



STATE PROCUREMENT OFFICE
NOTICE & REQUEST FOR SOLE SOURCE

RECEIVED BY
STATE PROCUREMENT OFFICE
10/30/2015

TO: Chief Procurement Officer

FROM: Transportation
Name of Requesting Department

Pursuant to HRS §103D-306 and HAR chapter 3-122, Subchapter 9, the Department requests sole source approval to purchase the following:

1. Describe the goods, services, or construction to be procured.
Refurbish/rebuild four (4) ventilation fans at the H-3 Tunnel facility by the original equipment manufacturer. The four fans are among the 32 fans that were installed and commissioned in 1995 and, after 20 years of use, only fifty percent of the fans remain in service with age, malfunctioning of hardware and corrosion issues. These four exhaust fans are among the most critical which are needed to be put back in service. Howden North America, Inc. ("Howden") is the successor to TLT-Babcock, Inc., the original manufacturer. Howden provides all the services and warranties previously done by TLT-Babcock. In addition to the cost of Howden's Base Scope (see Attachment A), a 6% contingency and GET taxes have been added for a total request of \$4.66 million for this project.

Table with 2 columns: Vendor/Contractor/Service Provider Name, Amount of Request, Term of contract, and Prior SPO-001, Sole Source (SS) No. Includes handwritten notes and dates.

6. Describe in detail the following:
a. The unique features, characteristics, or capabilities of the goods, service or construction.
The H-3 Tunnels are the longest vehicular tunnels in the state of Hawaii, at one-mile in length. There are two tunnel bores, one in the Halawa to Kaneohe direction and the other from the Kaneohe to Halawa direction. A ventilation system, of which the 32 fans are a key component, is required to provide safe passage for motorists who use the tunnels as well as DOT employees, who repair and maintain systems within the tunnels. Acceptable air quality levels are maintained through the use of 32 high-capacity, ventilation fans. Attachment B is a general description of the ventilation system for the H-3 Tunnels and the role of the ventilation fans.
b. How the unique features, characteristics or capabilities of the goods, service or construction are essential for the department
The DOT is responsible for the safe movement of vehicles and people traveling on state highways and roads. To ensure the safety of motorists through the H-3 Tunnels, a dependable ventilation system is required to keep noxious gases to safe levels. The rebuilding of these four fans is Phase 3 of a multi-year project to restore all 32 fans to last 20 years. Six fans are being rebuilt under Phase 1 and is scheduled for completion in September 2015. Three fans are being rebuilt under Phase 2 and is scheduled for completion in November 2015. Less than 20 percent of the fans can be removed to continue an adequate level of service for motorists.

7. Describe the efforts and results in determining that this is the only vendor/contractor/service provider who can provide the goods, services or construction.

High-capacity industrial fans are only made world-wide by a handful of equipment manufacturers. As the original equipment manufacturer, Howden is the only company that can refurbish and rebuild these fans and provide a warranty on their service, to meet manufacturer's specifications and provide ongoing service to maintain the fans and connected devices. Howden is an international company which manufactures more than 95% of large axial fans in the USA for commercial/industrial/governmental purposes. See Attachment D.

8. Alternate source. Describe the other possible sources for the goods, services, or construction that were investigated but did not meet the department's needs.

DOT attempted to repair and restore two tunnel fans between 2011 and 2013 with some locally-based vendors; unfortunately, the local vendors were unable to restore the fans due to the exacting demands and size of the machinery, coupled with its electro-mechanical controls. This history was detailed in the previously approved sole source request, SS15-028K. Howden is committed to be a compliant vendor in the Hawaii Compliance Express system to be able to offer their services in support of this equipment.

9. Identify the primary responsible staff person(s) conducting and managing this procurement. (Appropriate delegated procurement authority and completion of mandatory training required.)

*Point of contact (Place asterisk after name of person to contact for additional information).

Name	Division/Agency	Phone Number	E-mail Address
Pratt M. Kinimaka 	HWY/HWY-0	831-6813-x126	pratt.kinimaka@hawaii.gov
Albert Chung*	HWY/HWY-OT	271-4931	albert.chung@hawaii.gov

Department shall ensure adherence to applicable administrative and statutory requirements, including HAR chapter 3-122, Subchapter 15, Cost or Pricing Data if required.

*All requirements/approvals and internal controls for this expenditure is the responsibility of the department.
I certify that the information provided is to the best of my knowledge, true and correct.*



Department Head Signature

10.16.15
Date

For Chief Procurement Officer Use Only

Date Notice Posted: 11/2/2015

Submit written objection to this notice to issue a sole source contract within seven calendar days or as otherwise allowed from date notice posted to:

state.procurement.office@hawaii.gov

Chief Procurement Officer (CPO) Comments:

This request is disapproved. Howden North America, Inc. is the only company that can rebuild/refurbish the fans to their original working order. However, sole source contracts in excess of \$100,000 require certified cost or pricing data and analysis for price reasonableness pursuant to HAR Chapter 3-122, subchapter 15. The Department failed to provide the cost or pricing data and analysis.

It is advised that once the Department negotiates a discounted rate based on the full amount of fans rebuilt/refurbished over time and completes an in-depth cost analysis, they will submit one sole source request for the remaining fans that need work (to be done in a multi-phase contract).

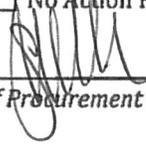
The department is also reminded that individual(s) participating in procurement activities must be in compliance with Procurement Delegation No. 2010-01, as amended, and Procurement Circular No. 2010-05, Statewide Procurement Training, as appropriate. The SPO does not have a record of written delegation on file for Albert Chung, named in Item No. 9.

If there are any questions, please contact Carey Ann Sasaki at 586-0575, or careyann.r.sasaki@hawaii.gov.

Approved

Disapproved

No Action Required


Chief Procurement Officer Signature

12/2/15
Date

Additional Documentation in Support of SPO-001
DOT H-3 Tunnels Fan Rebuilding Project by Howden North America, Inc.

INDEX

- a. Attachment A – Proposal from Howden and Quotation for Fans
 - b. Attachment B – H-3 Tunnel Ventilation System
 - c. Attachment C – Cost Breakdown
 - d. Attachment D – Howden’s Unique Qualification as Sole Source
 - e. Attachment E – Cost of Rebuilding Versus Replacing Fans
-
- f. Attachment F – Pricing Certification

September 23, 2015

State of Hawaii

Hawaiian Department of Transportation

H-3 Harano Tunnels

Exhaust Fans

Phase 3

Quote No. HNAGVS.AFM.000258 Rev. 6

Reference:

Refurbish Existing Fans Budget Pricing

Exhaust Fans TF-6 and TF-7 Halawa Side Honolulu Bound
Exhaust Fans TF-30 and TF – 31 Haiku Side Kaneohe Bound

Dear Mr. Albert Chung,

In regards to your request for a Budget Turnkey price to refurbish/rebuild H-3 Harano Tunnel Two (2) Exhaust Fans on the Halawa Side and Two (2) Exhaust Fans on the Haiku Side, including Motors and Supply/ Install new VFD Drives during the 2015 Fiscal Year 2015/2016 Howden North America Inc. is pleased to offer the following proposal for your review.

Howden/TLT is now the sole OEM for these Fans with the acquisition of TLT. Howden maintains all records in our Medina and Buffalo Offices and has proprietary rights to all the Fan As Built Drawings, Performance Records, Manufacturing Standards and all Engineering data. In addition Howden/TLT as the OEM can supply not only supply all replacement parts and perform repairs on your existing equipment we can provide on site Total Turn Key preventative Warranty Service on all equipment associated with these Fans as a Total package.

All Howden Turn Key Services (Labor and Equipment) are backed by Factory Warranty on our work

Howden has performed a significant number of Turnkey projects for Large Utility and Industrial Axial fans and has an impressive team of engineers, project managers, and field service personnel to support this kind of work. In performing this turnkey work Howden has an excellent safety record and we have brought every project to completion within the predicted time frame. We look forward to providing you with the same exemplary service for your fan project.

As the original equipment manufacturer of this equipment Howden is uniquely qualified to refurbish/rebuild your TLT Axial fans and perform maintenance inspections. Benefits to using Howden over other Contractors to perform this work include:

- Howden will be managing and directly supervising the work force as opposed to acting as technical advisors.
- Howden will bring this job to completion far quicker than any other contractor.
- Howden will be using local Union Craft field labor, including Howden Technical Supervisors and Construction Managers that have experience executing this type of work.
- Howden has a team of engineers, project managers, and support personnel that will be involved in the execution of this project.
- As the supplier for the design, parts and equipment manufacturer for this project, Howden has a high stake in maintaining control of the quality of the installation work, as does Hawaii DOT personnel.
- All new/refurbished parts/equipment install will be per original manufacturer drawings and specifications.
- A full work scope schedule will be contingent upon receipt of P.O.

Howden North America, Inc. will supply Turnkey services as outlined below:

HOWDEN (HNA) Scope of Work: Phase Three 2015/2016

Howden Turnkey will provide Project Manager, Howden Supt. /Engineers, local Union Craft labor, tool trailer, equipment required, consumables, materials, supervision, technical assistance and craft supervision to perform the following work scope: Howden will have a craft trailer, Consumables and materials.

Howden Turnkey group will handle all coordination with outside shops, communication between shops, field and Engineering as required. We will also handle shipping and keep the HDOT advised on a daily basis of progress on all equipment shipped off site as well as on-going work on site. We will work off a Primavera Schedule and keep this up to date on a daily basis.

Howden's technical personnel on site will assure all dimensional settings are correct and recorded.

