Notice of Construction Application

A notice of construction permit is required before installing a new source of air pollution or modifying an existing source of air pollution. This application applies to facilities in Ecology's jurisdiction. Submit this application for review of your project. For general information about completing the application, refer to Ecology Forms ECY 070-410a-g, "Instructions for Ecology's Notice of Construction Application."

Ecology offers up to two hours of free pre-application assistance. We encourage you to schedule a pre-application meeting with the contact person specified for the location of your proposal, below. If you use up your two hours of free pre-application assistance, we will continue to assist you after you submit Part 1 of the application and the application fee. You may schedule a meeting with us at any point in the process.

Upon completion of the application, please enclose a check for the initial fee and mail to:

Department of Ecology
Cashiering Unit
PO Box 47611
Olympia, WA 98504-7611

For Fiscal Office Use Only: 0299-3030404-B00-216--001--000404

Check the box for the location of your proposal. For assistance, call the appropriate office listed below:

Check box	Ecology Permitting Office	Contact
☐	**Chelan, Douglas, Kittitas, Klickitat, or Okanogan County** Ecology Central Regional Office (509) 575-2490	Lynnette Haller (509) 457-7126 lynnette.haller@ecy.wa.gov
☑	**Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Stevens, Walla Walla, or Whitman County** Ecology Eastern Regional Office (509) 329-3400	Karin Baldwin (509) 329-3452 karin.baldwin@ecy.wa.gov
☐	**San Juan County** Ecology Northwest Regional Office (206) 594-0000	David Adler (425) 649-7267 david.adler@ecy.wa.gov
☐	**For actions taken at Kraft and Sulfite Paper Mills and Aluminum Smelters Only** Ecology Industrial Section (360) 407-6900	James DeMay (360) 407-6868 james.demay@ecy.wa.gov
☐	**For actions taken on the US Department of Energy Hanford Reservation Only** Ecology Nuclear Waste Program (509) 372-7950	Lilyann Murphy (509) 372-7951 lilyann.murphy@ecy.wa.gov

Check the box below for the fee that applies to your application.

New project or equipment:

- ☐ **$1,904: Basic project** initial fee covers up to 16 hours of review.
- ☐ **$12,614: Complex project** initial fee covers up to 106 hours of review.

Change to an existing permit or equipment:

- ☐ **$357: Administrative or simple change** initial fee covers up to 3 hours of review. Ecology may determine your change is complex during the completeness review of your application. If you project is complex, you must pay the additional xxx before we will continue working on your application
- ☐ **$1,190: Complex** change initial fee covers up to 10 hours of review
- ☑ **$350flat fee**: Replace or alter control technology equipment under WAC 173-400-114. Ecology will contact you if we determine your change belongs in another fee category. You must pay the fee associated with that category before we will continue working on your application.

Read each statement below, then check the box next to it to acknowledge that you agree.

- ☑ The initial fee you submitted may not cover the cost of processing your application. Ecology will track the number of hours spent on your project. If the number of hours Ecology spends exceeds the hours included in your initial fee, Ecology will bill you $119 per hour for the extra time.
- ☑ You must include all information requested by this application. Ecology may not process your application if it does not include all the information requested.
- ☑ Submittal of this application allows Ecology staff to visit and inspect your facility.

Part 1: General Information

I. Project, Facility, and Company Information

1. Project Name: Donaldson Dust Collection Modification
2. Facility Name: Walla Walla Foundry
3. Facility Street Address:
   405 Woodland Avenue, Walla Walla, WA, 99362
4. Facility Legal Description: Abbreviated Legal Description: 30-7-36 (SURVEY 1998-04110) TAX 16F IN 19-7-36; ALSO TAX 34 IN 30-7-36
5. Company Legal Name (if different from Facility Name):
   Walla Walla Foundry, INC.
6. Company Mailing Address (street, city, state, zip)

   405 Woodland Avenue, Walla Walla, WA, 99362

II. Contact Information and Certification

1. Facility Contact Name (who will be onsite): Grant Griffen
2. Facility Contact Mailing Address (if different than Company Mailing Address:
   -same-

3. Facility Contact Phone Number: 509.386.1144
4. Facility Contact E-mail: grant@wallawallafoundry.com
5. Billing Contact Name (who should receive billing information):
   Scott Jacobson
6. Billing Contact Mailing Address (if different Company Mailing Address):

   -same-

7. Billing contact Phone Number: 509.522.2114
8. Billing Contact E-mail: scott@wallawallafoundry.com
9. Consultant Name (optional – if 3rd party hired to complete application elements):
   Marie Piper
10. Consultant Organization/Company: Cascade Environmental Management
11. Consultant Mailing Address (street, city, state, zip):
12. Consultant Phone Number: 360.672.0088
13. Consultant E-mail: marieatcascade@gmail.com
14. Responsible Official Name and Title (who is responsible for project policy or decision making):
    Grant Griffen, Facility Manager
15. Responsible Official Phone: 509.386.1144
16. Responsible Official E-mail: grant@wallawallafoundry.com
17. Responsible Official Certification and Signature:

    I certify that the information on this application is accurate and complete.

Signature: [signature] for Walla Walla Foundry Date: 03.20.2025

Part 2: Technical Information

The Technical Information may be sent with this application form to the Cashiering Unit, or may be sent directly to the Ecology regional office with jurisdiction along with a copy of this application form.

For all sections, check the box next to each item as you complete it.

III. Project Description

- ☑ Written narrative describing your proposed project.
- ☑ Projected construction start and completion dates.
- ☑ Operating schedule and production rates.
- ☑ List of all major process equipment and manufacturer and maximum rated capacity.
- ☑ Process flow diagram with all emission points identified.
- ☑ Plan view site map.
- ☑ Manufacturer specification sheets for major process equipment components
- ☑ Manufacturer specification sheets for pollution control equipment.
- ☐ Fuel specifications, including type, consumption (per hour and per year) and percent sulfur.

IV. State Environmental Policy Act (SEPA) Compliance

Check the appropriate box below. Note: There will be no changes to emissions, if any, there will be less due to emitting indoors. Please refer to the current permit application.

- ☐ SEPA review is complete. Include a copy of the final SEPA checklist and SEPA determination (e.g., DNS, MDNS, and EIS) with your application.
- ☐ SEPA review has not been conducted:
  - ☐ If review will be conducted by another agency, list the agency. You must provide a copy of the final SEPA checklist and SEPA determination before Ecology will issue your permit. Agency reviewing SEPA: _____
  - ☐ If the review will be conducted by Ecology, fill out a SEPA checklist and submit it with your application. You can find a SEPA checklist online at https://ecology.wa.gov/Regulations-Permits/SEPA/Environmental-review/SEPA-document-templates

V. Emissions Estimations of Criteria Pollutants Note: There will be no changes to emissions, if any, there will be less due to emitting indoors. Please refer to the current permit application.

Does your project generate criteria air pollutant emissions? ☐ Yes ☑ No

If yes, please proved the following information regarding your criteria emissions in the application.

- ☐ The names of the criteria air pollutants emitted (i.e., NO_X, SO_2, CO, $PM_{2.5}$, PM_{10}, TSP, VOC, and Pb)
- ☐ Potential emissions of criteria air pollutants in tons per hour, tons per day, and tons per year (include calculations)
- ☐ If there will be any fugitive criteria pollutant emissions, clearly identify the pollutant and quantity

VI. Emissions Estimations of Toxic Air Pollutants Note: There will be no changes to emissions, if any, there will be less due to emitting indoors. Please refer to the current permit application.

Does your project generate toxic air pollutant emissions? ☐ Yes ☐ No

If yes, please provide the following information regarding your toxic air pollutant emissions in your application.

☐ The names of the toxic air pollutants emitted (specified in WAC 173-460-150[1])

☐ Potential emissions of toxic air pollutants in pounds per hour, pounds per day, and pounds per year (include calculations)

☐ If there will be any fugitive toxic air pollutant emissions, clearly identify the pollutant and quantity

VII. Emission Standard Compliance Note: There will be no changes to emissions, if any, there will be less due to emitting indoors. Please refer to the current permit application.

☐ Provide a list of all applicable new source performance standards, national emission standards for hazardous air pollutants, national emission standards for hazardous air pollutants for source categories, and emission standards adopted under Chapter 70A.15 RCW.

Does your project comply with all applicable standards identified? ☐ **Yes** ☐ **No**

VIII. Best Available Control Technology Note: There will be no new equipment added to our process

☐ Provide a complete evaluation of Best Available Control Technology (BACT) for your proposal.

IX. Ambient Air Impacts Analyses Note: There will be no changes to emissions, if any, there will be less due to emitting indoors. Please refer to the current permit application for the following.

Please provide the following:

☐ Ambient air impacts analyses for Criteria Air Pollutants (including fugitive emissions)

☐ Ambient air impacts analyses for Toxic Air Pollutants (including fugitive emissions)

☐ Discharge point data for each point included in air impacts analyses (include only if modeling is required)

- ☐ Exhaust height
- ☐ Exhaust inside dimensions (ex. diameter or length and width)
- ☐ Exhaust gas velocity or volumetric flow rate
- ☐ Exhaust gas exit temperature
- ☐ The volumetric flow rate
- ☐ Description of the discharges (i.e., vertically or horizontally) and whether there are any obstructions (ex., raincap)
- ☐ Identification of the emission unit(s) discharging from the point
- ☐ The distance from the stack to the nearest property line
- ☐ Emission unit building height, width, and length
- ☐ Height of tallest building on-site or in the vicinity and the nearest distance of that building to the exhaust
- ☐ Whether the facility is in an urban or rural location

Does your project cause or contribute to a violation of any ambient air quality standard or acceptable source impact level? ☐ **Yes** ☑ **No**

To request ADA accommodation, call Ecology at (360) 407-6800, 711 (relay service), or (877) 833-6341 (TTY)

[1] http://apps.leg.wa.gov/WAC/default.aspx?cite=173-460-150

Part 2: Technical Information

The Technical Information may be sent with this application form to the Cashiering Unit, or may be sent directly to the Ecology regional office with jurisdiction along with a copy of this application form. For all sections, check the box next to each item as you complete it.

Written narrative describing your proposed project.

The Walla Walla Foundry currently has one Scientific Dust Collector filtering emissions from a Stainless Steel Pouring Furnace (can be referenced from our current air emissions permit) and one Donaldson Dust Collector filtering emissions from a Sandcasting Operation (can be referenced from our current air emissions permit). We plan to discontinue the operation of the current Scientific Dust Collector (SDC) and remove it from service. We will then replace the Scientific Dust Collector with the Donaldson Torit that is currently connected to our Sandcasting process. By adding new ductwork, we can utilize our Donaldson Torrit collector for both operations. This will allow for us to continue capturing our emissions for both the Sandcasting Operation and the Stainless Steel Pouring Operation using one dust collector rather than two. We do not run both of these operations at the same time, so this change will allow us to utilize our best available control technology for both of these operations without negatively affecting our flow of production. This modification will increase our efficiency by lowering our maintenance costs and will improve the capture zone effectiveness to our Stainless Steel Pouring operation because the Donaldson dust collector is capable of capturing more CFM than the current dust collector being used. This will also free up the SDC dust collector so that it may be considered for future projects. The scope of work will include modifications to the Donaldson Torrit ductwork and collection hood at the stainless steel furnace location.

Projected construction start and completion dates

April 1, 2025 - April 18, 2025. Note: We hope to commence work on April 18th but will wait until authorization from the Deparment of Ecology.

Operating schedule and production rates

Both Sandcasting and Stainless Steel melt operations will be put on hold during construction until Donaldson Dust Collector duct modifications have been completed. No emissions will be generated during that time. Projected use of material rates will not differ from rates listed in the existing permit.

