG	60	70	80	90	100	110	120	130	140	150	175	200	225	250
	BAR	4.2	4.9	5.6	6.3	7.0	7.7	8.4	9.1	9.8	10.5	12.3	14.1	15.8	17.6
Multiplier		0.65	0.74	0.83	0.91	1.00	1.04	1.08	1.12	1.16	1.20	1.29	1.37	1.45	1.52

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Appendix B - Compressor Datasheet

40-60 HP FIXED SPEED ROTARY SCREW COMPRESSORS

L-Series

Advanced Technology. Inspired Simplicity.

L-Series compressors from Gardner Denver feature more than just the latest compressor technology. They contain the cleanest, simplest, most intuitive machine layouts on the market. Equipped with standard TEFC main motors, wye-delta starters, Governor™ microprocessor controllers and quiet enclosures, an L-Series unit from Gardner Denver is the optimal solution when a feature-rich, simple-to-operate compressor is required.

First Class Serviceability

The L-Series units set a new standard in serviceability. By utilizing integrated airend design techniques, Gardner Denver delivers unprecedented access to service and routine maintenance items. At the same time, the compact design eliminates unneeded connections and minimizes piping; reducing the opportunity for leaks. Couple these features with an intuitive touch screen controller with optional data logging and sequencing capabilities and you have a world class compressor package.

L30-L45 ROTARY SCREW COMPRESSOR

MODEL	DRIVE MOTOR		50 Hz NOMINAL PRESSURE		50 Hz FAD[1]		60 Hz NOMINAL PRESSURE		60 Hz FAD[1]		NOISE LEVEL[2]	WEIGHT		DIMENSIONS L × W × H IN. (MM)
	HP	KW	PSIG	BAR	ACFM	M³/MIN	PSIG	BAR	ACFM	M³/MIN	DB(A)	LBS	KG	
			110	7.5	203	5.75	110	6.9	196.9	5.78				
L30	40	30	145	10	176.9	5.01	125	8.6	181.1	5.13	69	2035	923	
			190	13	150.7	4.27	190	13.0	138.4	3.92				
			110	7.5	247.1	7.00	110	6.9	233.7	6.62				
L37	50	37	145	10	217.8	6.17	125	8.6	218.6	6.19	70	2130	966	67.8 × 36.2 × 65.3 (1722 × 920 × 1659)
			190	13	187.1	5.30	190	13.0	171.9	4.87				
			110	7.5	282.4	8.00	110	6.9	269.4	7.63				
L45	60	45	145	10	247.1	7.00	125	8.6	245.7	6.96	71	2178	988	
			190	13	215.7	6.11	190	13.0	189.2	5.36				

1) Data measured and stated in accordance with ISO1217, Ed. 4, Annex C & Annex E at the following conditions:
Air Intake Pressure 1 bar A, Air Intake Temperature 20° C, Humidity 0% (Dry)
2) Measured in free field conditions in accordance with ISO 2151, tolerance +/- 3dB

L-Series Features (40-60 HP)

- Direct-gear drive, oil flooded, single stage rotary screw air compressor
- AEON 9000SP lubricant
- Air-cooled standard
- Air supply piping includes hard pipe design with Viton Victaulic couplings
- CRN and ASME rated aftercooler
- GD Governor™ microprocessor controller
- Electrical components UL listed for the US and Canada, including C-UL-US listed open control panel
- Integrated spin-on oil filter
- Integrated thermostatic thermal mixing valve
- Type 1 electrical enclosure
- Load/no load control and timed shutdown
- Moisture separator (shipped loose)
- Mounted and wired wye-delta starter
- Multi-compressor sequencing
- Quiet enclosure
- Second pressure band control for lead/lag operation
- Built-in data logging
- TEFC main motor
- Two-stage air filter and air/oil separation system
- Voltage: 200 / 230 / 460 / 575V (3 phase only)

Gardner Denver, Inc.
1800 Gardner Expressway
Quincy, IL 62305
866-440-6241
www.gardnerdenver.com/gdproducts

H375313-1000-240-202-0001	Rev. 0	Prepared by:	Reviewed by:
Compressed Air Piping & Equipment Calculation		K. Piro 5/14/2024	B. Nolan 5/14/2024