Note: Our repair center (MRSC) is now called HNA- Medina

- Howden will mobilize equipment, and manpower to site.

Base Work Scope: Refurbish/Rebuild Two (2) Exhaust Fans on the Kaneohe Side, and Two (2) Exhaust Fans on the Halawa Side, including Motors, and Supply/ Install/Upgrade new VFD.s

Item No. 1: Refurbish Four (4) Exhaust Fans (TF-06, TF-07, TF-30 and TF-31)

- Dis-assemble Fan housing
- Remove Motor and Fan Rotor w/Blades
- Remove Fan Blades
- Crate Fan Motor
- Crate Fan Hubs
- Ship Fan Hubs to Howden Shops (see Motor, Rotor and Blade Scope below)
- Ship Motors to Howden local Motor Shop for Inspection/Repairs
- Inspect Fan Housings prep and paint as required.
- Load and unload Fan housing sections required to be painted and transport to and from local shop for sandblasting and painting.
- Sandblast, apply one (1) coat Amercoat Zinc Primer @2.5 to 3.0 mils DFT, one (1) coat Amerlock 2 Epoxy @ 3 to 5 mils DFT and one (i) coat Amercoat 450HPolyurethan 1.5 to 2 mils DFT to the inside surfaces of fan wheel housing section (surfaces inside of outer shell and outside of inner cylinder only)
- Exterior surfaces NOT included.
- Existing Orange painted surfaces (blade pass) to be sandblasted and painted per specifications above. Blade clearances to be verified and adjusted during re-assembly to meet Howden specifications..
- Install Siemens G120, 300hp VFD Drives with new , PLC's,HMI panels and controllers. Program Controllers and integrate system with existing Dynac ES System
- Replace and upgrade the fuse, fuse holders, fuse distribution bus, contactors, wires, labeling, etc.
- Confirm full functionality of each VFD-PLC-HMI system ("Drive") and it's respective connection to the traffic control system ("The System")
- Download firmware and programs to HMI, PLC, VFD, confirmation of wiring termination, i/o relay-field devise checks, interlock checks, testing of communications protocol between HMI/PLC to the System, comprehensive functionality system test, and reporting will be recurring tasks performed on all new VFD Drive Units installed.
- All transportation costs
- Inspect Inlet & Outlet Dampers
- Lubricate Damper Bearings
- Option: Repair or replace Damper Actuators if required. Final repair/replace decision based on condition of damper actuators.
- Receive Motors, Rotors and Blades
- Install Rotor with Blades on Motor
- Install Motor with Rotor/Blades
- Re-assemble Fan Housings
- Supply new gasket material between Fan Housing and Diffuser
- Upgrade vibration monitoring probes to Standard Accelerometers, and associated hardware and all cables required
- Install new pressure differential switches on Fan casings
- Reroute electrical controls for Motor Heaters into VFD Fan Cabinets
- Provide Start-up assistance and field balance if necessary

Item No. 2: Variable Frequency Drive Replacement (TF-06, TF-07, TF-30 and TF-31)

The overall general scope of this project is to provide turn-key engineering services to replace original and obsolete Reliant drives with new Siemens G120 drives.

Project scope includes the following:

- Design and engineering (i.e., drawings, programming, and system integration)
- Supply and install three (3) new Siemens G120 300 hp VFDs, industrial controls, power, PLCs and HMI panel
- System integration with existing Dynac ES system
- Relocate Motor Heater Circuits
- Testing and troubleshooting
- Startup, commissioning, and training
- Removal and disposal of existing VFDs, main circuit breaker, contactors, older obsolete cabinet components

Equipment age and condition present risks to the successful startup and operation of the tunnel fans. As a result, this scope includes the complete removal of existing drives, power distribution components and controls including main circuit breaker, control relays, contactors, control transformers, etc. Some existing components will remain and include but are not limited to reusable pilot devices, switches and ground lugs.

All e-waste materials generated during this project will be disposed of in accordance with local State and Federal regulations for solid and hazardous waste disposal.

Additional materials and services included in the scope:

1. Spare parts to be provided include:

- One spare drive complete with power module, control unit and operator panel;
- One complete PLC rack,
- One HMI

2. Vibration Switches (Metrix)

3. Accelerometers & Cables

4. Rotopulser (Dynapar)

5. Frequency to Analog Convertor Modules (Dynapar)

Parts will be stored at Fluid Technologies until system owner is ready to receive.

- . Software for PLCs, HMIs and Drives

6. Additional review and re-engineering of ladder logic provided by H3 Tunnels staff on April 26, 2015.

Scope includes the following:

- Review, Redesign and Engineering of System PLC logic.
- Programing: Update existing VFD programming to meet H3 Staff requirements.
- Install programing modifications
- Testing and troubleshooting.

7.. Relocate fan motor heater circuits

Scope includes the following:

- Redesign and Engineering: Revise design, bill of material and electrical drawings to incorporate the fan motor heaters into their respective VFD cabinets.
- Power Distribution and Controls: Supply motor heater contactors, fuses, and fuse holders.
- Install Power Distribution and Controls: Install power distribution and control components, rewire circuits
- Testing and troubleshooting.

8.. Upgrades from Original Design

Scope includes the following:

- Redesign and Engineering: Fuse Holder and Fuse Distribution Design.
- New contactors
- Controls Integrations: Additional i/o points verification, calibration, connection to controls system.
- Documentation upgrades for Controls Integration: (O&M's)

9. Replace existing UPS in each drive portal:

***UPS is needed to provide backup power to controls.

OTHER RECOMMENDED ADDERS THAT SHOULD BE CONSIDERED:

- Extended Warranty
- Service Contract
- Study to document H3 communication network:
 - a. Document as is network infrastructure.
 - b. Recommendation to upgrade network to IP based communications.

Item No.3: Motor Inspection/Rebuilds Exhaust Fans (TF-06, TF-07, TF-30 and TF-31)

- Perform incoming visual inspections
- Perform incoming electrical testing
- Dismantle Motor
- Perform incoming mechanical inspections
- Clean all parts
- Varnish treat and Bake Stator
- Growler test rotor for open and / or broken bars
- Furnish and install new Motor bearings
- Encoder operation test
- Replace Rotopulser Encoder
- Remount Motor Heaters per manufacturer recommendations
- Assemble Motor

- Paint motor per Howden specifications
- Prep Motor for shipment

Item No. 4: Fan Rotor/Blade Replacement Exhaust Fans (TF-06, TF-07, TF-30 and TF-31)

- Inspect Rotors as received
- Supply and Install all new Fan Blades (Exhaust Fans)
- Thermal Coat all new fan Blades (Exhaust Fans)
- Rebuild Hubs and replace parts as required
- Supply all new Blade Base Lock Plates and associated hardware
- Inspect, sandblast and coat hubs
- Supply new special bolts for mounting blades
- Mount Blades on Hubs and Balance Assembly in Shop
- Transportation included

Item No. 5: Testing and Commissioning: Four (4) Exhaust Fans (TF-06, TF-07, TF-30 and TF-31)

- Perform a test run of each fan to ensure that fan operates as intended and is suitable for long term operation. In particular the test run shall:
- Ensure that all diagnostic equipment is functioning as designed and is indicating properly in the control system. (Electrical by Plant)
- Ensure that the fans are operating as designed, all bearing temperatures, vibration data is within tolerance for long term continued service.
- Remedy any deviancies found during the test run.
- Field Balance Fans within Howden Specifications if required.
- Provide a detailed project report of the work performed: Within 30 days from the completion of the field work.

Option A: Repair Damper Actuator (As required)

- Field Labor to remove and re-install Auma Actuator
- In- house labor to inspect and evaluate repairs required
- Repair parts for Auma SA Actuator consisting of Seal Kit, 4GTLS Geared Limit Switch, Declutch Assembly and Open & Close Torque Dials
- Repair parts if required; Motor, Worm Shaft, Worm Gear Assembly and Kirk Key Interlock

Option B: Replace Limitorque MX Series Actuator (As required)

- Replace MX-10, Nema 4X enclosure, 480 VAC, On/Off Controls
- Replace QA Contacts (R1-R4) Top Mounted Hand Wheel
- Torque Nut Bore & Keyed Disconnect Switch
- Field Removal and Installation of Limitorque Actuator

HDOT - H-3 Harano Tunnel Scope of Work

- Plant to lock out and tag out fans as necessary, lock out damper actuators on both inlet and outlet dampers.
- Plant to provide unlimited access to the fans during the duration of Howden North America's work in order for us to complete the work in a timely manner
- Plant to allow for additional hours each day plus Saturdays as need to complete all 4 Fans on schedule.
- Plant to assign additional laydown/storage area for dis-assembly on the Honolulu side.
- Plant to supply 110 volt power at fan.
- Plant will provide necessary operations support to conduct cold air fan runs for field balancing and operational check of both fans
- Plant to provide a "one point of contact" for each shift to coordinate and communicate with Howden Project Manager

Pricing for Refurbishment of Exhaust Fans TF-6 & 7 TF-30 & 31

Howden will supply all tools, equipment, experienced field Union labor, and Howden Project Manager, Field Supt's/Engineers to perform the above scope of work during a planned 2015/2016 outage based on the following prices shown in the table below depending on options selected.