List of all major process equipment and manufacturer and maximum rated capacity.

There will be no new equipment installed. The Donaldson Dust Collector is currently listed in our permit and will remain in operation. When the modifications are complete, it will continue to service Sandcasting with the addition of the Stainless Steel pouring operation added to the duct system. Manufacturer: Donaldson Torit, Maximum rated capacity: 12,430cfm

Process flow diagram with all emission points identified.

Attached. Note that emissions will be returned to the inside of the building so there will be no emission point.

Plan view site map.

Attached.

Manufacturer specification sheets for major process equipment components

Stainless Steel Furnace Manual Attached

Manufacturer specification sheets for pollution control equipment

Manual and Grain Loading specs for Donaldson Attached

PROCESS FLOW DIAGRAM

PROJECT SCOPE OF WORK:
-Determine Donaldson Baghouse compatability with Stainless Steel Pouring, Hex. Chrome Fume Collection.
-Calculate ducting to provide adequate cfm to capture zone for capturing 100% of fumes generated.
-Calculate heat loss from the source through the ductwork to determine the heat temp. when it reaches the baghouse will not damage the filtration system.
-Provide quote for Engineering, ductwork and installation
-Replace current SDC collection system by connecting Donaldson Baghouse to SS Collection Hood.
-Grain Loading Guarantee to be 1-2 GR/CU FT
-Bag Efficiency needs to be 99.9% of incoming grain load of 1 micron particle or larger (No HEPA required)
-Capture Efficiency needs to be 100%

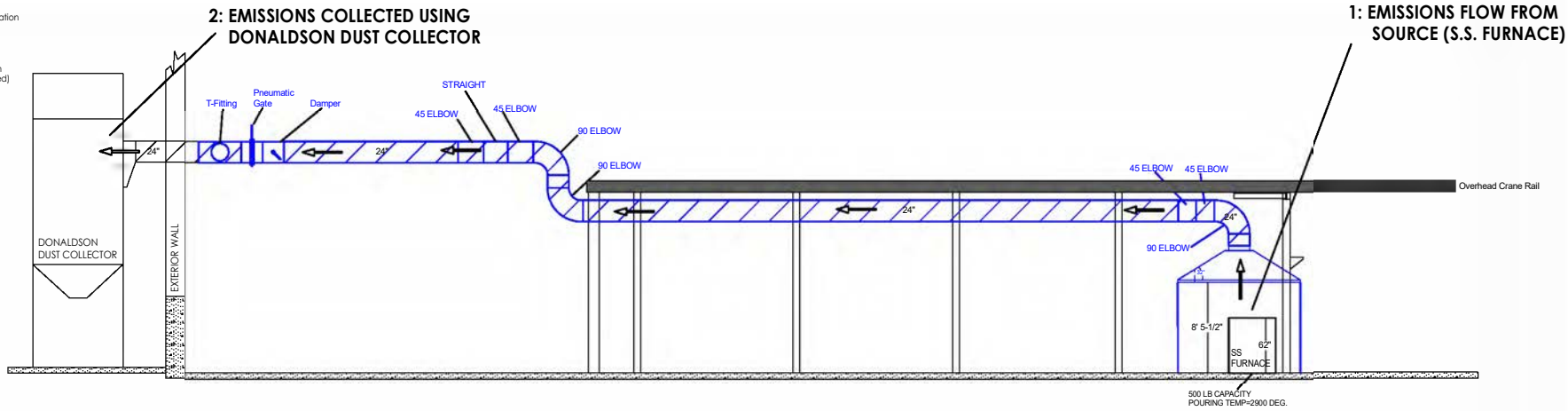
DONALDSON COLLECTOR SPECS.
-MODEL NO.= 128HPT-8
-SERIAL/ORDER ENTRY NO.= 2283295
-ELECTRICAL REQUIREMENTS= 208-230/480V
-MOTOR HP= 30
-# OF FILTER BAGS= 128
-FILTER BAG DIMENSIONS= 3" X 6" OVAL X 96"
-FILTER MATERIAL= ?
-ACTUAL FILTER AREA= 1272 SQ.FT.
-FILTER P/N= 048-0990-01-PEI6SU-D
-FILTER MANUF.=Dust Collector Services Inc.
-NOMINAL AIRFLOW RANGE= 12,800-20,500cfm
-COMPRESSED AIR REQUIRED= 90-100psi
-AIR CONSUMPTION= 1.1 SCF / PULSE
-GRAIN LOADING GUARANTEE= No more than .004 grains per dry standard cubic foot
-BAG EFFICIENCY= 99.929, 1mic

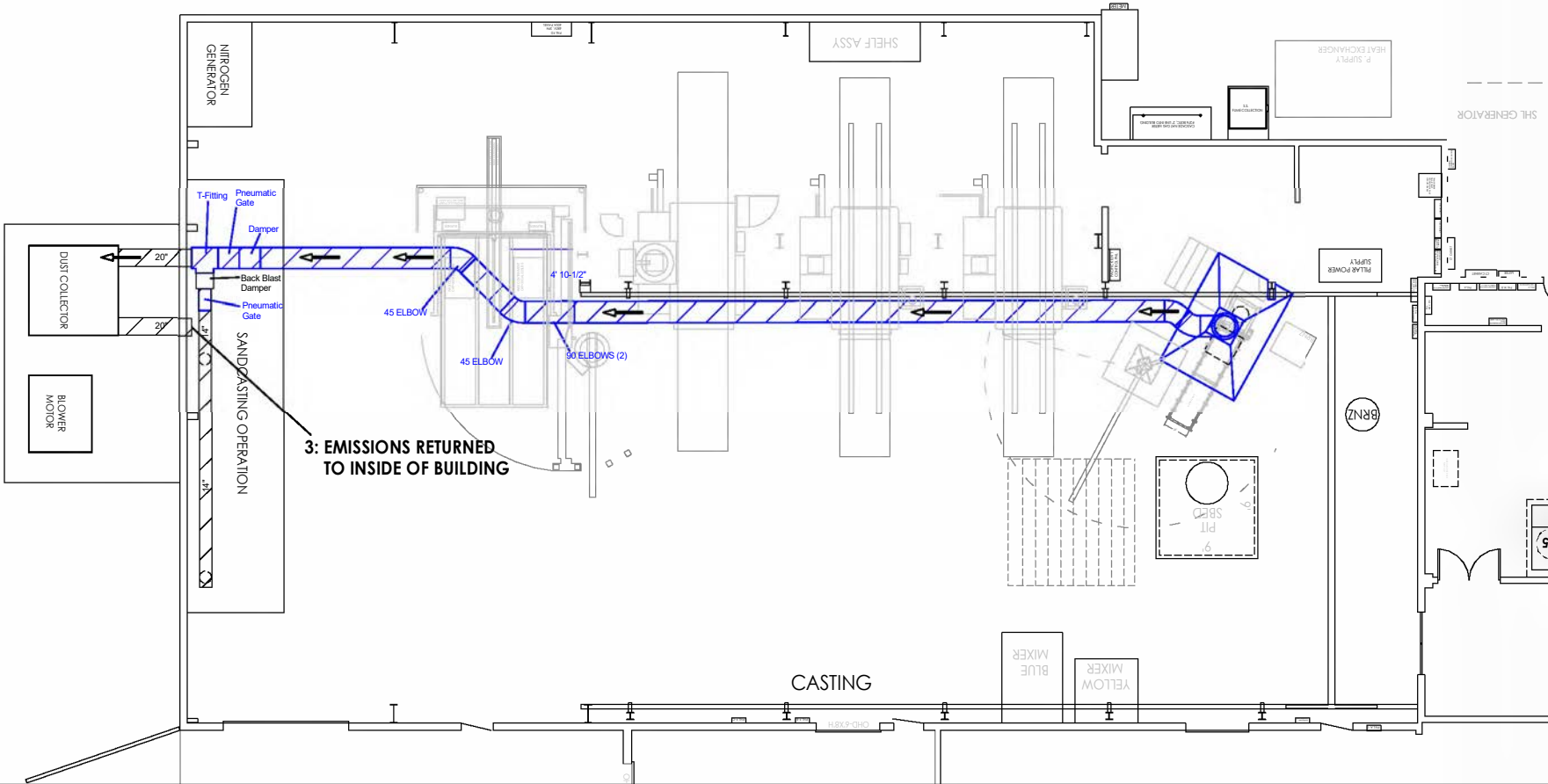
DRAWING NOTES:

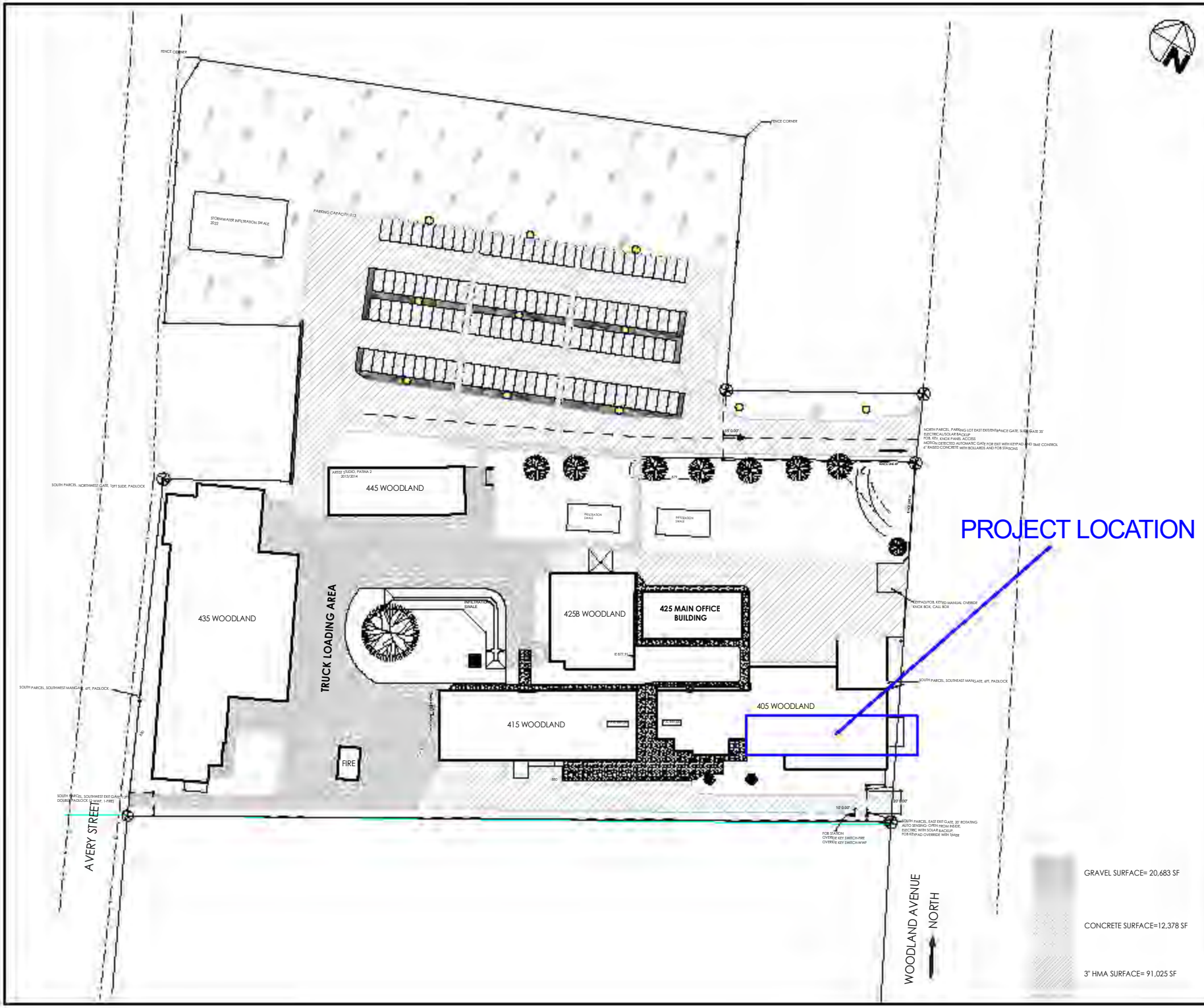
-BLUE ANNOTATIONS ARE CONCEPTUAL ONLY
-DRAWNING COMPLETE 3.13.25

2: EMISSIONS COLLECTED USING DONALDSON DUST COLLECTOR

1: EMISSIONS FLOW FROM SOURCE (S.S. FURNACE)