Appendix B - Filter Datasheet

	REPLACEMENT MODEL GRADE-FEATURES	CAPACITY		CONNECTIONS NPT/ANSI FLG.	STANDARD FEATURES FILTER GRADES					MAX PRESSURE PSIG [KGF/CM²] & TEMP °F (°C)		DIMENSIONS HEIGHT		WIDTH		WEIGHT		ELEMENT	
		SCFM	M³/MIN		A	B	C,E,F	D	G	MANUAL DRAIN	WITH D OR L	IN	MM	IN	MM	LB	KG	MODEL-GRADE	QTY
MODULAR TYPE HOUSINGS	FIL12-11	20	0.57	⅜" NPTF								8.15	207	4.13	105	4.2	1.9	FIL12-E	
	FIL14-13	35	1.00	½" NPTF	A	A P	A P	P				11.05	281	4.13	105	8.1	3.7	FIL14-E	
	FIL16-13	60	1.72	½" NPTF								13.4	340	4.13	105	8.5	3.9	FIL16-E	
	FIL18-15	100	2.9	¾" NPTF	A	A G				300 psig 21 kgf/cm² 150°F 66°C	250 psig 17.6 kgf/cm² 150°F 66°C	15.32	389	5.25	133	6.3	2.9	FIL18-E	
	FIL20-17	170	4.9	1" NPTF			A G		NONE			19.57	497	5.25	133	6.9	3.1	FIL20-E	
	FIL22-21	250	7.2	1½" NPTF		G						22.8	579	6.44	164	10.2	4.6	FIL22-E	1
	FIL24-21	375	11	1½" NPTF	(1)	(1)		G				27.29	693	6.44	164	11.3	5.1	FIL24-E	
	FIL26-23	485	14	2" NPTF								31.08	789	7.63	194	28	12.7	FIL26-E	
	FIL28-25	625	18	2½" NPTF	(1)	G (1)	A G					36.83	935	7.63	194	33	15.0	FIL28-E	
	FIL30-25	780	22	2½" NPTF								42.96	1091	7.63	194	38	17.2	FIL30-E	
	FIL32-27	625	18	3" NPTM	A	A G	A G			300 psig 21 kgf/cm²	300 psig 21 kgf/cm²	40.88	1038	10.25	260	36	16.3	FIL32-E	1
PRESSURE VESSELS	FIL34-27	1,000	29	3" NPTM								48.00	1219	16.00	406	91	41.3	FIL34-E	2
	FIL36-27	1,250	36	3" NPTM								48.00	1219	16.00	406	91	41.3	FIL32-E	
	FIL38-27	1,875	54	3" NPTM								49.00	1245	16.25	413	120	54.4	FIL32-E	3
	FIL40-29	2,500	72	4" FLG.								52.25	1327	20.00	508	179	81.2	FIL32-E	4
	FIL42-29	3,125	89	4" FLG.				G	NONE (1)	225 psig 15.8 kgf/cm² 150°F 66°C	225 psig 15.8 kgf/cm² 150°F 66°C	52.25	1327	20.00	508	182	82.6	FIL32-E	5
	FIL44-31	5,000	143	6" FLG.	(1)	G (1)	G (1)					54.63	1387	24.00	610	271	123	FIL32-E	8
	FIL46-31	6,875	197	6" FLG.								62.56	1589	28.00	711	518	235	FIL32-E	11
	FIL48-31	8,750	250	6" FLG.								62.56	1589	28.00	711	527	239	FIL32-E	14
	FIL50-33	11,875	340	8" FLG.								69.13	1756	33.00	838	709	322	FIL32-E	19
	FIL52-33	16,250	465	8" FLG.								67.94	1726	39.00	991	918	416	FIL32-E	26
	FIL54-35	21,250	608	10" FLG.								70.94	1802	45.88	1165	1412	640	FIL32-E	34

(1) Drain plugs standard. Externally mounted automatic drains are available.
A – Internal Automatic Drain; E – Electronic Demand Drain; P – Differential Pressure Slide; G – Differential Pressure Gauge; L – Liquid Level Indicator

Sizing Correction Factors

To find the maximum flow at pressures other than 100 psig [7 kgf/cm²], multiply the flow by the Correction Factor corresponding to the minimum pressure at the inlet of the filter. Do not select filters by pipe size; use flow rate and operating pressure.

PSIG	20	30	40	60	80	100	125	150	175	200	250	300
KGF/CM²	1.4	2.1	2.8	4.2	5.6	7.0	8.8	10.6	12.3	14.1	17.6	21.1
CORRECTION FACTOR	0.30	0.39	0.48	0.65	0.82	1	1.22	1.43	1.65	1.87	2.31	2.74

QUALITY CLASSES	SOLID CONTAMINANTS (MAX. PARTICLE SIZE) MICRONS	MAXIMUM PRESSURE DEW POINTS °F (°C)	MAXIMUM OIL CONTENT (DROPLETS, AEROSOLS, VAPOR) PPM W/W (MG/M³)
1	0.1	-94 (-70)	0.008 (0,01)
2	1	-40 (-40)	0.08 (0,1)
3	5	-4 (-20)	0.8 (1)
4	15	38 (3)	4 (5)
5	40	45 (7)	21 (25)
6	-	50 (10)	-