Item No's.	Option	Description	Qty of Fans	Price:
1,2,3,4,5	Base Scope	Refurbishment/rebuild of Two Exhaust Fans on Kaneohe Side and Two (2) Exhaust fans on the Halawa Side including motors and new VFD's and system upgrades Scope described in Item's 1,2,3,4,and 5 above, <u>(TF-06.&TF-07, and TF-30 & TF-31</u>	2 Exhaust Fans Halawa Side 2 Exhaust Fans Kaneohe Side	\$1,051,151.00each Exhaust Fan, Motor and VFD
		Note: No overtime has been included in cost per Fan	Total Package Four (4) Exhaust Fans	\$4,204,604.00 Four (4) Exhaust Fans

	A	Repair Auma SA Damper Actuator as required Time and Material Not to Exceed	1	\$12,299.00 each
	B	Replace Damper Actuator with New Limitorque as required.	1	\$11,528.00 each
	C	Special Kluber NBU 12/300 KP grease – 1 pail (25kg)	1	\$ 4600.00 ea. Plus Frgt Cost plus 10%
		Note: Cost of supplying Performance Bond for 100% of Contract Value Included in above Pricing		

Other Notes and Clarifications:

Note: This Firm proposal is valid for 30 days

- 1) As the OEM of the original fan assembly, Howden strives to provide mechanically safe and reliable rotating equipment to our customers, and will insure the highest level of workmanship provided by the seller.
 - A. Howden shall respond to technical inquiries in a prudent and expeditious manner as agreed to on a case by case basis
- 2) Howden will not be responsible for any additional work beyond the scope outlined above. The cost for any unforeseen additional work shall be negotiated and agreed in writing by both parties (Howden North America, Inc. and HDOT). Any additional work as the result of delays or downtime outside Howden's control will be billed to HDOT on a negotiated basis
 - A. Howden shall notify HDOT of any broken, damaged, worn items within the work shift it was found
- 3) The given price does not include any taxes. This will have to be determined during the negotiation stage.
- 4) The Fan is required to be available for field balancing and check out after completion of all work without having to de-mobilize and then return later for balancing. If a return trip would be required additional costs would apply.
- 5) No hazardous material handling is included or anticipated.
- 6) HDOT is responsible for any/all asbestos and lead paint remediation
- 7) Howden North America Aftermarket does not accept Liquidated Damages as Standard Business Practice and this quotation has no legal or cost provisions for the acceptance of Liquidated Damages.
- 8) Any major delays resulting from initial disassemble and "as found" condition requiring additional work and/or parts outside of work scope or unexpected repairs will be billed as an extra. These items will be documented in a separate report and submitted to HDOT in a timely manner for their review and approval

- 9) Howden shall provide a Project Team Leader (Steve Graeff Manager Turn Key) to lead the project and serve as one point of contact to all coordination and communication with HDOT of all field and shop work, including technical support and engineering services from any other Howden office.
- 10) Howden Project Team Leader shall meet with HDOT' Point of contact and other applicable personnel on a daily basis to review progress, issues and upcoming work. Howden shall provide a weekly written report covering progress, schedule updates, costs to date ,HNA Medina, OH shop updates, etc. Howden shall maintain an action items and/or issues list that will be reviewed during the daily meetings. This is to facilitate decision making, and to maintain project schedule.

Payment Terms:

- 20% Due upon Dis-assembly
- 20% Due upon completion of Receive and Inspect in Shops
- 20% Due upon completion of all shop work
- 35% Due upon completion of Re-assembly and Start-up
- 5% Due upon receipt of Final job report

Terms and Conditions:

This quote is subject only to the Terms and Conditions previously negotiated for Hawaii Department of Transportation PO No. 41098753. Unless otherwise negotiated and agreed to by HNA in writing. No other terms shall apply regardless of any statement on Buyer's documents to the contrary.

Howden North America does not accept Liquidated Damages or in place warranty as standard business practice.

*If quoted deliveries do not meet your requirements, please advise.

For Prepay and Charge orders, there will be a 4% charge of the net selling price applied to Buyer's invoice as a separate item to cover the standard transportation and handling expenses to the first North American destination. In addition, any expense incurred by Seller because of special delivery arrangements requested by Buyer shall be billed to Buyer. Howden does not provide copies of freight invoices.

Pricing does not include Federal, State, Local, or Export taxes or duties.

Payment Terms are Net Forty-Five (45) days from invoice date.

Quote expires 30 days from noted and is subject to customer credit approval.

Minimum order value is \$350.00.

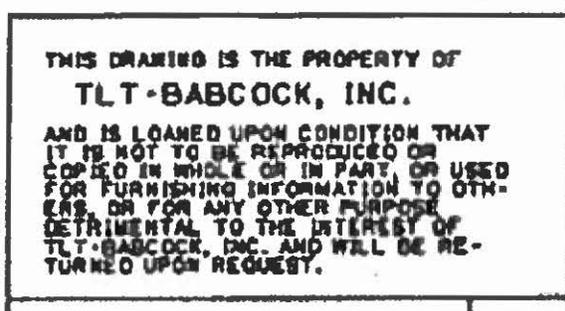
Non inventory parts are not returnable; returned inventory parts are subject to restocking charges.

Howden feels that no other vendor can successfully refurbish/repair these fans for HDOT since the necessary information is not legally available to them.

Howden is the OEM for the 32 existing TLT fans at HDOT and has and owns all of the applicable proprietary information, which Howden is not willing to share. Any other vendor attempting to rebuild these fans will be doing so either by using "reverse engineering" (HDOT runs the risk of not getting a reliable and certified rebuild by the OEM) or by utilizing Howden IP

information (which they should not have in their possession and for use of which Howden would pursue legal remedies).

Below is the TLT documentation legend on drawings:



Below is TLT terms language on their contracts with HDOT:

12. CONFIDENTIAL INFORMATION All drawings, diagrams, technical data, vendor selections, reference lists and materials furnished by SELLER shall be deemed to be confidential, and are provided to PURCHASER for their use only. Such information has been developed at great expense and contains the trade secrets of SELLER. PURCHASER shall exercise reasonable care to hold such information in confidence and not use such information to SELLER's detriment.

Below are Howden IP terms on our contracts with HDOT:

INTELLECTUAL PROPERTY - Seller's intellectual property rights and proprietary information (in hard copy or in electronic format) remain the property of Seller. Notwithstanding any other provisions or requirements of this Order, no intellectual property or proprietary information is being sold, granted, transferred, licensed, or assigned; there are no works-made-for-hire or unrestricted use (any government rights shall be "limited rights"). Seller shall not be required to provide, or provide access to, any confidential or proprietary area or information. Buyer shall not reverse engineer or otherwise attempt to re-create the Goods/Services.

On behalf of Howden North America Inc., we greatly appreciate your interest in doing business with us. Howden is committed to providing the best quality products and services to our valued customers and we look forward to working with the HDOT on this valued project.

Should you have any questions or concerns regarding this proposal, please don't hesitate to contact us any time.

Kind Regards,

Steve Graeff
Manager, Turnkey
Howden North America, Inc.
(941) 661-9056
steve.graeff@howden.com

CC:

George Abcede
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Mauricio Salazar, Regional Sales Manager
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Sales Representative:
Industrial Marketing Systems
Ms. Sharon Kilborn
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skilborn@aol.com

Section 2.7
Tunnel Ventilation System

Section 2.7 contains the following subsections:

- 2.7.1 System Summary
- 2.7.2 Tunnel Ventilation Fan and Duct System
 - 2.7.2.1 Air Supply System
 - 2.7.2.2 Air Exhaust System
 - 2.7.2.3 Fan Operation
 - 2.7.2.4 Damper System
 - 2.7.2.5 Tunnel Airflow Patterns
- 2.7.3 Tunnel Ventilation Modes
 - 2.7.3.1 Manual Mode
 - 2.7.3.2 Semi-automatic Mode
 - 2.7.3.3 Automatic Mode
 - 2.7.3.4 Fire Mode
 - 2.7.3.5 Tunnel Fire Mode

Introduction

All gasoline- and diesel-powered vehicles generate pollutants, such as carbon monoxide (CO). On open roadways, vehicle-generated pollutants are quickly dispersed into the atmosphere.

In vehicle tunnels, however, pollutants are confined, and if ventilation is not adequate, the contaminants in the tunnels may rise to hazardous levels. Therefore, vehicle tunnels are typically ventilated either by natural means, by a traffic-induced "piston" effect, and/or by mechanical equipment. This section describes the tunnel ventilation system at the Harano Tunnel facility.

In most vehicle tunnels, carbon monoxide is the pollutant of greatest concern. Carbon monoxide is an odorless, colorless, and poisonous gas that is produced by vehicle engine combustion. During normal tunnel operations, the Harano Tunnel ventilation system reduces carbon monoxide accumulation to safe levels. In fact, one of the primary roles of the tunnel ventilation system is to remove carbon monoxide from the tunnels. The ventilation system also removes other dangerous pollutants, including nitrogen oxides (NO_x) and hydrocarbons.

The Harano Tunnels are located in an area where prevailing trade winds often provide an adequate natural flow of ventilation from the Haiku side of the tunnels (the windward side of Oahu) to the Halawa side (the leeward side of Oahu). The tunnels provide an artificial conduit through the Koolau Range in which the air is funneled, resulting in a tunnel wind that often

exceeds five miles per hour. Occasionally, the wind flows in the opposite direction, from the Halawa side to the Haiku side. At other times, however, air pressure on each side of the Koolau Range is balanced and little or no natural ventilation flows through the Harano Tunnels.

Because the natural ventilation cannot be modified or controlled, it is not sufficient to ensure continuous, adequate ventilation of the Harano Tunnels and continual removal of pollutants. Therefore, the Harano Tunnels are designed with a mechanical tunnel ventilation system that provides safe CO levels within the tunnels by supplying fresh air to the tunnels and by removing polluted air. The mechanical ventilation system at the Harano Tunnel facility supplements the natural ventilation and provides ventilation whenever the natural ventilation is not adequate.