WALLA WALLA FOUNDRY
405 WOODLAND AVE
WALLA WALLA WA, 99362

405 WOODLAND SITE PLAN

NOTES:
GRANT GRIFFEN
509-386-1144
grant@wallawallafoundry.com

GG

405 WOODLAND SITE PLANS-Lev-1

S-1

Manufacturer specification sheets for major process equipment components

FREE STANDING BOX FURNACE

INSTRUCTION MANUAL

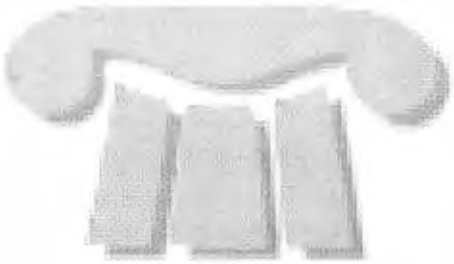
PP1209-5

11/4/13
Chad Gerszewski
cell=(414)-218-1114

- no insulators required for 500 lbs mount

Pillar Induction
21905 Gateway Road
Brookfield, Wisconsin 53045

Phone: (262) 317-5300



Foreword

This manual has been prepared for the use of all foundry personnel – operators, maintenance, supervisors and other management.

The Pillar Induction Box Furnace has been designed for optimum efficiency and safety. For safe utilization of the equipment, specific safety and maintenance procedures must be established.

This manual provides a chapter on safety.
It is suggested that the precautions outlined be modified or expanded for each foundry operation.

Pillar Induction Free Standing Box Furnaces

Table of Contents

Chapter 1 General Information

Furnace Specification 5

Major Components 6

Definitions 7

Chapter 2 Installation

Installation Instructions 11

A. Site Selection

B. Power Connection

C. Water Connection

D. Hydraulic Interconnection (Opt.)

Relining Check List & Inspection 12

Chapter 3 Refractories

Major Components 13

Definitions 15

Crucible Linings 16

Rammed Linings 19

Chapter 4 Safety

Personnel Protection 24

Furnace Refractory 24

Melting Procedure 25

Furnace Maintenance 26

Leakage Detector 27

Emergency Procedures 28

Chapter 5 Maintenance

Furnace Box 29
Induction Melting Coil 29
Hydraulic Components (Opt.) 29
Hydraulic Fluids 30
Water Cooled Leads 31

Appendix

Table of Typical Materials 33
Color Scale of Temperature 34
Suggested Reading 35
Rammed Lining Cross Section (DG1675) 36
Straight Wall Crucible Summary (DI425-1) 37-39

CHAPTER 1 GENERAL INFORMATION

FURNACE SPECIFICATION

The Box Furnace is one of the most familiar members of the induction melting furnace family. Its inherent simplicity makes it suitable for a very wide range of melting applications, covering sizes from 50 pound capacity through 3,000 pound capacity in design frequencies of 540 Hz through 10 kHz.

Pillar Induction offers a full line of standard air melting furnaces in either hoist or hydraulic tilt versions, as well as special designs to suit a particular application. Vacuum melt furnaces are also offered in the full line of furnaces, with special tilting mechanisms as required for any application.

All Box Furnaces are designated as pounds of molten steel capacity. Standard straight wall crucibles, as manufactured by all major crucible vendors, determine coil diameters.

The basic furnace is constructed of an aluminum frame, cast refractory top and bottom, high efficiency copper induction melting coil and steel stanchions.

MAJOR COMPONENTS

The Free Standing Box Furnace is broken down into two major components:

1. Removable Furnace Box – Includes the following parts of the Box Furnace:

    A. Furnace Frame – the structural aluminum gives rigidity to the box and is welded in a prescribed manner to avoid inductive loops, which could cause excessive heat and power loss.
    B. Cast Refractory Top – A lightweight "floating" cast-able providing protection to the coil.
    C. Cast Refractory Bottom – A two-component cast-able which provides a base for the coil and strength for the furnace bottom.
    D. Induction Melt Coil – A high conductivity copper coil with the proper number of turns to efficiently resonate at the power and frequency of the melting power supply, plus a lower cooling coil.

2. Stanchion Assembly – Constructed of steel channel and tube for solid footing and consists of the following:

    A. Stanchions – Mounted to floor and providing base for tilting frame and furnace box.
    B. Tilting Frame – Support for removable furnace box and the connection between box and stanchions.

DEFINITIONS

1. Active coil – The electrically active portion of the coil in a coreless induction furnace.
2. Cast Refractory Bottom – A two component cast refractory system providing maximum thermal insulation and strength provided by reinforced refractory.
3. Cast Refractory Top – Stainless steel wire reinforced refractory providing strength and thermal insulation.
4. Center Tap – Water feed connection at the center of the coil to increase cooling water flow.
5. Coil Stud – A threaded stud that is brazed to the turns of the coil for connection of the coil support.
6. Coil Support – A hardwood support that is drilled to accommodate the rows of coil studs for proper turn spacing and mechanical support.
7. Cooling Coil – The portion of the coil that is used only for support and cooling of refractories.
8. Counterwound Coil – A coil in which the active section is made up of two sections with the common points at the coil center and at the ends and the pitch of the sections being opposite.
9. Cross Polarization – Configuration of electrical conductors for minimizing voltage drop, maximizing efficiency and reducing heating by stray induction fields such that adjoining components are of opposite polarity. Examples:
10. Emergency Lifting Assembly – Mechanism for tilting the furnace with an overhead crane.
11. Extren – See Glastic.
12. Fin – (1) A copper spacer brazed to the top or bottom turn of a coil to provide refractory support. (2) A type of metal run through providing a flat, thin piece of solidified metal in a refractory crack.

13. Flared Fitting – Male fitting threaded into the termination block for connection of the flared tube connector on the end of a water-cooled lead.
14. Flow Control Valve – Adjustable flow control valve located at the bottom of each cylinder to regulate the rate of descent of the furnace.
15. Flux Shield – Conductive plate (aluminum or copper) used to contain stray magnetic flux and reduce unwanted induction heating.
16. Front Cover Plat – Aluminum cover plate for the front of the furnace box which also acts as a flux shield for the ladle bumper.
17. Furnace Frame – A structural aluminum frame welded in a prescribed manner to avoid inductive loops. The frame is the basis for the furnace box and is bolted to the tilting frame.
18. Glastic - Brand name for fiberglass reinforced polyester insulating materials used as electrical insulators and mechanical reinforcement.
19. Glyptol - Brand name for electrical grade varnish for insulating the coil, supports and termination area.
20. Hose Barb – A tube connection with retaining ridges or rings for connection of water hoses.
21. Hose Clamp – A non-magnetic stainless steel clamp for sealing of water hoses in induction applications.
22. Hydraulic Cylinder Mounting Plate – Eye bracket for connection of the hydraulic cylinder to the stanchion. Connection is made with a pivot pin.
23. Hydraulic Cylinder – Lifting mechanism for the furnace box.
24. Inductive Loop – A closed circuit path for induced currents, producing heating by induction.
25. Knuckle – Female threaded block with an eye for connection of hydraulic cylinder rod to the tilting frame using a mounted pivot pin.
26. Ladle Bumper – Stanchion cross member for protection of the front of the furnace box and as an enclosure for hydraulic tubing.

27. Lead Adapters – Adapters for connection of flared fittings to bus bar, normally containing a termination block.
28. Lead Clamp – A fitted clamp of non-conductive material used to provide support for water-cooled leads at the furnace entrance.
29. Lifting Eyes – Mounted on the furnace box frame for removing the furnace box from the tilting frame.
30. Mica Insulators – High temperature electrical insulation material used to insulate portions of the furnace from each other, eliminating inductive loops.
31. Pivot Pin – Hardened steel pin with grooves for retainer rings on the ends.
32. Platform – Bolt on platform for standing at the rear of the furnace, used on larger furnaces to adjust the charge height for the operator.
33. Plug-Type Water Cooled Lead – A water-cooled lead with a tapered rubber plug attached for power feed through a vacuum port.
34. Pour Spout – A welded, stainless angle and channel assembly designed to hold the formed refractory pour spout.
35. Side Cover Plates – Glastic cover plates for the sides of the furnace box.
36. Stanchion – The upright posts and mounting assembly that is bolted to the floor. The hydraulic cylinders, flow valves and interconnect tubing is mounted to the stanchion assembly.
37. Termination Block – A machined copper block providing electrical and water connections.
38. Termination Stack – Copper tubes connecting the termination blocks to the active coil ends.
39. Tilting Frame – A steel frame for supporting the furnace box. The frame is the tilting element pivoting on the stanchions and lifted by the hydraulic cylinders or hoist.
40. Top Angle – A stainless steel angle bolted to the furnace frame to hold down the cast refractory top.

41. Water Cooled Lead – Flexible electrical conductors enclosed within a robber hose that provides electrical insulation and a path for cooling water.

CHAPTER 2 INSTALLATION

INSTALLATION INSTRUCTIONS

A. Site Selection – Customer should place furnace in an open, unrestricted space close to the power supply. ABP will provide an installation drawing with the recommended locations of the furnace and power supply upon request. We recommend a flat, unobstructed surface of concrete. Locate some suitable anchor through holes provided in the base and bolt securely to the floor.

B. Power Connection – Water cooled power transmission leads are provided with the furnace, and they are to connect the coil termination to the flared male connectors. They are fed through an opening on either side of the box and secured there with a lead clamp. The opposite end connects to lead adapters located either inside the power cabinet (short runs) or the end of a bus bar run in a trench (long runs). The leads must be long enough to comfortably reach the full tilt position of the furnace and feed through a lead ring in the trench cover plate, where applicable. Leads should be cross polarized and taped together on two-foot centers.

C. Water Connection – Most often the power leads also carry the water supply to the drains. However, in the case of a many-turn coil with a large power supply, a "center tap" coil may be used, in which case, a separate water supply hose (provided by Pillar Induction) must be run from the cabinet water valve (marked "Furnace Water") to the center tap of the coil. Refer to the water diagram supplied with the drawing set for flow and temperature requirements for your particular installation.

D. Hydraulic Interconnection (Opt.) – If this furnace is equipped with hydraulic tilt cylinders, provisions are made for hydraulic lines to connect to the tilt valve. No hydraulic lines should be located under a furnace.

   With this option, the customer needs only to connect to the pressure (P) and tank (T) ports of the tilt valve.

   A very important feature that is standard with hydraulic tilting furnaces is the use of flow controls attached directly to the bottom port of the tilt cylinders. These controls regulate the rate of descent of the furnace under any condition and are adjustable to suit the requirements of the process. They are preset at the Pillar Induction Factory for a slow rate of return of an empty furnace and may be readjusted by a Pillar Induction Field Serviceman.