SEVEN FILTRATION GRADES PROVIDE ISO 8573.1 STANDARD AIR QUALITY

FILTER GRADE	DESCRIPTION	FILTRATION[1] WATER DROPLETS[2] PPM W/W	SOLID PARTICULATES MICRON	OIL REMOVAL PPM W/W	ISO 8573.1 QUALITY CLASSES SOLIDS	OIL
A	Water Separator	30,000	-	-	-	-
B	Separator/Filter	25,000	3	5	3	5
C	General Purpose	2,000	1	1	2	4
D	Dry Particulate	-	1	-	2	-
E	High Efficiency Oil Removal	1,000	0.01	0.008	1	1
F	Maximum Efficiency Oil Removal	100	0.01	0.0008	1	1
G	Oil Vapor Removal	-	0.01	0.003	1	1

1)Tested to CAGI ADF400 & ADF500. 2)Maximum inlet liquid load.

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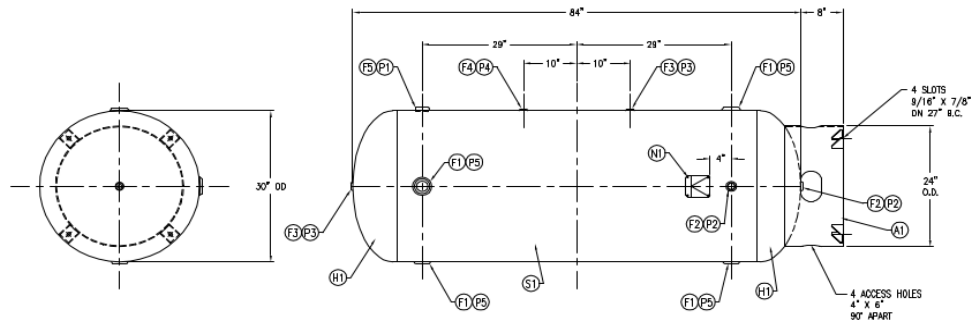
		5/14/2024	5/14/2024

Appendix D - Reciever Cutsheet

CODE/ADDENDA ________ APPROVED ______
RELEASED FOR PRODUCTION
Q.C. __________ DATE __________

FIND NO.	NPT SIZE
F1	2
F2	1
F3	1/2
F4	1/4
F5	1-1/2

NO.	QTY	PART NO.	DESCRIPTION	
H1	2		HEAD:	SA-414-G
S1	1		SHELL:	SA-414-G
F1	4		FLANGE: 2 NPT RAD.	SA181-70
F2	2		FLANGE: 1 NPT	SA181-70
F3	2		FLANGE: 1/2 NPT	SA181-70
F4	1		FLANGE: 1/4 NPT	SA181-70
F5	1		FLANGE: 1.1/2 NPT RAD	SA181-70
A1	1	A85002	BASERING ASSY FOR 30" TANK	AP.C
N1	1		NAME PLATE: ASME / NB	AP.G



SYM	DATE	BY	REVISION	APP	NOTES
A		EGB			
1		SN		TA LB	
2		JC		JC	
3		JC			

SPECIFICATIONS

O.D. 30 LGTH. 84	SH.
MAWP 200 PSI @ 400 °F	HD.
RT- MDMT °F@ PSI	GAL. 240 S.A. 59
EXMT TEST	WT. 670# CU.FT. 32.16
XRAY	CORR ALW SH HD
CRN --	CODE ASME / NB
WELD DETAILS: M-1932	PER DATE OF DWG/LAST REV

STD. TOLERANCES (UNLESS OTHERWISE NOTED): M-2461

Q:\3000\

MANCHESTER

VERTICAL AIR RECEIVER
240 GALLON

DRAWN BY	DATE	SCALE: NONE
LB		
APP. BY	DATE	DRAWING NO.
AS		302428

Appendix D - Client Inputs

From: Jonathan Boese <Jonathan.Boese@ontarionorthland.ca>
Sent: Tuesday, February 13, 2024 3:17 PM
To: Bryce Girard <Bryce.Girard@ontarionorthland.ca>
Subject: RE: ONTC RIP Track - Mechanical questions

Hi Bryce,

Could you answer the highlighted questions

Thanks,

Jon

From: Totarella, Matthew <matthew.totarella@hatch.com>
Sent: Tuesday, February 13, 2024 1:19 PM
To: Jonathan Boese <Jonathan.Boese@ontarionorthland.ca>
Cc: Middleton, Andrew <andrew.middleton@hatch.com>
Subject: [External] ONTC RIP Track - Mechanical questions

3

CAUTION - EXTERNAL EMAIL - Do not click links or open attachments unless you recognize the sender.