The tunnel ventilation system plays a crucial role in the effective operation of the tunnels. The system prevents the accumulation of toxic vehicle-generated pollutants, such as carbon monoxide. In addition, the tunnel ventilation system is designed to provide a very rapid flow of supply and exhaust air during an emergency in the tunnels, such as a tunnel fire. The tunnel ventilation system also maintains an acceptable level of visibility within the tunnels by removing smoke and other particulates.

The tunnel ventilation system is completely separate from the heating, ventilation, and air conditioning (HVAC) system, described in Section 2.8, and should not be confused with the HVAC system. The HVAC system provides ventilation to the portal buildings, Control Building, crosspassages and Maintenance Tunnel. The HVAC system also regulates humidity and air temperature in certain areas of the Harano Tunnel facility. In contrast, the tunnel ventilation system ventilates only the vehicle tunnels.

2.7.1 System Summary

The tunnel ventilation system at the Harano Tunnel facility is designed to provide a safe atmosphere within the tunnels by:

- Supplying fresh air to the tunnels, and by
- Removing polluted air

The tunnel ventilation system consists of:

- 32 supply and exhaust fans
- Supply and exhaust ventilation duct systems extending the entire length of each tunnel
- Fan damper and bulkhead damper systems
- Air monitoring devices, including carbon monoxide (CO) detectors
- Fan control system, including fan controls and equipment monitors

Each portal building contains four supply and four exhaust fans, as well as an air supply and exhaust ventilation duct system. Air within each duct is directed by a fan and damper located in that duct. Supply fans at each portal building draw fresh air into intake ducts. The supply air is sent to the tunnel through a supply duct located above the tunnel ceiling. The fresh air is discharged into the tunnel through supply vents, which are evenly spaced throughout the tunnel and are located near the tunnel floor.

There are a series of exhaust vents located in the ceiling of each tunnel. Exhaust fans at the nearest portal building draw tunnel air up into the exhaust vents. This air enters the exhaust duct, which is located above the tunnel ceiling and next to the supply duct. The exhaust air travels through the exhaust duct to the portal building, where the air is discharged at the roof level of the portal building.

The TOC Operator controls the 32 ventilation fans by using the DYNAC software. The Operator uses DYNAC to monitor the fans and to assign the tunnel ventilation system to one of four modes. The four modes are:

- *Manual Mode*
If the fan system is placed in Manual Mode, the Operator may run each of the 32 fans at a "High", "Low", or "Off" setting, independent of the status of the other fans.
- *Semi-automatic Mode*
In Semi-automatic Mode, the Operator chooses to run all of the fans in a tunnel at a predefined "step" level, from Step 0 (all fans off) to Step 7 (all fans on "High").

Tunnel Ventilation System

- *Automatic Mode*

If the ventilation system is set to Automatic Mode, the Operator chooses to operate the fans in one of four sub-modes. Each sub-mode includes a predefined method of fan operation. The sub-modes include:

- 1). Time of day
- 2). Carbon monoxide level
- 3). Vehicle count
- 4). Predictive

- *Fire Mode*

The Operator should set the ventilation system to Fire Mode if an emergency that requires a high level of ventilation, such as a fire, occurs inside the tunnels. If the ventilation system is set to Fire Mode, the fans will operate under predefined conditions, depending on the location of the fire, in order to control the movement of smoke or noxious gases away from motorists.

During normal conditions, the ventilation system usually operates in Manual Mode.

2.7.2 Tunnel Ventilation Fan and Duct System

Each vehicle tunnel contains an independent supply and exhaust ventilation fan and duct system. Each tunnel has eight supply and eight exhaust fans located at that tunnel's portal buildings, for a total of 32 supply and exhaust fans at the entire tunnel facility. There are four supply air fans and four exhaust air fans located in each portal building. Each fan is seven feet in diameter, is approximately 200 horsepower, and can move 210,000 cubic feet of air per minute at high speed.

The fans are numbered in sequential order and are located as follows:

- *Halawa Inbound Portal Building*
Fans 1 - 4 (Supply Fans)
Fans 5 - 8 (Exhaust Fans)
- *Halawa Outbound Portal Building*
Fans 9 - 12 (Supply Fans)
Fans 13 - 16 (Exhaust Fans)
- *Haiku Inbound Portal Building*
Fans 17 - 20 (Supply Fans)
Fans 21 - 24 (Exhaust Fans)
- *Haiku Outbound Portal Building*
Fans 25 - 28 (Supply Fans)
Fans 29 - 32 (Exhaust Fans)

The basic components of the tunnel ventilation system are shown in Figure 2.7 2-1.

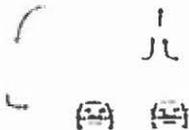
2.7.2.1 Air Supply System

Two supply fans are located on Level 2 and two supply fans are located on Level 3 of each portal building. Each supply fan draws fresh, outside air into its respective supply air duct. The four supply air ducts at each portal building merge into a single, large supply air duct that extends throughout the tunnel, above the tunnel ceiling. The supply duct and exhaust duct (see Section 2.7.2.2) are referred to as the *plenum*.

A series of supply air flues are located on the right side of each tunnel, spaced every five feet. Each supply air flue terminates in a supply air vent located near the floor of the tunnel. Fresh air travels through the supply duct above the ceiling, then down the flue and out the vent, providing an efficient air mixing throughout the length of the tunnel, as polluted air is exhausted through exhaust vents located in the tunnel ceiling (see Section 2.7.2.2).

The air supply system is shown in Figure 2.7.2.1-1. Figures 2.7.2.1-2 through 2.7.2.1-4 illustrate elements of the air supply system.

Face 1 4 (Supply)
Face 5 6 (Exhaust)



Typical Tunnel Cross Section



Tunnel Cross Section
Bulkhead Damper Area

Face 8 14 (Supply)
Face 13 16 (Exhaust)



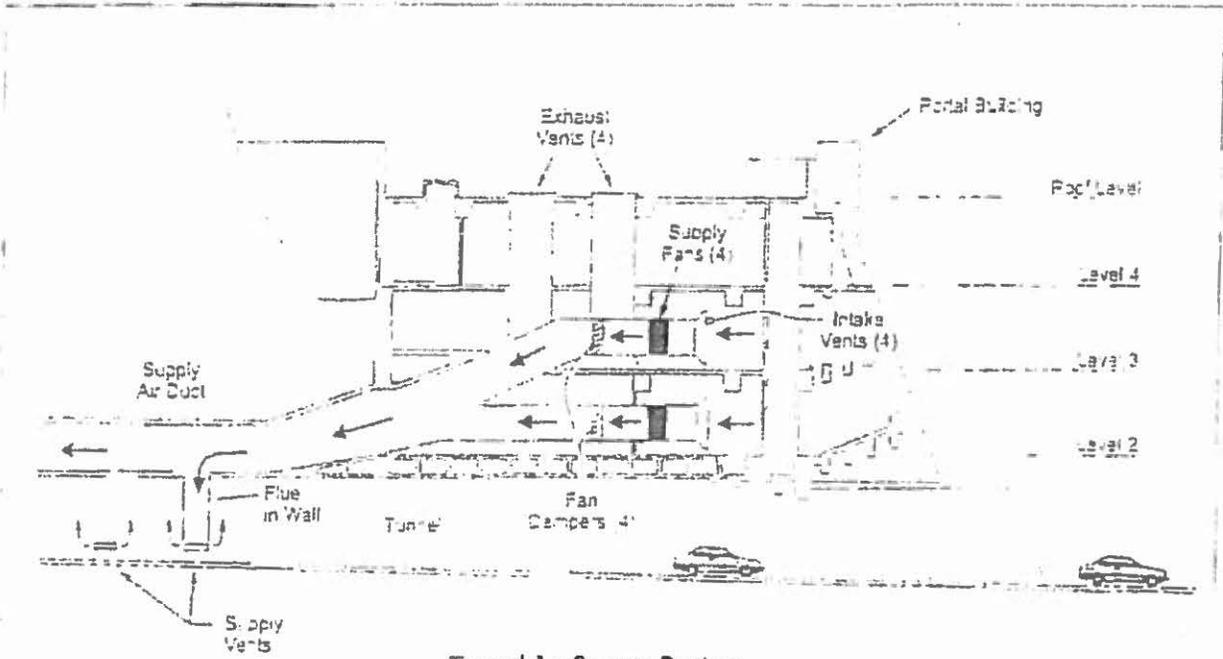
Face 17 20 (Supply)
Face 21 24 (Exhaust)



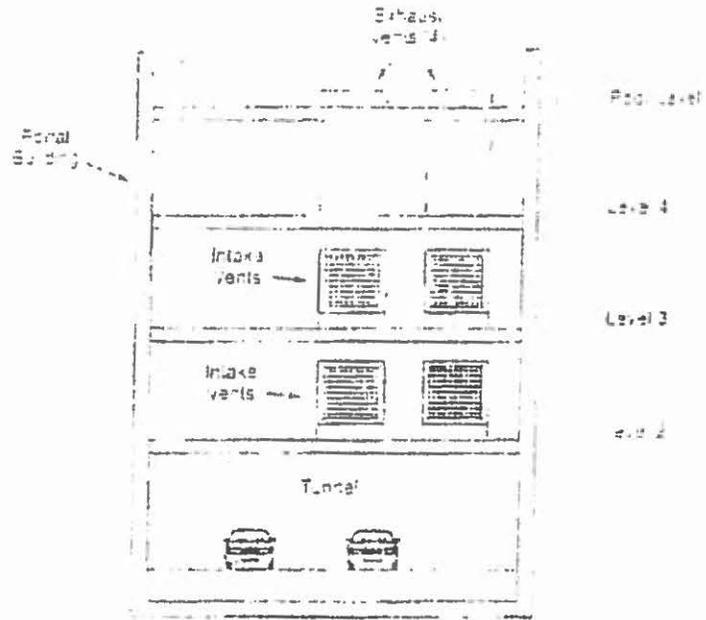
Face 25 28 (Supply)
Face 29 32 (Exhaust)