RE-LINING CHECKLIST AND INSPECTION

A. Furnace stanchions firmly bolted down and leveled. _____

B. Furnace power connections made. _____

C. Furnace water supply connected. _____

D. Water flow as required per diagram (30 PSI min.). _____

E. Coil grout smooth, intact and dried. _____

F. Insulating paper or cloth on hand for lining. _____

G. Ramming tools on hand and ready for use. _____

H. Refractory on hand (either crucible type or rammed type). _____

I. Furnace tilts properly: _____

1. If hoist type, cycle furnace tilting a few times.
2. If hydraulic, make sure all lines are connected properly, no leaks and hydraulic power supply fully operable. Cycle furnace up and down a number of times until all air is out of lines.

J. Turn power on from power supply and check for proper connection of leads (cross polarized) and check for proper operation of coil (no short circuits). _____

K. Lining form on hand (rammed linings). _____

L. Charge material on hand (ingots or large pieces preferred for starting with rammed linings). _____

M. Handling equipment operating and ready. (ladles, overhead cranes, hoists, etc.) _____

N. Method of heating ladles for steel melting. _____

O. Molds ready. _____

P. Temperature measuring instrument on hand. _____

CHAPTER 3 REFRACTORIES

MAJOR COMPONENTS

A. Coil Grout performs several important functions:

1. Acts as a filler to stabilize the coil, maintain turn spacing and reduce vibration.
2. Acts as an insulator to reduce arcing between turns.
3. Provides a back up refractory for the furnace working lining in the event of a run through.
4. Provides a smooth surface for establishing a sheer plane between the furnace working lining and coil. (This is particularly important when monolithic linings, which tend to lock into coil turns, are used).

The best coil grout is a high aluminia oxide, hydraulic, fast setting cement. Acid bonded refractories should not be used due to corrosive reaction with the coil copper resulting in coil damage and a greater chance of arcing between turns. Low temperature hydraulically bonded silica grout should be used only with silica linings or for non-ferrous melting.

Coil grout may be patched or replaced by troweling. Thickness should be the minimum to allow a smooth surface and should never be more than three-eighths inch thick. Coil grout must be thoroughly dried before installing the refractory lining after initial installation or after patching. If a torch is used, direct flame contact must be avoided and coil cooling water must be left on. Best results are achieved by turning off the coil cooling water (to avoid condensation) and applying a heat lamp inside the furnace overnight when patching and for twenty four hours when replacing or patching large areas of grout.

B. Shear Plane

The shear plane is a thermal and mechanical interface between the furnace working lining and the coil grout. This interface prevents the working lining from bonding with the coil grout and provides a vertical shear plane to prevent coil damage due to expansion of the working lining. The material used for the shear plane is ceramic fiber paper or cloth that has replaced the asbestos cloth or millboard previously used. The thermal insulation characteristics of this material are very good and can produce little temperature drop through the main lining if used in excessive amounts. In face-sintered refractories such as dry ram silica and aluminia linings, excessive sintering can occur which may result in cracks through the entire thickness of the main lining. For dry rammed

lining, one-eighth inch of material is recommended. For monolithic linings (generally wet rammed), one-quarter inch is recommended.

C. Bottom Insulation

The bottom insulation is a thermal and mechanical interface between the furnace cast refractory bottom and the working lining in a rammed furnace, or the crucible back-up refractory in a crucible furnace. This interface prevents the working lining from bonding with the cast refractory bottom and provides a significant portion of the thermal insulation in the furnace bottom. The material used in this portion of the furnace refractory lining is the same ceramic fiber paper or cloth that is used in the shear plane. The material is installed by removing the stainless steel ground probe assembly, installing one-fourth inch of insulation and replacing the probe assembly.

D. Cast Refractory Top

The cast refractory top is a stainless steel wire reinforced refractory providing strength and thermal insulation.

E. Cast Refractory Bottom

The cast refractory bottom consists of a two component cast refractory system providing maximum thermal insulation and strength provided by reinforced refractory.

F. Top Cap and Spout

An air set phosphoric or hydraulic bonded refractory that is compatible with the working lining and the metallurgy of the melt. The top cap and spout provide maximum mechanical strength for protection of the crucible or working lining. In the case of some monolithic linings, the working lining extends through to the spout.

DEFINITIONS

1. Crucible Back-up – Non-bonding dry refractory back-up of rammed crucibles for protection against run-through due to crucible fracture.
2. Holding Power – The power level equal to the furnace electrical and thermal losses; the point at which there is no change in bath temperature.
3. Meniscus – The convex upper surface of the molten bath caused by the pinching effect of the coil magnetic field on the molten metal.
4. Meniscus Height – The height from the crown of the meniscus to the point at which the molten metal touches the refractory wall.
5. Parting Line – The line at which the top cap meets the crucible or working lining.
6. Ramming – Tamping or pounding down by a series of blows or taps. The method most commonly used in small, coreless induction furnaces for installation of working linings or crucible back-up.
7. Sinter (Fritter) – Heating the refractory to the point at which a ceramic bond is formed.
8. Slag – Fused refuse separated from metal in the melting process – less dense than the metal.
9. Slag Coagulant – A high melt temperature material that can be spread on the surface of a molten metal bath to facilitate removal of slag. Sometimes used to reduce radiated losses in open top furnaces or ladles.
10. Stirring – The circulation of the molten metal caused by pressure exerted on the bath by the applied magnetic field, and the resultant electrical current in the bath.
11. Vent Holes – Holes intentionally made in lining forms or top caps for the release of moisture or steam produced in the drying process.

CRUCIBLE LININGS

Crucible linings for coreless induction furnaces are straight-wall type rammed with back-up and the spout formed of refractory.

Crucibles are of two types:

A. Conductive: Silicone carbide or Clay Graphite

Silicone carbide crucibles are recommended for 180 Hz operation only and will tend to overheat internally at higher frequencies.

Clay graphite crucibles are used for non-ferrous melting. A portion of the power is coupled into the crucible wall resulting in higher coil and furnace efficiencies. Care must be taken to purchase crucibles for the frequency of the furnace. Clay graphite crucibles are installed with the bottom flush with the bottom of the last active coil turn.

B. Non-Conductive Pre-Formed Refractory

Refractory crucibles provide simplicity of installation and consistency for all types of ferrous and other high temperature melting.

Selection of the type of refractory is based upon the metallurgy and temperature of the melt.

Refractory crucibles are installed with the inside bottom flush with the bottom of the last active coil turn.

Crucibles are held in place by:

1. Crucible refractory back-up.
2. Crucible top cap and spout.

C. Crucible Installation

The following is a typical procedure for installing crucible linings. It is for reference only. Specific instructions should be requested from the crucible manufacturer.

After inspection of the face of the coil grout for integrity, check to make sure you have an adequate quantity of all materials needed on hand to be able to complete the installation from start to finish without interruption.

1. Ensure that area to be lined is clean.
2. Ensure that the grouting is in good condition.
3. IT IS EXTREMELY IMPORTANT WHEN LINING A FURNACE TO KEEP RAMMING MATERIAL FREE FROM ALL FOREIGN OBJECTS. THEREFORE, INSTALLERS SHOULD BE CAREFUL AND KEENLY AWARE OF ALL FOREIGN OBJECTS IN THE AREA OF MATERIAL.
4. Ground detector probes must be inspected for suitable length as per print. Conductive crucibles should be carefully ground at bottom for probes to make electrical contact.
5. Insert Insulating Paper. Fit the 1/8" thick layer of insulating paper against the inner face of the coil grout from bottom to top of furnace. It will provide a shear point for easy removal of the lining when the crucible is worn out. Fit the ¼" thick layer of insulating paper in the furnace bottom.
6. Fill bottom cavity with Back-up Refractory. Install in no more than 2" levels at a time. Ram and fork material until proper height of material at bottom is reached.
7. Set Crucible in place and ram Back-up. Ram no more than 2" layers all around crucible. Tamp and fork each layer until it is solid. Place crucible at bottom, maintaining proper centering to coil. Be sure bottom is centered as well as top.

   NOTE: Improper centering will cause hot spots on crucible. To ensure crucible remains in place add a charge of metal, wooden wedges may also be used in order to keep crucible centered properly. Proceed with the back-up ram to within 1" of the top of the crucible and leave surface rough. At this point, wedges may be removed.
8. Install top cap and spout. Use the recommended top cap material (usually a phosphoric bonded alumna) and begin ramming the

remaining 1" below the crucible and continue on up to form the rounded cap and spout. Use a wooden mallet and a trowel for this portion and if the top cap is not a pre-mixed variety, add only enough water to make it workable.

9. Dry the lining before use. You may either allow the top cap to air dry or force dry it with gas or strip heaters if quick turnaround is required. You can also place ingots in the spout area during the first heat and let them inductive heat dry the spout for you. In any case, don't rush through drying too fast, as you can crack the cap through thermal shock or even pop holes in it if steam pockets form. It will be helpful to poke 1/8" diameter holes four (4) inches apart all around the top to help vent the steam if your refractory is a particularly wet mix. In all cases, be sure to have water circulating through the induction coil during drying or heating cycles to prevent heat damage to the coil.
10. In cases where lining is to be left overnight before use, it is preferable to put top cap on prior to use.
11. When heating for the first time on new crucible, use no more than ¼ power for first twenty minutes. For the next ten minutes use ½ power and for ten minutes use ¾ power. After these steps have been completed, turn the unit to full power.
    On cold furnaces or the first melt of the day, allow fifteen minutes at 1/3 power, five minutes at 2/3 power and then full power.

    CAUTION NOTE: Never charge a crucible too tightly. This will avoid cracking the crucible when heating.
    NOTE: It is wise to use an immersion type temperature reading device. This will help prolong crucible life because of accuracy.

RAMMED LININGS

Rammed linings are field formed around a pattern of the desired shape and dimensions.

Lining forms are of various types:

A. Melt Out Form – Usually a welded steel form used once and melted with the first heat.
B. Removable Form – A steel form that is tapered to allow removal after lining (usually wet) is formed.
C. Collapsible Form – A multi-section form that is disassembled and removed after the lining is formed.
D. Transite Form – A refractory form that is melted with the first heat.

Rammed refractory linings are of two basic types:

1. Face Sintered (Dry Type) refractory lining – In this type, the shape, initial melt sinters, surface producing a ceramic crucible and the unsintered dry material provide the back-up refractory.

The following is a typical procedure for installing a dry lining. It is for reference only. Specific instructions should be requested from the refractory manufacturer.

After inspection of the face of the coil grout for integrity, check to make sure you have an adequate quantity of all materials needed on hand to be able to complete the installation from start to finish without interruption.

A. Ensure that are to be lined is clean.
B. Ensure that proper grouting is intact.
C. IT IS EXTREMELY IMPORTANT WHEN LINING A FURNACE TO KEEP RAMMING MATERIAL FREE FROM ALL FOREIGN OBJECTS. THEREFORE, INSTALLERS SHOULD BE CAREFUL

AND KEENLY AWARE OF ALL FOREIGN OBJECTS IN THE AREA OF MATERIAL.

D. Ground detector probes must be inspected for suitable length as per print. They should be extended 1/16" to 1/8" above bottom level of lining.

E. Insert Insulating Paper. Fit the 1/8" thick layer of insulating paper against the inner face of the coil grout from bottom to top of furnace. This will provide a back-up lining. Install ¼" thick bottom insulation.

F. Ramming the bottom. Fill the bottom cavity with 2" layers of loose refractory and use the Bosch Vibrator or equivalent with the proper size tool slightly below the surface of the loose material. On the first pass, allow the vibrator to move under its own weight without pressure; then apply slight pressure for second pass. This will remove the air pockets and set the layer up for compacting. Repeat the vibration twice more, increasing the pressure with each pass for maximum density. Score the top with a fork tool and repeat until the bottom thickness is about ¼" above the desired height. Remove enough material to place the form level and in good contact at the correct height (even with bottom of active coil). Be careful to center bottom of liner first and then the top.