Hello Jon,

Following our site visit last week, see attached questions from our mechanical team:

- Provide an operation philosophy on the typical repairs at the RIP track (cars are moved into place, then brakes are pressurized, then cars are jacked up, etc.)
  - Work done on the RIP depends on what the cars are brought in for. Every car is different on every day.
  - Welding
  - Jacking
  - Cutting
  - Brake testing. Full test or just an apply and release.

Hello Jon,

Following our site visit last week, see attached questions from our mechanical team:

- Provide an operation philosophy on the typical repairs at the RIP track (cars are moved into place, then brakes are pressurized, then cars are jacked up, etc.)
  - Work done on the RIP depends on what the cars are brought in for. Every car is different on every day.
  - Welding
  - Jacking
  - Cutting
  - Brake testing. Full test or just an apply and release.

- Provide an operation philosophy on the typical process for Brake Charging (what does the typical worker do/check/monitor in the air shack to charge the air brakes?)
  - Car comes in for air brake test. Hook up 1 ¼" airline to car from air stand with air brake buggy. Air stand provides 110 PSI shop air.
  - Car needs to be charged and hold at 90 PSI in order to do a brake test (AAR required).
  - Do a 20-pound air reduction application so brakes apply and carry on with brake test with air brake buggy. There are built in regulators and gauges on buggy.
  - Cars are typically 50 – 100 feet long with a brake pipe length of 50-100ft and 1 ¼' diameter.
  - Standard reservoir sizes are typically 20 gallons.
- Can the client confirm if there are any physical fail-safes for the car brakes when they are being worked on? (if the pressure drops below ~80psi in the Rip area, is there a guard that they put in place to prevent the brakes closing on a worker?)
  - No fail-safes.
  - Employee only has safety risk if car is hooked with air, charging, and trying to change a brake shoe at the same time when possible air loss could occur.
  - Loss of air would be like applying the brakes (air brake reduction).
- Existing Gardner Denver air compressor data (model number, serial number, capacities, etc.) as we were unable to locate an equipment plate while on site.
  See attached drawings from TSSA registration
- Confirmation of the following: typically, compressors 2 and 3 operate together and generate 800cfm @ 114 psi. When an increase in compressed air delivery is foreseen, client switched over to compressor 1, which provides 900cfm @ 114psi.
  Compressor are set for 110 psi. see attached performance information.

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- Are there any foreseeable or documented issues with running all 3 compressors at the same time in certain instances where an increase in compressed air is required?
  Air Dryer Capacity is the limiting factor. Future increases would be completed by removing the EAU200 and adding up to two additional VS70s, for a total or four, to work together one system. 4 would require an upgrade to the air dryer.
- Typical pressure readings at RIP Track area
  110 psi
- Typical pressure readings at Brake Charging Shack (psi supplied to the receivers, what pressure the receivers are pressurized to, what pressure is supplied to the train cars)
  - Shop air at shack is 110 PSI.
  - Same process as above for air brake test on RIP minus air brake buggy. Train must hold min 80 PSI. There is a regulator and gauges mounted on the shack wall. Cars range from 10-120 per train.
  - Cars are all hooked up with their fixed end of car hose bags (1 ¼") creating one large train.
  - 1A brake test requires 80 PSI.
- Train car compressed air requirements (CFM and pressure required to perform repairs on a typical car in the RIP track)
  - All air tools are run off our air stands that consist of 110 PSI shop air.
- Brake Charging compressed air requirements (CFM and pressure required to charge the air brakes on the worst case train [100 cars was discussed on site]).

	d) Assuming 4 plugs active at any given time.
	Mechanical: Information required to finalize compressed air system sizing.
1.	Please cconfirm if brake charging is occurring at 80 psi. 80-100 **Yes**
2.	Confirm the following assumptions for flow to RIP tracks is acceptable: **a.** Total design flow for pneumatic tools is 60 CFM. **Yes**

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HATCH

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	b. Typical tools include Huck Gun (10 cfm each), and impacts (20 cfm each) **and manual device TBD by ONTC (Bryce)** c. Average 15 cfm = 4 users. (Consistent with Design Basis Memo). **Ok, looks good**
3.	Confirm design pressure required at RIP track for air tools is 100 psi at most remote user. (Closer users results in less loss ~110 psi.). **OK, Looks good**
4.	Confirm storage room to be have an airline connection?. **yes , electrical heat ventilation**.