Ventilation System: Harano Tunnels



**Tunnel Air Supply System
(Cross Section of Portal Building,
Viewed From Side)**



**Tunnel Air Supply System
(Cross Section of Portal Building,
Viewed From Approach)**

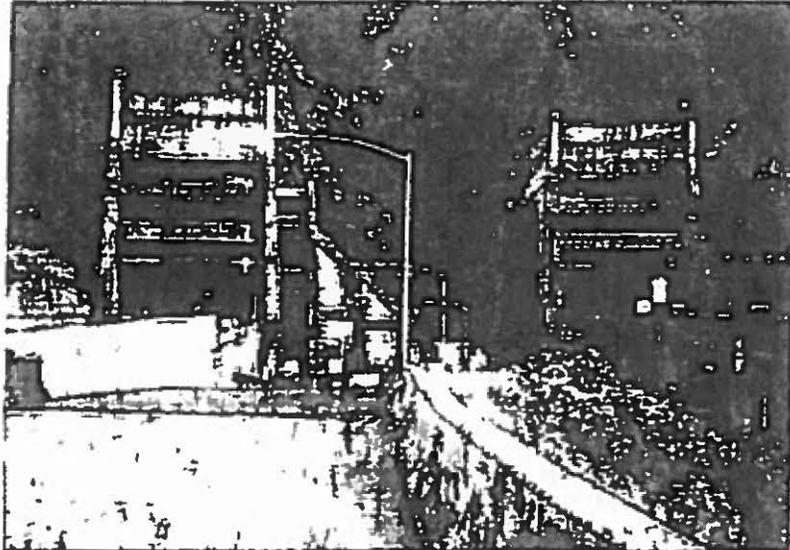


Figure 2.7.2.1-2 *The tunnel supply ventilation fan system is located on Level 2 and Level 3 of each portal building. The exhaust air is discharged at the roof level.*

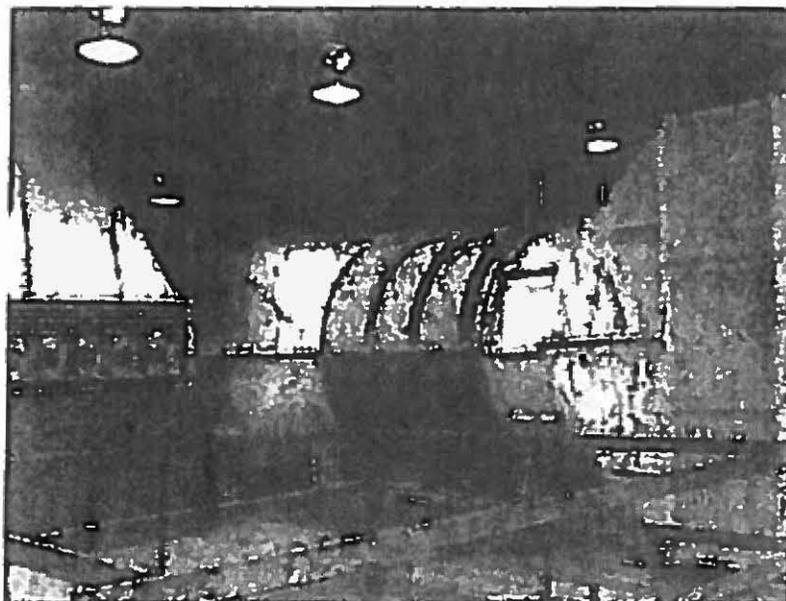


Figure 2.7.2.1-3 *A supply fan is located inside each portal building supply air duct (right). The fan is located within the darker area of the supply duct. An exhaust duct is shown on the left and leads to the roof.*

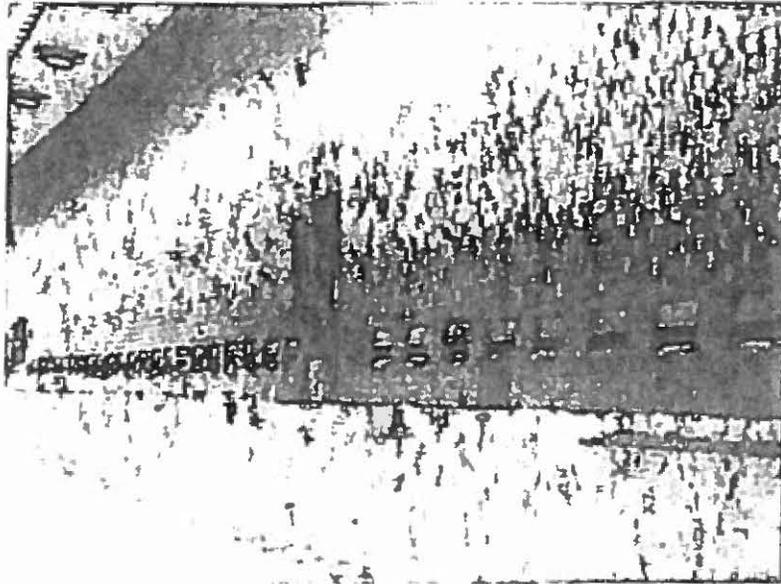


Figure 2.7.2.1-4 Supply air is provided into each tunnel via a series of supply air fixtures. Supply air fixtures are located on the right side of each tunnel. The fixtures are a few feet above the roadway and extend throughout the entire length of each tunnel.

2.7.2.2 Air Exhaust System

Exhaust vents are located on the ceiling of each tunnel, spaced every twenty feet (see Figure 2.7.2.2-1). Exhaust vents draw tunnel air into the exhaust fan and duct system. The exhaust air duct is located above the tunnel ceiling and adjacent to the supply air duct. The exhaust duct and supply duct (see Section 2.7.2.1) are referred to as the *plenum*. Exhausted air travels through the exhaust air duct towards the nearest portal building.

At the portal building, the exhaust duct divides into four smaller exhaust ducts. Each of the four exhaust ducts travel upward through the portal building to an exhaust fan. The exhaust fans are located on Level 4 of the portal building. Each exhaust duct extends above the roof level of the portal building, where the exhaust air is discharged into the atmosphere.

The air exhaust system is shown in Figure 2.7.2.2-2. Figures 2.7.2.2-3 and 2.7.2.2-4 illustrate elements of the air exhaust system.

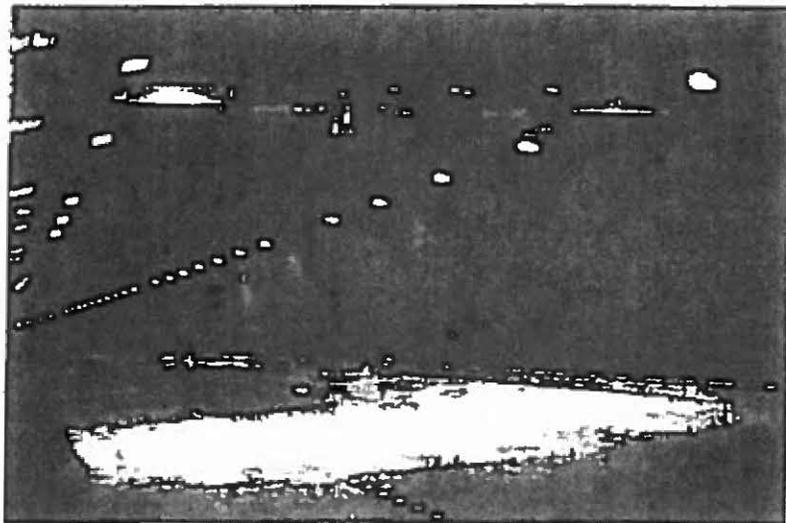
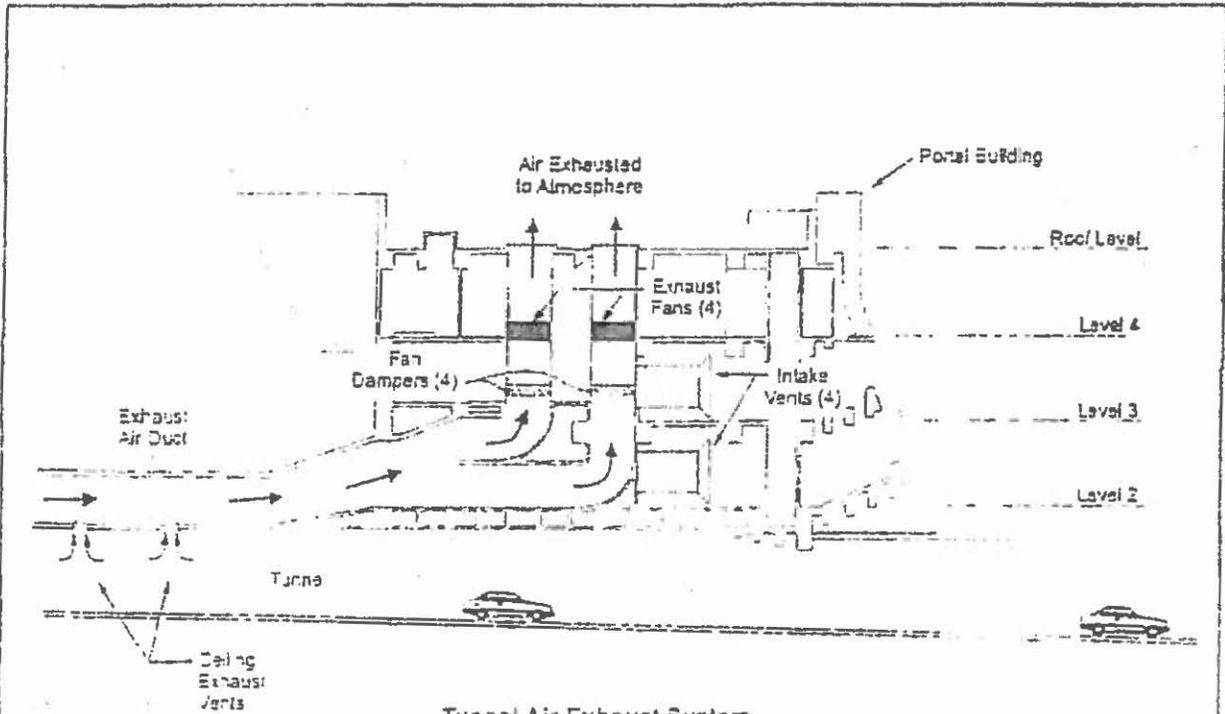
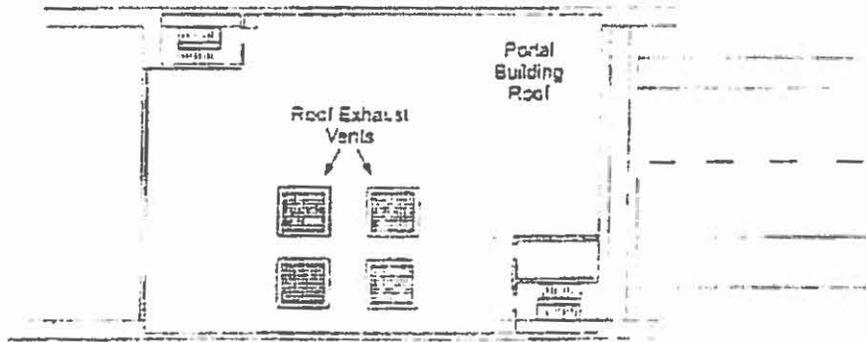