G. Weigh the lining form down with starter blocks and charge material. Wedges may be used if necessary.

H. Ramming the sidewalls. Begin ramming the sidewalls, using 2" layers of loose fill. Four complete and overlapping passes with hand tools or two complete passes with a vibrator will compact the material down to 1" to 1½". Do not remove the loose material after scoring the surface of each layer. Score each layer before adding the next.

I. Top cap. About 1" to 2" above the maximum melt line, begin installing the top cap and forming the spout with the recommended

material. This material is usually an air-setting plastic refractory with similar thermal expansion to the rammed mix. Every 2" put 1/8" breathing holes in the top cap. This will allow moisture to escape. Foundry-men in some cases prefer to mix top cap and lining material as an interface to top cap and the lining material to prevent melt line separation. A length of 1" – 2" is suitable for this, depending on furnace size.

Form the spout approximately as shown in the cross section drawing, paying particular attention to the slope of the curve. Do NOT form a flat groove or any sharp corners, as this will affect the trajectory of the pour stream.

NOTE: Spout and throat should have sufficient depth because of its being an "extreme wear area". This is the area where most hazards occur.

J. Sintering Procedure. For Box Furnaces in size of 50# through 2000# capacity, the sintering procedure should be approximately the same.
   1. Charge the furnace with enough material to fill lining form to the top. Generally, ingots are preferred.
   2. Bring the temperature up at a rate of 200° per hour, depending upon the size of the furnace and amount of moisture present.
   3. During the process of bringing center temperature up, <u>be extremely careful **NOT** to do the following:</u>
      (a) Blister the lining form.
      (b) Melt out any part of lining form.
      (c) Split any part of lining form prematurely.
   4. When melting temperature of melt-out form is reached, charge continually so that continual portions of melt-out form are

gradually melted. This will ensure proper sintering of upper area.

5. When full molten and metal is at desired melt height (pounds), take temperature up 100º F. above desired top temperature. Hold power and temperature constant for approximately one hour. DO NOT MELT ABOVE PARTING LINE UNDER ANY CIRCUMSTANCES.

K. Monolithic (Wet Type) Refractory Lining. In this type, the lining form (removable) provides the shape; torch drying and the initial melt fire it into a solid one-piece ceramic refractory.

Monolithic linings tend to transmit more effects of expansion to the coil due to the loss of the soft, non-sintered back up. One-quarter inch of insulating paper is recommended to absorb some expansion and to allow a shear plane. Coil maintenance is greater with this type of lining.

Ramming and sintering or drying procedures vary with the size of furnace, type of refractory and refractory manufacturer. Typical procedures are not consistent for wet rammed linings, and therefore, not included in this manual.

CHAPTER 4 SAFETY

PERSONNEL PROTECTION

1. All personnel should wear safety glasses at all times. Special dark tint lenses should be worn when observing high temperature molten baths. Facemasks may be required in some instances.
2. All personnel involved in charging and pouring the furnace should wear heat and flame retardant clothing.
3. Keep all furnace cover plates in place at all times while in operation.
4. Keep all walkways and furnace access areas clear of obstructions.
5. Keep all unauthorized personnel away from the melting operation.

FURNACE REFRACTORY

1. All furnace refractories must be suitable for the metal to be melted and the temperatures to be achieved. Refer to the refractory manufacturer's specifications.
2. Furnace linings must be inspected and measured on a regular basis to determine refractory failure and wear.
3. All refractories must be installed, dried or sintered in accordance with the refractory manufacturer's specification.
4. Patching below the slag line should be avoided and all patching should be done in accordance with the refractory manufacturer's specifications.
5. Temperature of the molten bath must be controlled to minimize refractory erosion.
6. Thermal and mechanical shock must be avoided by heating refractory slowly and by controlling charge material.
7. Minimal time should be allowed between ramming of a furnace with dry-rammed refractory and the start of the sintering cycle to avoid water pick-up.

MELTING PROCEDURE

1. Furnace areas and spill pits must be free of standing water and dry while melting.
2. Charging material must be dry and free of combustible materials.
3. Do not charge material that has closed or partially closed containers such as tubes pipes or cans.
4. Irregular shaped materials that may hang up on the refractory walls should not be used since they may cause “bridges”. Bridges of scrap and slag may obstruct view of and lose contact with the molten bath allowing overheating of the metal and rapid refractory erosion and lining failure.

   If bridge forms, tilt the furnace enough to bring the molten metal in contact with the bridge, reduce the power to about twice the normal holding power until molten metal is visible.
5. The furnace may then be returned to the normal position and charge added to the now visible bath.

   NOTE: The furnace must never be tilted during the sinter cycle. Extreme care must be taken to avoid bridging.
6. In steel melting, rapid oxidation in the form of a carbon boil can occur because of slow melt rates, dirty scrap or excessive temperature. The strong bubbling action of a carbon boil can cause splattering of molten metal or, in worse case, frothing of the bath and overflowing of the furnace. Carbon boils should be avoided but many times can be brought under control depending upon the desired metallurgy through the addition of ferro manganese, silico-manganese or ferrosilicon at the point the boil begins or addition of pieces of aluminum scrap when carbon boil cannot be controlled by other means.
7. Charge furnaces at start-up with pure metals or alloys not high in low melt constituents of the final metallurgy. Excessive amounts of low melting point alloys of lead, zinc or magnesium early in the melt can cause these alloys to penetrate the refractory lining and cause lining failure.

FURNACE MAINTENANCE

1. Never patch over the grounding probes in the furnace bottom, as this will allow the bath to "float electrically" and to present a hazard to the operator in the event of a run-through.
2. Always use at least two independent supporting means when working on or around a tilted furnace.
3. Never try to melt out a frozen furnace full of metal when a silica lining is used. If a furnace with a frozen slug of metal must be melted, first consider the type and condition of the refractory.

   If it is felt that the refractory will allow a cold melt out, proceed with caution: Tilt the furnace and use minimal power to increase the temperature at a rate of no more than 400° F. per hour and pour as soon as possible.

LEAKAGE DETECTOR

Leakage detector systems are designed to continuously monitor electrical leakage current from the output circuit (capacitors, bus bars and induction coil) to ground while the high voltage and frequency are applied. By solidly grounding the molten bath or conductive crucible through non-magnetic, stainless steel wire probes installed through the bottom refractory in the furnace, the electrical resistance of the furnace refractory may be measured. Grounding the molten bath also provides maximum protection against accidental electrocution from the furnace. The leakage detector will remove power to the furnace in the event of high leakage current to ground caused by molten metal or fins of solidified metal coming into contact with the furnace coil.

High leakage current and consequent shutdown may also be caused by:

1. External damages to coil insulation or conductive paths to ground through metal parts, chips or conductive dust build up on the coil exterior.
2. Electrical ground in the output circuit such as a grounded capacitor or grounded output bus bar.
3. Moisture build up within the furnace refractory lining, condensed water on the coil exterior (due to too cold of cooling water), or wet insulators in the furnace power transmission system (bus bars, etc.)
4. Decrease in cooling water resistance through chemical contamination or additions to the water such as softening agents, acids or use of conductive rubber hose.

NEVER OPERATE THE UNIT WITHOUT THE DETECTOR SYSTEM AND DO NOT TAMPER WITH, BYPASS OR DISCONNECT THE DETECTOR CIRCUITRY OR A POTENTIALLY DANGEROUS ELECTRICAL HAZARD COULD RESULT.

When patching the refractor lining in the furnace or relining the furnace, MAKE **ABSOLUTELY SURE THE LEAKAGE DETECTOR PROBES ARE NOT COVERED OVER BY REFRACTORY MATERIAL**. This will cause the current leakage detector to be inoperative. In the event molten metal contacts the coil when this circuitry is inoperative, **A DANGER OF ELECTROCUTION OR FURNACE EXPLOSION COULD EXIST.**

EMERGENCY PROCEDURES

Personnel should be familiar with emergency furnace tilting procedures and procedures for connection of emergency cooling water in the event of power failure.

Procedures should be prepared for the event of refractory failure and metal run through. Such procedures should include:

1. Removal of cooling water (or application of emergency cooling water).
2. Disconnection of electrical power.
3. Fire fighting techniques and materials.
4. Melt area evacuation.

CHAPTER 5 MAINTENANCE

FURNACE BOX

On a periodic basis, side covers should be removed and an inspection of the furnace box done.

Cast refractory top and bottom should be replaced if cracked.

Mica insulators should be inspected and cracked or missing insulators replaced.

FURNACE COIL AND CONNECTIONS

All furnace coil and connections, water hoses and hose clamps should be inspected, tightened and/or replaced as required.

Termination blocks and insulators must be kept clean and dry.

Coil supports should be inspected for cracks and carbon build-up from heat or electrical arc.

Pin hole leaks or dents in the coil may be repaired by filling with a high silver content solder (see Appendix). Low temperature solder should not be used at any time, because it will preclude the use of silver solder. Electrical varnish should be used to insulate any areas repaired.

Parker fittings are soft soldered into the termination blocks and care must be taken not to overheat the area if one is to be replaced.

HYDRAULIC COMPONENTS (OPTIONAL)

For hydraulic tilting furnaces, parts that are subject to wear are the rod seals on the cylinders and the “O” rings in the tilt control valve. Periodic inspection and immediate maintenance of leaks will again prevent most emergency situations from arising.

Care should be taken to prevent abrasive foundry dirt from accumulating around the rod of hydraulic cylinders by maintaining the integrity of the cylinder boot.

A complete separate parts list and instructions are included with any furnaces that have hydraulic power supplies.

HYDRAULIC FLUIDS

All Pillar Induction equipment using hydraulic components is designed with standard Buna-N seals for use only with water glycol fire resistant fluids. There are a number of manufacturers of this type of fluid and it is readily available in most parts of the world. It is also available through Pillar Induction as a part of the initial equipment or as a replacement item.

Following is a partial list of manufacturers of acceptable fluids:

MANUFACTURER	PRODUCT	VISC. @ 100° F.
E.F. Houghton	Houghtosafe 620	200 SUS
Union Carbide	Ucon Hydrolube 200 CP	200 SUS
Citgo	FR20XD	190 – 210 SUS

It is important to maintain proper water content in the fluid so that the fire resistant properties are not affected and to ensure a balanced viscosity. The liquid level should be checked in the reservoir periodically and distilled water only added when necessary. Do not add new whole fluid, as that will increase viscosity since the fluid loss is due to evaporation under normal conditions. Whole fluid should, of course, be added if a leak has reduced the liquid level. The return line filters are cartridge-type, which should be inspected periodically and replaced when necessary. Some larger models have an indicator associated with the filter to show condition.

Refer to separate hydraulic power supply manual for complete parts list and maintenance schedule.

WATER COOLED LEADS

The two things that are most harmful to the leads are dirty water and no water. Most often the dirty water leads to total blockage in very short order.

The instruction book for the Pillar Induction Power Supply contains a chapter on water conditions and recommended purity. Please refer to this section and adherence to these specifications will assure you of water quality that will give maximum service life to the leads as well as to the other components.

Periodic inspection again is recommended, specifically by monitoring drain water flow and temperature. A rise in temperature accompanied by a reduction in flow in any furnace circuit is USUALLY an indication of gradual clogging of a water-cooled lead. If this condition is detected during a melt, you can usually finish the melt (if the water hasn't turned to steam) and take care of the blockage before restarting.

The best procedure to follow to try clearing a blockage is:

1. In closed systems, separate return line at cabinet. In open systems, this is not necessary.
2. Blow air through the line in the reverse direction.
3. Flush with water in the reverse direction.
4. Reconnect and check flow.
5. Repeat if necessary.

If all these attempts do not clear the blockage and visual inspection shows evidence of solids build-up then you may want to try a mild solution of HCE or Muriatic Acid flushed through for a period of time as required to clear the passages.

NOTE: After using such acids, make sure proper water flushing is done. Otherwise, unit will react improperly.

It is also worth noting that because of the electrical field surrounding the leads, care should be taken not to let them come in contact or close proximity to

magnetic steel or iron since some power may be induced into that member. The resultant heat that is generated could easily burn through the protective covering and cause a failure. This is particularly true at higher frequency/high power levels.

Pillar Induction recommends in any case that the customer consider keeping a spare set of leads on hand and replacing, as they are needed.

APPENDIX

TABLE OF TYPICAL MATERIALS

Part	**Material / Manufacturer**
Copper Parts	Alloy 102 oxygen free high conductivity 101% IACS.
Grout	Allied Mineral Products Company – A23 Didier Taylor Refractories Corp. 414FW United Refractories Corp. Unicast 95 Fine. A.P. Green Refractories Company - Greencast – 94
Shear Plane	Carborundum Company. Fiberfrax 970-J Paper Carborundum Company. Fiberweave 1000 Cloth A.P. Green Refractories Co. Inspaper
Silver Solder	Eutectic Corporation – Eutecrod 1810 (Flowtectic 1100 Flux) J.W. Harris Company – Stay Silv 30
Coil Supports	Kiln dried rock maple or other hardwood

SUGGESTED READING

1. American Foundrymen's Society publications.

A. Principles of Induction Melting TE7705

B. Lining Procedures for Coreless Induction Furnaces CR7901

C. Manual on Refractories for Coreless Induction Furnaces in Iron Foundries OS8002

D. Melting Procedures for Coreless Furnaces CR8003

E. Representative Startup, Meltdown & Sintering Procedures for CIF CR7605

2. Allied Mineral Products, Inc.

A. Manual for Installing, Drying & Sintering Monolithic Lined Coreless Furnaces with Meltdown and Reusable Forms.

3. Norton Refractories Division

A. Ramming Procedures for Wet and Dry Refractory Cements.

4. Didier Taylor Refractories Corporation

A. CIB 78-16 Installation, Sintering & Maint. of Wet Ramming Mixes in Induction Furnaces.

B. CIB 78-17 Installation, Sintering & Maint. of Dry Ramming Mixes in Induction Furnaces.

5. Allied Mineral Products, Inc.

A. Manual for Installing, Drying & Sintering Monolithic Lined Coreless Furnaces with Meltdown and Reusable Forms.

6. Norton Refractories Division

A. Ramming Procedures for Wet and Dry Refractory Cements.

7. Didier Taylor Refractories Corporation

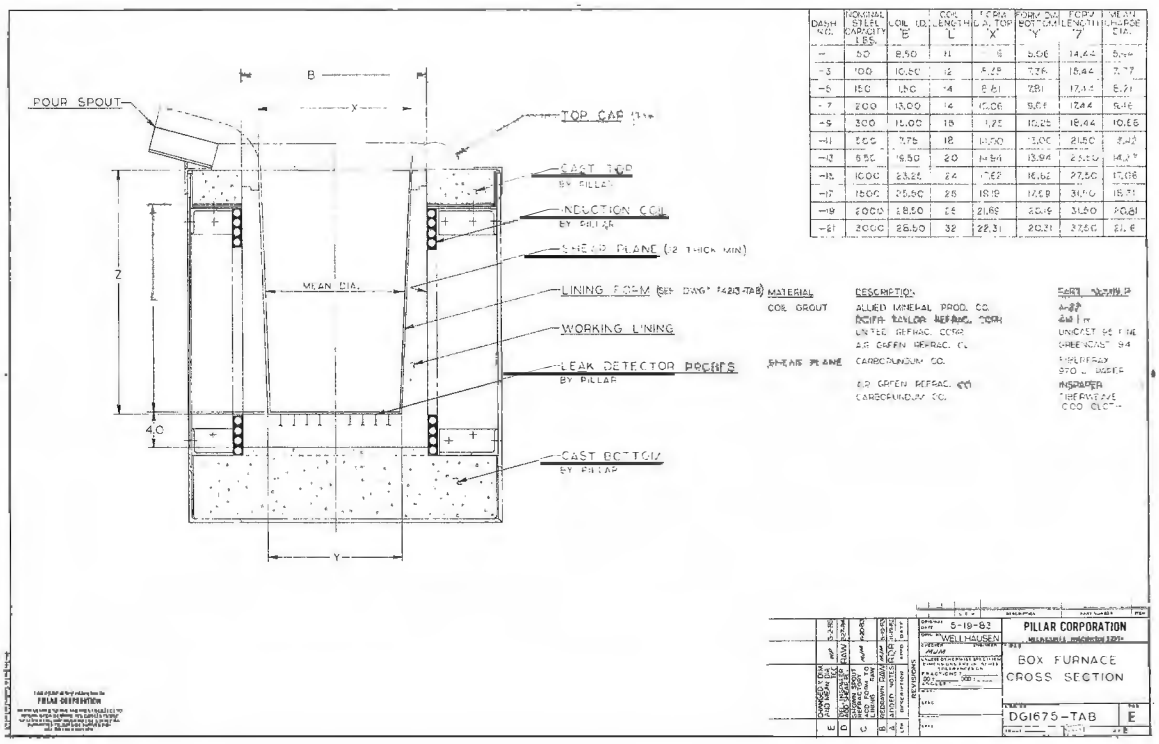
A. CIB 78-16 Installation, Sintering & Maint. of Wet Ramming Mixes in Induction Furnaces.

B. CIB 78-17 Installation, Sintering & Maint. of Dry Ramming Mixes in Induction Furnaces.

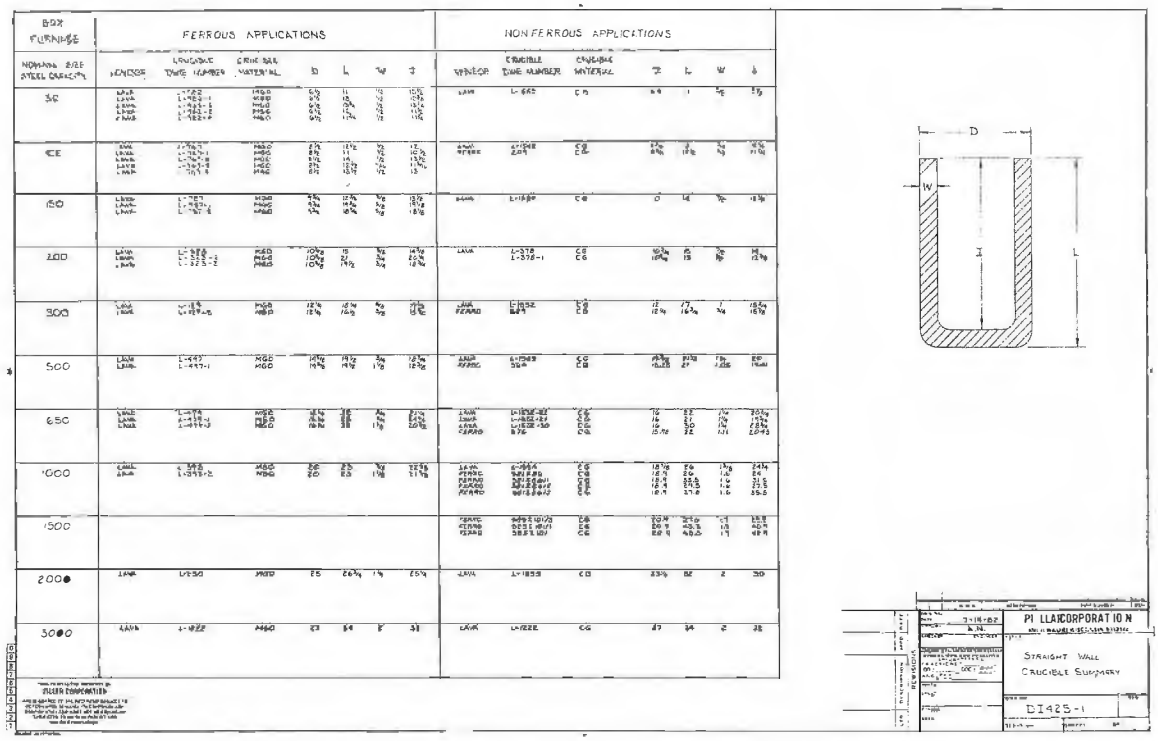
COLOR SCALE FOR TEMPERATURE

Color	°C.	°F.
Lowest Visable Red	475	885
To Dark Red	475 – 650	885 – 1200
To Cherry Red	650 – 750	1200 – 1300
To Bright Cherry Red	750 – 815	1380 – 1500
To Orange	815 – 900	1500 – 1650
To Yellow	900 – 1090	1650 – 2000
To Light Yellow	1090 – 1315	2000 – 2400
To White	1315 – 1540	2400 – 2800
To Dazzling White	1540 and Up	2800 and Up

Eyeballing is extremely inaccurate for high temperature estimation. Immersion type pyrometer is recommended.



DASH NO.	NOMINAL STEEL CAPACITY LBS.	COIL I.D. 'B'	COIL LENGTH 'L'	FORM DIA. TOP 'X'	FORM DIA BOTTOM 'Y'	FORM LENGTH 'Z'	MEAN CHARGE DIA.
-2	50	8.50	11	6.06	5.06	14.44	5.44
-4	100	10.50	12	8.38	7.38	15.44	7.77
-5	150	11.50	14	8.81	7.81	17.44	8.21
-7	200	13.00	14	10.06	9.06	17.44	9.46
-9	300	15.00	15	11.75	10.25	18.44	10.66
-11	500	17.75	18	14.00	13.00	21.50	13.47
-13	650	19.50	20	14.94	13.94	23.50	14.37
-15	1000	23.25	24	17.62	16.62	27.50	17.06
-17	1500	25.50	25	18.19	17.69	31.50	18.31
-19	2000	28.50	26	21.69	20.19	31.50	20.81
-21	3000	28.50	32	22.31	20.31	37.50	21.16


BOX FURNACE
FERROUS APPLICATIONS
NON FERROUS APPLICATIONS
NOMINAL SIZE STEEL CAPACITY
VENDOR
CRUCIBLE TIME NUMBER
CRUCIBLE MATERIAL
D
W
I
L
PI LLAR CORPORATION
STRAIGHT WALL CRUCIBLE SUMMARY
DI425-1