Figure 2.7.2.2-1 Tunnel air is drawn up into the exhaust vents located on the ceilings of both tunnels. It is then discharged at each portal building roof.



Tunnel Air Exhaust System
(Cross Section of Portal Building,
Viewed From Side)



Tunnel Air Exhaust System
(Portal Building Roof)

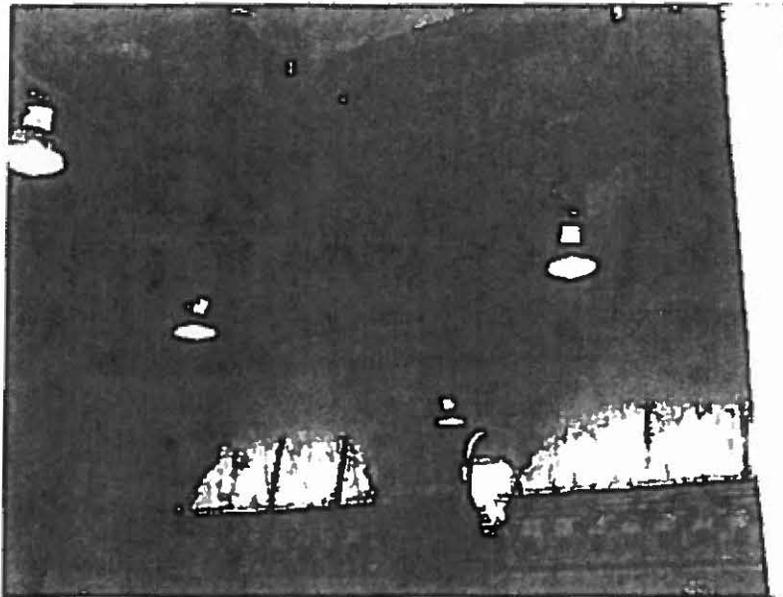


Figure 2.7.2.2-3 *An exhaust fan is located inside each portal building exhaust air duct. This photo shows three of the four exhaust ducts in a portal building (two in the foreground, one in the background). The ducts extend up to the portal building roof, where the air is discharged*



Figure 2.7.2.2-4 *Each portal building roof contains four exhaust vents. Exhausted air from the tunnel is discharged into the atmosphere here.*

ATTACHMENT C

Cost of Rebuilding Four Tunnel Exhaust Fans

Rebuild four fans per Base Scope of Howden North America proposal dated 9-3-2015	\$ 4,204,604
Contingency for repair/replacement of damper actuators and other necessary repairs, not included in Base Scope	\$ 242,276
Hawaii G.E.T. tax	\$ 213,120
	<hr/>
TOTAL =	\$ 4,660,000

Attachment D



Howden North America Inc.
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Depew, New York 14043
USA

Tel: (716) 817-6900
Fax: (716) 817-6901
Web: www.howden.com

September 22, 2015

Albert Chung
Project Manager
Hawaii Department of Transportation

Dear Mr. Chung,

We are pleased to furnish this letter as part of our offer for the refurbishment of the remaining fans in the H3 Tunnels. As the original equipment manufacturer of this equipment Howden North America is uniquely qualified to refurbish/rebuild your TLT axial fans and perform maintenance inspections. Howden North America is able to provide full support of all needed work to complete your project so you have a single point of contact to insure that the work is done to meet the OEM standards that are needed, and is committed to long-term support and service of all of our installed products

For clarification, Howden North America does not certify any other resellers or mechanical shops to perform work on equipment that was sold by our company. We have extensive in-house aftermarket technical and mechanical support that exclusively refurbishes and rebuilds Howden equipment.

Howden is a global company that owns the intellectual property to all of the equipment it has installed worldwide. This makes Howden North America the only company qualified to perform work on the H3 tunnel fans. We are able to guarantee the work that we perform and warranty all refurbished equipment.

We believe we are the only company that can return the H3 tunnel fans to like new conditions, fully support the integration of the fans with the tunnel control system, and replace the fan VFD drives which cannot be refurbished because we own the intellectual property which includes all of the drawings, calculations and engineering work on these fans. Howden has already successfully worked on several of these fans as part of Phase 1 and Phase 2, and have demonstrated our ability to perform as required on these fans with quality work, excellent quality control, and speed of execution. There is a significant cost savings in refurbishing as versus replacing. The cost to provide all new fans was more than double the price to refurbish, and as the OEM Howden North America was able to assess your fans and make a determination of the correct course of repair to recommend to the Hawaii DOT.

Thank you for the consideration of our proposal.

Yours sincerely,

A handwritten signature in black ink, appearing to read "Mauricio Salazar".

Mauricio Salazar
Regional Sales Manager, Western USA
Howden North America Inc.
mauricio.salazar@howden.com

ATTACHMENT E

Rebuilding vs Replacing Cost Comparison

1. Rebuild four (4) fans - \$4,204,604

The life cycle of the rebuilt fans is expected to be 20 years like the original, and possibly longer depending on how well they are maintained on a regular basis, and protected from incoming water. In essence we will have close to new fans as all major components are new or completely refurbished.

2. Replace four (4) fans with new - \$7,193,968 (proposal attached)

The life cycle for new fans is expected to be 20 years like the original, and possibly longer depending on how well they are maintained and protected from incoming water.

3. Redesign a new fan ventilation system

Complete redesign of a new fan ventilation system was considered but it's not a viable option. It is cost prohibited since all of the existing fan components and controls are being replaced. Existing duct work would need to be replaced to work with the new system. Additional electrical controls would have to be upgraded between the new drives installed and the existing control room to handle new logic and load characteristics of a new system. In addition there are potentially changes to meet current building codes that may require structural strengthening of the H-3 portals.

September 3, 2015

State of Hawaii

Hawaiian Department of Transportation

H-3 Harano Tunnels

Exhaust Fans

Phase 3

Quote No. HNAGVS.AFM.000258 Rev. 4

Reference:

Supply all New Fans with Removal and Installation Budget Pricing

Exhaust Fans TF-6 and TF-7 Halawa Side Honolulu Bound

Exhaust Fans TF-30 and TF – 31 Haiku Side Kaneohe Bound

Dear Mr. Albert Chung,

In regards to your request for a Budget Turnkey price to supply all New Fans, Motors, VFD Drives, Dampers, Actuators and Duct Modifications including Turn Key Removal of Existing Equipment and Installation of New, during the 2015 Fiscal Year 2015/2016 Howden North America Inc. is pleased to offer the following proposal for your review.

Howden/TLT is now the sole OEM for these Fans with the acquisition of TLT. Howden maintains all records in our Medina and Buffalo Offices and has proprietary rights to all the Fan As Built Drawings, Performance Records, Manufacturing Standards and all Engineering data. In addition Howden/TLT as the OEM can supply not only supply all replacement parts and perform repairs on your existing equipment we can provide on site Total Turn Key preventative Warranty Service on all equipment associated with these Fans as a Total package.

All Howden Turn Key Services (Labor and Equipment) are backed by Factory Warranty on our work

Howden has performed a significant number of Turnkey projects for Large Utility and Industrial Axial fans and has an impressive team of engineers, project managers, and field service personnel to support this kind of work. In performing this turnkey work Howden has an excellent safety record and we have brought every project to completion within the predicted time frame. We look forward to providing you with the same exemplary service for your fan project.

As the original equipment manufacturer of this equipment Howden is uniquely qualified to refurbish/rebuild your TLT Axial fans and perform maintenance inspections. Benefits to using Howden over other Contractors to perform this work include:

- Howden will be managing and directly supervising the work force as opposed to acting as technical advisors.
- Howden will bring this job to completion far quicker than any other contractor.
- Howden will be using local Union Craft field labor, including Howden Technical Supervisors and Construction Managers that have experience executing this type of work.
- Howden has a team of engineers, project managers, and support personnel that will be involved in the execution of this project.
- As the supplier for the design, parts and equipment manufacturer for this project, Howden has a high stake in maintaining control of the quality of the installation work, as does Hawaii DOT personnel.
- All new/refurbished parts/equipment install will be per original manufacturer drawings and specifications.
- A full work scope schedule will be contingent upon receipt of P.O.

Howden North America, Inc. will supply Turnkey services as outlined below:

HOWDEN (HNA) Scope of Work: Phase Three 2015/2016

Howden Turnkey will provide Project Manager, Howden Supt. /Engineers, local Union Craft labor, tool trailer, equipment required, consumables, materials, supervision, technical assistance and craft supervision to perform the following work scope: Howden will have a craft trailer, Consumables and materials.

Howden Turnkey group will handle all coordination with outside shops, communication between shops, field and Engineering as required. We will also handle shipping and keep the HDOT advised on a daily basis of progress on all equipment shipped off site as well as on-going work on site. We will work off a Primavera Schedule and keep this up to date on a daily basis.

Howden's technical personnel on site will assure all dimensional settings are correct and recorded.

Note: Our repair center (MRSC) is now called HNA- Medina

- Howden will mobilize equipment, and manpower to site.

Base Work Scope: Replace Two (2) Exhaust Fans on the Kaneohe Side, and Two (2) Exhaust Fans on the Halawa Side, including Motors, and Supply/ Install/Upgrade new VFD.s

Item No. 1: Replace Four (4) Exhaust Fans (TF-06, TF-07, TF-30 and TF-31)

- Dis-assemble Fan housing
- Remove Motor and Fan Rotor w/Blades
- Remove Fan Blades
- Crate Fan Motor
- Ship Motors to Howden local Motor Shop for Inspection/Repairs
- Install Siemens G120, 300hp VFD Drives with new , PLC's,HMI panels and controllers. Program Controllers and integrate system with existing Dynac ES System
- Replace and upgrade the fuse, fuse holders, fuse distribution bus, contactors, wires, labeling, etc.
- Confirm full functionality of each VFD-PLC-HMI system ("Drive") and it's respective connection to the traffic control system ("The System")
- Download firmware and programs to HMI, PLC, VFD, confirmation of wiring termination, i/o relay-field device checks, interlock checks, testing of communications protocol between HMI/PLC to the System, comprehensive functionality system test, and reporting will be recurring tasks performed on all new VFD Drive Units installed.
- All transportation costs
- Receive Motors
- Install Motor
- Assemble Fan Housings
- Supply new gasket material between Fan Housing and Diffuser
- Upgrade vibration monitoring probes to Standard Accelerometers, and associated hardware and all cables required
- Install new pressure differential switches on Fan casings
- Reroute electrical controls for Motor Heaters into VFD Fan Cabinets
- Provide Start-up assistance and field balance if necessary

Item No. 2: Variable Frequency Drive Replacement (TF-06, TF-07, TF-30 and TF-31)

The overall general scope of this project is to provide turn-key engineering services to replace original and obsolete Reliant drives with new Siemens G120 drives.

Project scope includes the following:

- Design and engineering (i.e., drawings, programming, and system integration)
- Supply and install three (3) new Siemens G120 300 hp VFDs, industrial controls, power, PLCs and HMI panel
- System integration with existing Dynac ES system
- Relocate Motor Heater Circuits
- Testing and troubleshooting
- Startup, commissioning, and training
- Removal and disposal of existing VFDs, main circuit breaker, contactors, older obsolete cabinet components

Equipment age and condition present risks to the successful startup and operation of the tunnel fans. As a result, this scope includes the complete removal of existing drives, power distribution components and controls including main circuit breaker, control relays, contactors, control transformers, etc. Some existing components will remain and include but are not limited to reusable pilot devices, switches and ground lugs.

All e-waste materials generated during this project will be disposed of in accordance with local State and Federal regulations for solid and hazardous waste disposal.

Additional materials included in this and scope:

1. Spare parts to be provided include:

- One spare drive complete with power module, control unit and operator panel;
- One complete PLC rack,
- One HMI

2 Vibration Switches (Metrix)

3. Accelerometers & Cables

4. Rotopulser (Dynapar)

5. Frequency to Analog Converter Modules (Dynapar)

Parts will be stored at Fluid Technologies until system owner is ready to receive.

2. Software for PLCs, HMIs and Drives

Additional scope of work not included in the original proposal but included in pricing of this phase.

1. Additional review and re-engineering of ladder logic provided by H3 Tunnels staff on April 26, 2015.

Scope includes the following:

- Review, Redesign and Engineering of System PLC logic.
- Programing: Update existing VFD programming to meet H3 Staff requirements.
- Install programing modifications
- Testing and troubleshooting.

2. Relocate fan motor heater circuits

Scope includes the following:

- Redesign and Engineering: Revise design, bill of material and electrical drawings to incorporate the fan motor heaters into their respective VFD cabinets.
- Power Distribution and Controls: Supply motor heater contactors, fuses, and fuse holders.
- Install Power Distribution and Controls: Install power distribution and control components, rewire circuits
- Testing and troubleshooting.

3. Upgrades from Original Design

Scope includes the following:

- Redesign and Engineering: Fuse Holder and Fuse Distribution Design.
- New contactors
- Controls Integrations: Additional i/o points verification, calibration, connection to controls system.
- Documentation upgrades for Controls Integration: (O&M's)

4. Replace existing UPS in each drive portal:
***UPS is needed to provide backup power to controls.

OTHER RECOMMENDED ADDERS THAT SHOULD BE CONSIDERED:

- Extended Warranty
- Service Contract
- Study to document H3 communication network:
 - a. Document as is network infrastructure.
 - b. Recommendation to upgrade network to IP based communications.

Item No.3: Motor Inspection Exhaust Fans (TF-06, TF-07, TF-30 and TF-31)

- Perform incoming visual inspections
- Perform incoming electrical testing
- Dismantle Motor
- Perform incoming mechanical inspections
- Clean all parts
- Varnish treat and Bake Stator
- Growler test rotor for open and / or broken bars
- Furnish and install new Motor bearings
- Encoder operation test
- Replace Rotopulser Encoder
- Remount Motor Heaters per manufacturer recommendations
- Assemble Motor
- Paint motor per Howden specifications
- Prep Motor for shipment

Item No. 5: Testing and Commissioning: Four (4) Exhaust Fans (TF-06, TF-07, TF-30 and TF-31)

- Perform a test run of each fan to ensure that fan operates as intended and is suitable for long term operation. In particular the test run shall:
- Ensure that all diagnostic equipment is functioning as designed and is indicating properly in the control system. (Electrical by Plant)
- Ensure that the fans are operating as designed, all bearing temperatures, vibration data is within tolerance for long term continued service.
- Remedy any deviancies found during the test run.
- Field Balance Fans within Howden Specifications if required.
- Provide a detailed project report of the work performed: Within 30 days from the completion of the field work.

Item No. 6: Installation of Four New (4) Exhaust Fans TF-6&7 TF-30 & 31

- Dis-assemble and Remove Complete Fan housings
- Remove Motor and Fan Rotor w/Blades
- Remove Fan Blades
- Prep Foundations and Install new Complete Fan Housings (have to be installed in sections due to rigging load restrictions), Inlet & Outlet Dampers with new Actuators, Rotors and Motors (Equipment Price Separate Line Item on Quote)
- Supply and Install new Siemens G120, 300hp VFD Drives with new, PLC's, HMI panels and controllers. Program Controllers and integrate system with existing Dynac ES System.
- Receive new Motors, Rotors and Blades
- Install new Rotor with Coated Blades on Motor
- Install new Motor with Rotor/Blades
- Assemble Fan Housings
- Provide Electrical Contractor to dis-connect all wiring and install new wiring for fan motors and damper actuators as required.
- Dis-connect all electrical connections and remove all applicable instrumentation as required.
- Replace and upgrade the fuse, fuse holders, fuse distribution bus, contactors, wires, labeling, etc.
- Confirm full functionality of each VFD-PLC-HMI system ("Drive") and it's respective connection to the traffic control system ("The System")
- Download firmware and programs to HMI, PLC, VFD, confirmation of wiring termination, i/o relay-field device checks, interlock checks, testing of communications protocol between HMI/PLC to the System, comprehensive functionality system test, and reporting will be recurring tasks performed on all new VFD Drive Units installed.
- Additional Engineering and labor to re-route all i/o back to the Dynac ES System
- Supply new gasket material between Fan Housing and Diffuser.
- Reroute electrical controls for Motor heaters to VFD Fan Control cabinet.
- **All transportation costs**
- Provide Start-up assistance and balance Fans if required to within Howden specifications.