Taken from DI425-1 Straight Wall Crucible Summary

Box Furnace	FERROUS APPLICATIONS						
Nominal Size Steel Capacity	Vendor	Crucible Dwg. #	Crucible Material	D	L	W	I
50	LAVA	L-982	MGO	6.5	11	0.5	10.50
	LAVA	L-982-1	MGO	6.5	13	0.5	12.375
	LAVA	L-982-2	MGO	6.5	13.75	0.5	13.25
	LAVA	L-982-3	MGO	6.5	12	0.5	11.50
	LAVA	L-982-4	MGO	6.5	11.75	0.5	11.25
100	LAVA	L-767	MGO	8.5	12.5	0.5	12
	LAVA	L-767-1	MGO	8.5	11	0.5	10.5
	LAVA	L-767-2	MGO	8.5	14	0.5	13.5
	LAVA	L-767-3	MGO	8.5	12.5	.6875	11.3125
	LAVA	L-767-4	MGO	8.5	13.5	0.5	13
150	LAVA	L-757	MGO	9.75	13.75	.625	13.125
	LAVA	L-757-1	MGO	9.75	19.75	.625	19.125
	LAVA	L-757-2	MGO	9.75	18.75	.625	18.125
200	LAVA	L-323	MGO	10.625	15	.625	14.375
	LAVA	L-323-2	MGO	10.625	21	.75	20.25
	LAVA	L-323-3	MGO	10.625	19.5	.75	18.75
300	LAVA	L-129	MGO	12.25	18.25	.625	17.625
	LAVA	L-129-5	MGO	12.25	16.5	.625	15.875
500	LAVA	L-497	MGO	14.625	19.5	.75	18.75
	LAVA	L-497-1	MGO	14.625	19.5	1.125	18.375
650	LAVA	L-479	MGO	16.25	22	.75	21.25
	LAVA	L-479-1	MGO	16.25	25	.75	24.25
	LAVA	L-479-2	MGO	16.25	22	1.125	20.875
1000	LAVA	L-395	MGO	20	23	.875	22.125
	LAVA	L-395-2	MGO	20	23	1.125	21.875
2000	LAVA	L-250	MGO	25	26.75	1.25	25.25
3000	LAVA	L-1222	MGO	27	34	2	32

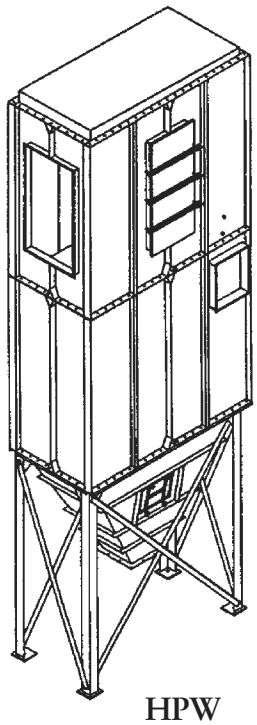
Taken from DI425-1 Straight Wall Crucible Summary

Box Furnace	NONFERROUS APPLICATIONS						
Nominal Size Steel Capacity	Vendor	Crucible Dwg. #	Crucible Material	D	L	W	I
50	LAVA	L-1583	CG	6.5	11	.625	5.875
100	LAVA	L-1548	CG	8.625	13	.75	12.25
	FERRO	509	CG	8.625	12.5	.625	11.75
150	LAVA	L-1584	CG	10	14	.875	13.125
200	LAVA	L-378	CG	10.75	15	.875	14
	LAVA	L-378-1	CG	10.75	15	.875	13.875
300	LAVA	L-1552	CG	12	17	1	15.75
	FERRO	529	CG	12.25	16.75	.75	15.875
500	LAVA	L-1585	CG	15.375	21.5	1.25	20
	FERRO	564	CG	15.23	21	1.05	19.41
650	LAVA	L-1532-22	CG	16	22	1.25	20.75
	LAVA	L-1532-21	CG	16	21	1.25	19.75
	LAVA	L-1532-30	CG	16	30	1.25	28.75
	FERRO	576	CG	15.98	22	1.11	20.43
1000	LAVA	L-1554	CG	18.875	26	1.375	24.25
	FERRO	581Z86	CG	18.9	26	1.6	24
	FERRO	581Z86/1	CG	18.9	33.5	1.6	31.5
	FERRO	581Z86/2	CG	18.9	29.5	1.6	27.5
	FERRO	581Z86/3	CG	18.9	37.8	1.6	35.8
1500	FERRO	585Z101/2	CG	20.9	27.6	1.7	25.2
	FERRO	585Z101/1	CG	20.9	43.3	1.7	40.9
	FERRO	585Z101	CG	20.9	45.3	1.7	42.9
2000	LAVA	L-1555	CG	23.25	32	2	30
3000	LAVA	L-1222	CG	27	34	2	32

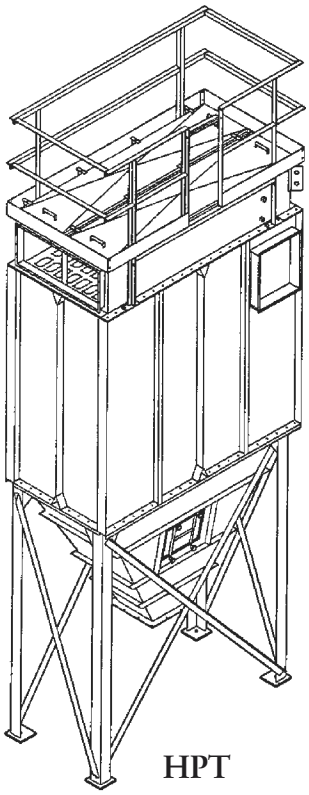
Pillar Induction
21905 Gateway Road
Brookfield, WI 53045
262-317-5300

Torit® Installation and Operation Manual

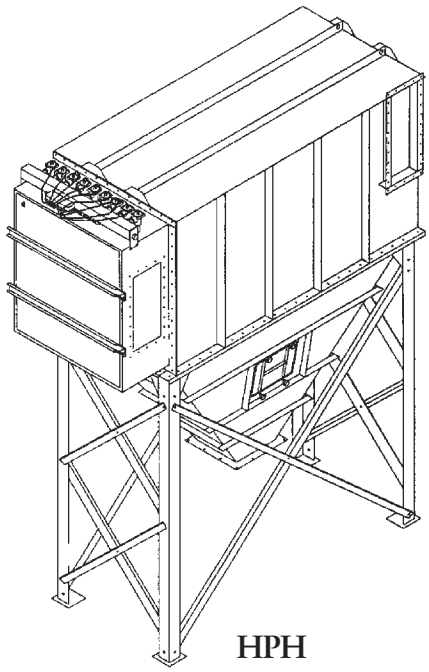
Torit Dust Collector
Models HPW, HPT, and HPH
Includes Installation, Operation, and Service Instructions



HPW



HPT



HPH

IMPORTANT

This manual contains specific precautionary statements relative to worker safety in appropriate sections. Read this manual thoroughly and comply as directed. It is impossible to list all of the potential hazards of dust control equipment or systems. It is imperative that use of the equipment be discussed with a Torit representative. Personnel involved with the equipment or systems should be instructed to conduct themselves in a safe manner.

IOM-29349-00
Revision 5

NOTE

Statements indicate precautions necessary to avoid potential equipment failure.

CAUTION

Statements indicate potential safety hazards.

CAUTION

APPLICATION OF DUST CONTROL EQUIPMENT:

- **Special care must be exercised in the use of dust collection equipment when combustible material, such as buffing lint, paper, wood dust, aluminum, or magnesium dust are present. These materials may present a fire or explosion hazard. A prudent user of Torit equipment should consult and must comply with all National and Local Fire Codes and/ or other appropriate codes when determining the location and operation of dust collection equipment.**

- **Under no conditions should anyone, including the machine operator, allow burning objects or lit cigarettes to enter the hood or ducting of any dust control system.**

- **Avoid mixing combustible materials with dust generated from grinding of ferrous metals due to the potential fire hazard caused by sparks being pulled into the dust collection equipment.**

- **When collection equipment is used to collect flammable or explosive dusts, as a minimum, the dust collection equipment should be located outside the building. Also, an installer of fire extinguishing equipment, familiar with the type of fire hazard and local fire codes, should be consulted for recommendations and installation of the proper fire extinguishing equipment. Torit equipment does NOT contain fire extinguishing equipment.**

- **Explosion relief vents are required on some applications. Consult with an insurance underwriter or a NFPA Manual to determine proper vent sizing requirements. Vents installed on dust collection equipment must relieve to the outside of the building to minimize chances of a secondary explosion. Consult the proper authority to determine proper method of venting the dust collection equipment. Torit equipment does NOT contain explosion relief vents, except on special order.**

- **To insure optimum collector performance, always use Torit-Built® replacement filters.**

ATTENTION

Portions of your Torit baghouse, including the clean and dirty chambers of the baghouse, may be considered "OSHA Permit Required Confined Spaces." OSHA Regulations, found in the Code of Federal Regulations, 29 CFR Section 1910.146 control the entry of "confined spaces." Please refer to this regulation to determine if your use of the baghouse requires a permit program.

Methods of determining "acceptable entry conditions" vary depending upon the application and the type of dust collected. In some cases, a visual inspection of airborne dust in the baghouse may be sufficient. In other cases, chemical tests may be necessary to insure safe entry and occupancy.

Torit recommends that employers follow safe work practices during installation and use of all dust collection equipment. This includes following applicable OSHA regulations and any other applicable local, state, or federal laws. Copies of OSHA Regulations can be obtained from your local OSHA office or:

Superintendent of Documents
US Government Printing Office
Washington D.C. 20402 Phone: (202) 783-3238

As always, if you have any questions about your Torit dust collector, do not hesitate to contact your local sales representative or the Torit headquarters office.

Table of Contents

	Notes and Cautions	2
	Data Sheet	3
1.0	Introduction	5
1.1	Operational Explanation	5
1.1.1	Normal Operation	5
1.1.2	Filter Cleaning	6
2.0	Installation	6
2.1	Inspection	6
2.2	Ship Loose Items	6
2.3	Equipment/Tools Required	7
2.4	Preinstallation	7
2.5	Assembly of Standard Equipment	8
2.5.1	General Safety Precautions	8
2.5.2	Erection (Major Collector Components)	9
2.5.3	Filter Tube Installation	11
2.6	Assembly of Optional Equipment	13
2.6.1	55-Gallon Drum Cover Pack With or Without Slide Gate	13
2.6.2	Transition Pack	14
2.6.3	Transition and Airlock	15
2.6.4	Magnehelic®* Gage	16
2.6.5	Photohelic®* Gage	17
2.6.6	Level Indicator	19
2.6.7	Platform and Handrails	19
2.6.8	Ladder/Cage	20
2.6.9	Light Pack (HPW Only)	20
2.6.10	Blower Fan Mounting Instructions	21
2.6.11	Damper Pack	23
2.7	Electrical Installation	23
2.7.1	Electrical Operation	24
2.7.2	Solid-State Control Timer Specifications	24
2.8	Installation—Compressed Air Supply	26
3.0	Prestart-Up Check	27
4.0	Start-Up	27
5.0	Routine Maintenance	27
5.1	Operating Checks	28
6.0	Service	28
6.1	Dust Removal	29
6.2	Compressed Air Components	29
7.0	Troubleshooting Guide	30
	Parts Ordering Information	36
	Warranty	36

Figures

Figure 1	- Typical Installation View	4
Figure 2	- Operational Schematic	5
Figure 3	- Hopper Joint and Leg Attachment	10
Figure 4	- Leg Bracing	10
Figure 5	- Sealing Details	11
Figure 6	- Filter Tube Installation	12
Figure 7	- Hose Drum Cover Pack with Gate	13
Figure 8	- Hose Drum Cover Pack without Gate	14
Figure 9	- Transition Pack, Transition, and Airlock	15
Figure 10	- Installation of Magnehelic Gage	16
Figure 11	- Installation of Photohelic Gage	17
Figure 12	- Photohelic Gage Wiring Diagram	18
Figure 13	- Weatherproof NEMA 4 Enclosure	18
Figure 14	- Blower Transition Assembly	22
Figure 15	- Damper Assembly	23
Figure 16	- Solid-State Control Timer Wiring Diagram	24
Figure 17	- Compressed Air Manifold	26

* Photohelic and Magnehelic are registered trademarks of Dwyer® Instruments, Inc.

Torit is the leading designer and manufacturer of air filtration systems for the control of industrial air pollution. Its systems are designed to help reduce occupational hazards, lengthen machine life, reduce in-plant maintenance requirements, and improve product quality.