HDOT - H-3 Harano Tunnel Scope of Work

- Plant to lock out and tag out fans as necessary, lock out damper actuators on both inlet and outlet dampers.
- Plant to provide unlimited access to the fans during the duration of Howden North America's work in order for us to complete the work in a timely manner
- Plant to allow for additional hours each day plus Saturdays as need to complete all 26 Fans on schedule.
- Plant to assist with gaining additional laydown/storage area for dis-assembly on the Honolulu side.
- Plant to dispose of all scrap, grease/lubricants, used oil and debris, provide dumpsters near the fans for us to place all materials. Plant to dispose of all materials. Plant to provide direction for proper dumpsters to be used for applicable debris and have dumpsters located within reasonable distance to the fans

- Plant to provide all fan parts required, including lubricants, grease and hub oil to support all disassembly and reassembly activities in work scope
- Plant to supply 110 volt power at fan.
- Plant will provide necessary operations support to conduct cold air fan runs for field balancing and operational check of both fans
- Plant to provide a "one point of contact" for each shift to coordinate and communicate with Howden Project Manager

Pricing for Replacement of Exhaust Fans TF-6 & 7 TF-30 & 31 with new fans

Howden will supply all tools, equipment, experienced field Union labor, and Howden Project Manager, Field Supt's/Engineers to perform the above scope of work during a planned 2015/2016 outage based on the following prices shown in the table below depending on options selected.

Item No's.	Option	Description	Qty of Fans	Price:
		Note: Cost of supplying Performance Bond for 100% of Contract Value Included in above Pricing		

Pricing for Supply , Removal of Existing Exhaust Fans TF-6&7 and TF 30 & 31 and Turn Key Installation with Commissioning:

Item No.	Options	Description	Quantity	Pricing
1		Removal and Installation of Four (4) New Exhaust Fans TF 6 & 7 and TF 30 & 31 scope described in Item 6 above, including Engineering (design, drawings, programming, documentation, etc) required for the first set of drives installed. Includes coated New Fan Blades	Four (4) Exhaust Fans	\$958,590.00 each Exhaust Fan (Labor)
		Complete New Vertical Exhaust fans TF 6 & 7 and TF 30 & 31 includes housing (inlet piece, transition pieces, housing, outlet diffuser, complete rotor assembly with coated blades and hub, replacement motor, complete	Four (4) Exhaust Fans	\$839,902.00 Each Exhaust Fan Assembly (Equipment)

		VFD with installation, integration with existing system and commissioning.		
		Total New Exhaust Fan each Installed		\$1,798,492.00 Total each New Exhaust Fan Installed Turn Key (Labor & Equipment)
		Total Four (4) New Exhaust Fans TF 6 & 7 and TF 30 & 31 Installed Turn Key		\$7,193,968.00 Total Each New Fan Installed Turn Key (Labor & Equipment)

Other Notes and Clarifications:

Note: This Firm proposal is valid for 30 days

- 1) As the OEM of the original fan assembly, Howden strives to provide mechanically safe and reliable rotating equipment to our customers, and will insure the highest level of workmanship provided by the seller.
 - A. Howden shall respond to technical inquiries in a prudent and expeditious manner as agreed to on a case by case basis
- 2) Howden will not be responsible for any additional work beyond the scope outlined above. The cost for any unforeseen additional work shall be negotiated and agreed in writing by both parties (Howden North America, Inc. and HDOT). Any additional work as the result of delays or downtime outside Howden's control will be billed to HDOT on a negotiated basis
 - A. Howden shall notify HDOT of any broken, damaged, worn items within the work shift it was found
- 3) The given price does not include any taxes. This will have to be determined during the negotiation stage.
- 4) The Fan is required to be available for field balancing and check out after completion of all work without having to de-mobilize and then return later for balancing. If a return trip would be required additional costs would apply.
- 5) No hazardous material handling is included or anticipated.
- 6) HDOT is responsible for any/all asbestos and lead paint remediation
- 7) Howden North America Aftermarket does not accept Liquidated Damages as Standard Business Practice and this quotation has no legal or cost provisions for the acceptance of Liquidated Damages.
- 8) Any major delays resulting from initial disassemble and "as found" condition requiring additional work and/or parts outside of work scope or unexpected repairs will be billed as

an extra. These items will be documented in a separate report and submitted to HDOT in a timely manner for their review and approval

- 9) Howden shall provide a Project Team Leader (Steve Graeff Manager Turn Key) to lead the project and serve as one point of contact to all coordination and communication with HDOT of all field and shop work, including technical support and engineering services from any other Howden office.
- 10) Howden Project Team Leader shall meet with HDOT' Point of contact and other applicable personnel on a daily basis to review progress, issues and upcoming work. Howden shall provide a weekly written report covering progress, schedule updates, costs to date ,HNA Medina, OH shop updates, etc. Howden shall maintain an action items and/or issues list that will be reviewed during the daily meetings. This is to facilitate decision making, and to maintain project schedule.

Payment Terms:

- 20% Due upon Dis-assembly
- 20% Due upon completion of Receive and Inspect in Shops
- 20% Due upon completion of all shop work
- 35% Due upon completion of Re-assembly and Start-up
- 5% Due upon receipt of Final job report

Terms and Conditions:

This quote is subject only to the Terms and Conditions previously negotiated for Hawaii Department of Transportation PO No. 41098753. Unless otherwise negotiated and agreed to by HNA in writing. No other terms shall apply regardless of any statement on Buyer's documents to the contrary.

Howden North America does not accept Liquidated Damages or in place warranty as standard business practice.

*If quoted deliveries do not meet your requirements, please advise.

For Prepay and Charge orders, there will be a 4% charge of the net selling price applied to Buyer's invoice as a separate item to cover the standard transportation and handling expenses to the first North American destination. In addition, any expense incurred by Seller because of special delivery arrangements requested by Buyer shall be billed to Buyer. Howden does not provide copies of freight invoices.

Pricing does not include Federal, State, Local, or Export taxes or duties.

Payment Terms are Net Forty-Five (45) days from invoice date.

Quote expires 30 days from noted and is subject to customer credit approval.

Minimum order value is \$350.00.

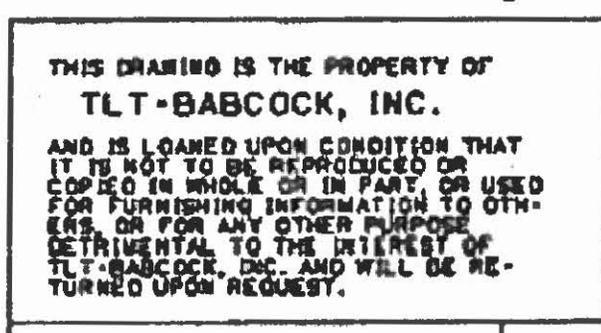
Non inventory parts are not returnable; returned inventory parts are subject to restocking charges.

Howden feels that no other vendor can successfully refurbish/repair these fans for HDOT since the necessary information is not legally available to them.

Howden is the OEM for the 32 existing TLT fans at HDOT and has and owns all of the applicable proprietary information, which Howden is not willing to share. Any other vendor

attempting to rebuild these fans will be doing so either by using "reverse engineering" (HDOT runs the risk of not getting a reliable and certified rebuild by the OEM) or by utilizing Howden IP information (which they should not have in their possession and for use of which Howden would pursue legal remedies).

Below is the TLT documentation legend on drawings:



Below is TLT terms language on their contracts with HDOT:

12. CONFIDENTIAL INFORMATION All drawings, diagrams, technical data, vendor selections, reference lists and materials furnished by SELLER shall be deemed to be confidential, and are provided to PURCHASER for their use only. Such information has been developed at great expense and contains the trade secrets of SELLER. PURCHASER shall exercise reasonable care to hold such information in confidence and not use such information to SELLER's detriment.

Below are Howden IP terms on our contracts with HDOT:

INTELLECTUAL PROPERTY - Seller's intellectual property rights and proprietary information (in hard copy or in electronic format) remain the property of Seller. Notwithstanding any other provisions or requirements of this Order, no intellectual property or proprietary information is being sold, granted, transferred, licensed, or assigned; there are no works-made-for-hire or unrestricted use (any government rights shall be "limited rights"). Seller shall not be required to provide, or provide access to, any confidential or proprietary area or information. Buyer shall not reverse engineer or otherwise attempt to re-create the Goods/Services.

On behalf of Howden North America Inc., we greatly appreciate your interest in doing business with us. Howden is committed to providing the best quality products and services to our valued customers and we look forward to working with the HDOT on this valued project.

Should you have any questions or concerns regarding this proposal, please don't hesitate to contact us any time.

Kind Regards,

Steve Graeff
Manager, Turnkey

Howden North America, Inc.
(941) 661-9056
steve.graeff@howden.com

CC:

George Abcede
George Abcede@hawaii.gov

Curtis Oki
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Additional contact information:

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Sales Representative:
Industrial Marketing Systems
Ms. Sharon Kilborn
Cell No. 909-337-2238
skilborn@aol.com

Attachment F



September 22, 2015

Howden North America
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Web: www.howden.com

Mr. Albert Chung, Project Manager
Oahu District, Highways Division
State of Hawaii Department of Transportation
727 Kakoi Street
Honolulu, Hawaii 96819

Dear Mr. Chung:

Subject: Pricing Certification for Howden North America proposal dated September 3rd, 2015 for H-3 Harano Tunnels Exhaust Fan Refurbishment

Howden North America is pleased to propose the work under the proposal dated September 3rd, 2015 for the H-3 Harano Tunnels Exhaust Fan Refurbishment of your tunnel ventilation fans for the H-3 Tunnel Facility, Honolulu, Hawaii.

We hereby certify, in accordance with the provisions of Hawaii Revised Statutes, Chapter 3-122, that the pricing offered to the State of Hawaii in the subject proposal is reasonable and in line with similar work for other agencies and companies.

If required once the agreement with the State of Hawaii is executed, we can provide reasonable and sufficient data and pricing necessary to support this certification.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Mauricio Salazar', written over a printed name.

Mauricio Salazar
Regional Sales Manager
Howden North America Aftermarket Sales

SS16-021C