Data Sheet

Customer Name _____

Address _____

_____

Shipping Date _____ **Installation Date** _____

Model Number _____ **Serial Number** _____

Filter Medium _____

Accessories _____

Other _____

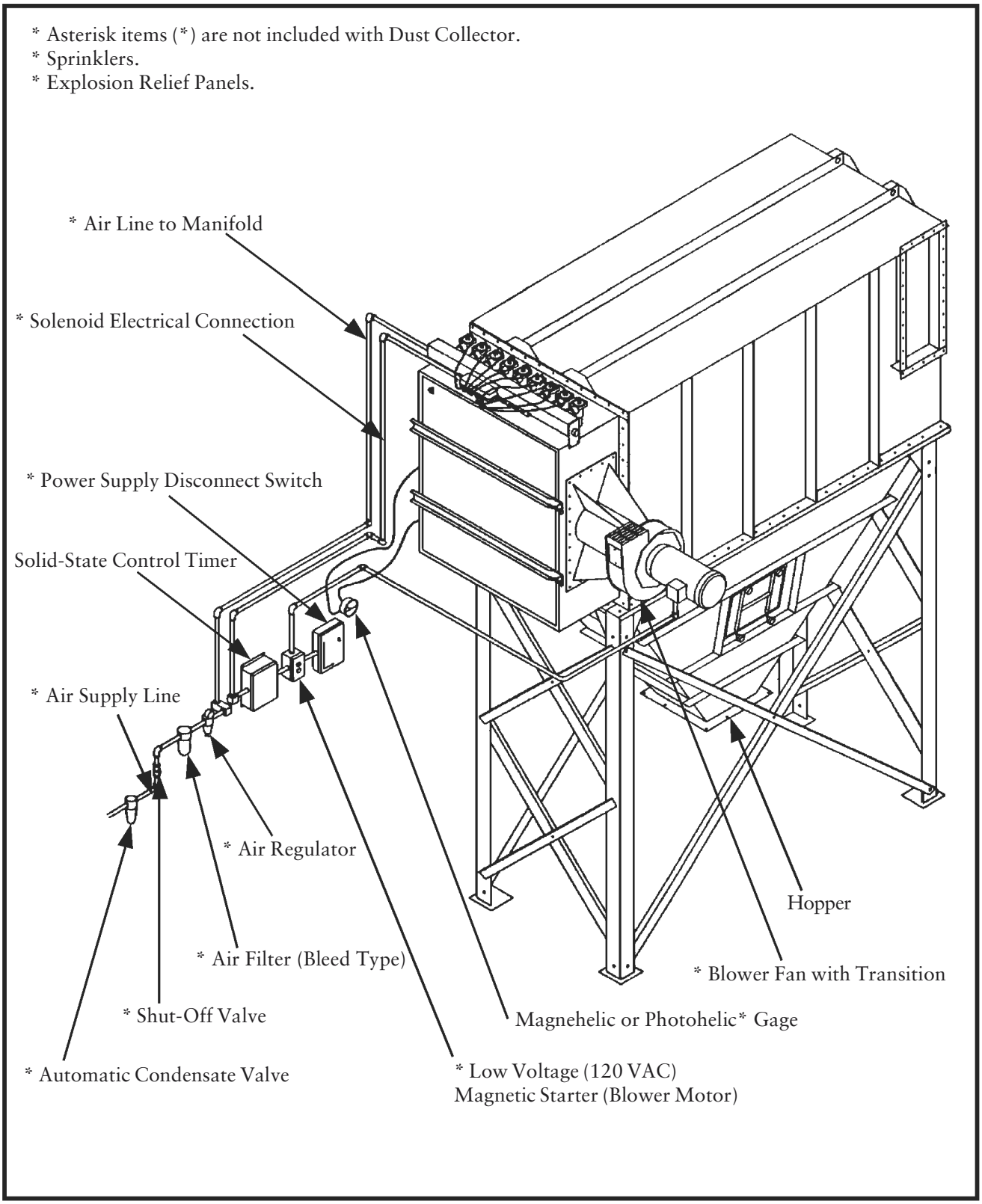


Figure 1
Typical Installation View (HPH Shown)

1.0 Introduction

The Torit HPH, HPT, and HPW are used for the collection of airborne dust and particulate. As part of a manufacturing process, the HP collector series provides highly efficient, continuous, on-line dust collection.

Standard HP models are available in sizes ranging from 36 to 320 filter tubes. Other sizes are available as specials. The standard filter length is 8 feet. The HPH is a low profile horizontal filter removal collector; the HPT is a vertical filter removal collector; and the HPW is a vertical filter removal collector with a walk-in top section.

If, after reading this manual, you have further questions or are in need of technical or field support, contact your local Torit representative.

1.1 Operational Explanation

1.1.1 Normal Operation (See Figure 2)

During normal operation, dust-laden air enters the HP inlet section next to the filter tubes. The airflow must turn 90° to pass through the filter tube section. The energy loss from turning and the reduced velocity in the inlet section causes the heavier dust particles to drop directly into the hopper below. A standard inlet baffle helps evenly distribute the dust-laden air around the filter tubes. The dust is collected on the outside surface of each filter tube where it forms a cake that aids in filtering efficiency. Filtered (clean) air passes through each filter tube into the clean air plenum where it is discharged through the clean air outlet.

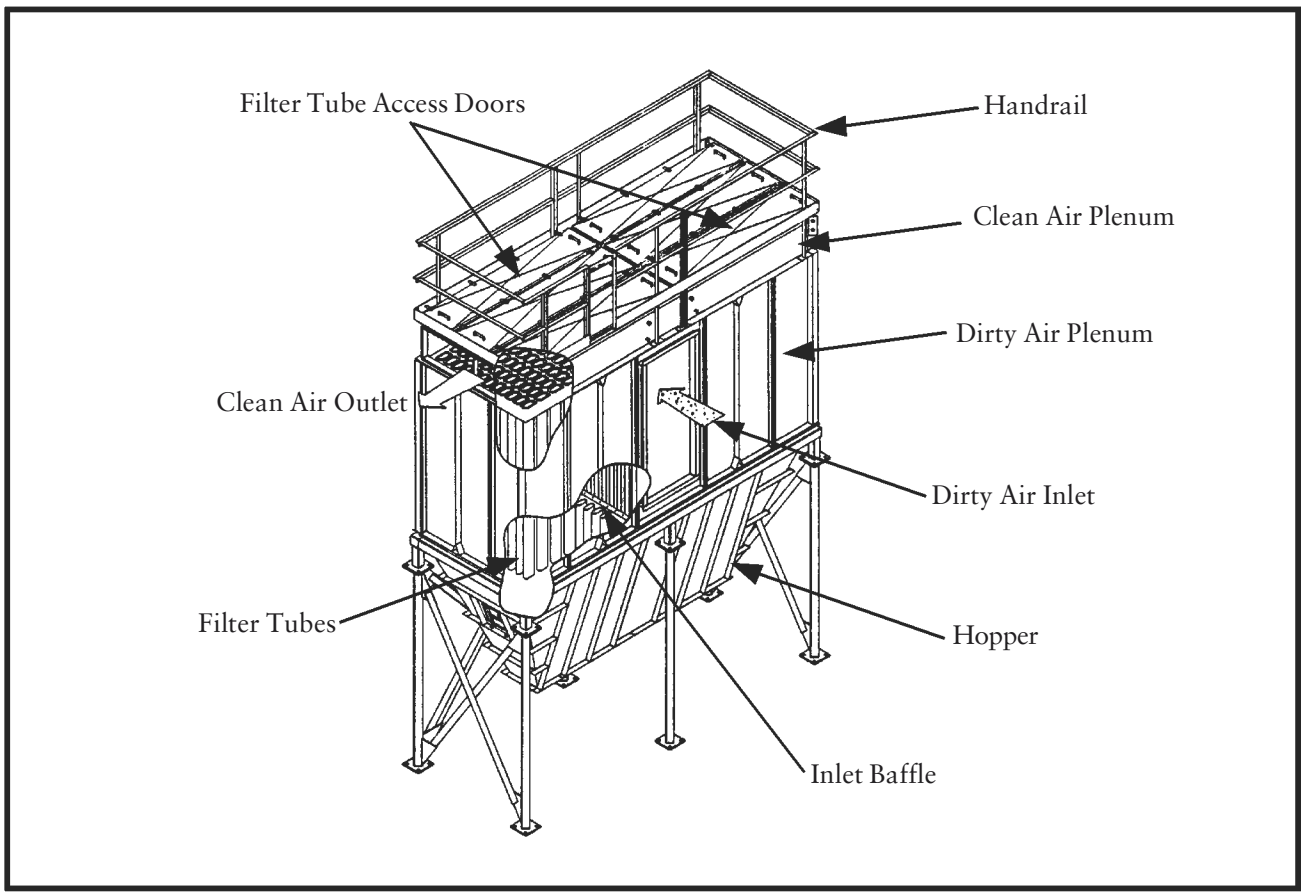


Figure 2
Operational Schematic (HPT Shown)

1.1.2 Filter Cleaning

Filter tubes are cleaned automatically and sequentially. Only one row of filter tubes is cleaned per pulse. During the filter tube cleaning purge, the solid-state timer energizes a solenoid valve. This action causes the corresponding diaphragm valve to send a pulse of compressed air out into the blowpipe. The blowpipe is equipped with two high pressure nozzles centered over each oval shaped filter tube. The high pressure pulse enters the inside of the filter tube forcing air through the filter. The collected contaminants are blown away from the outside surface of the filters. The dust falls into the hopper where it is discharged into drums, screw conveyor, or rotary valve.

2.0 Installation

2.1 Inspection

The collector is normally shipped with major components preassembled when possible. However, due to space restrictions and/or to minimize freight costs, some components may be shipped unassembled and nested. On most HPW/T models, the clean air plenum, dirty air plenum, and hopper/support weldment are unassembled.

On most HPH models, the clean air plenum is assembled to the dirty air plenum and the hopper and support are unassembled. Also, the blowpipes are unassembled to facilitate filter tube installation. In most cases, the filter tubes and frames are shipped separate (unassembled) for all models.

A packing list is enclosed with each dust collector. If there are any questions about completeness of a shipment or obvious damage to packaged parts, notify the carrier immediately. Also, damage to any section of the shipment should be noted on the carrier's Bill of Lading.

A crane is recommended for unloading, assembly, and installation of the dust collector. Before unloading major components, such as housing and hopper, check inside for smaller items that could be damaged if not removed first. Unload components in a location that allows for parts identification and assembly. The filter tubes should be stored in a dry, rodent-proof area until ready for installation.

2.2 Ship Loose Items

Items shipped loose with the HP dust collector may include:

- Hopper
- Legs and Cross Bracing
- 55-Gallon Drum Cover Pack
- Transition Pack
- Magnehelic Gage or Photohelic Gage
- Control Box
- Hardware/Sealant
- Explosion Vent
- Weather Cover
- Platforms
- Ladders
- Ladder Cages
- Air Locks
- Tubesheet
- Filter Tubes
- Filter Cages
- Blowpipes (HPH only)

2.3 Equipment/Tools Required

The following is a list of typical tools and equipment required to install and assemble an HP dust collector:

- Crane/Lift Truck
- Slings/Spreader Bars/Clevice Pins
- Drift Pins
- Clamps
- Screwdrivers
- Pipe Wrenches
- Socket Wrenches
- End Wrenches
- Large Crescent Wrench
- Drill and Drill Bits
- Pipe Sealant
- Extension Cords
- Trouble Light

NOTE

Wearing safety equipment such as helmets and glasses is recommended for all persons while working in or around the collector.

CAUTION

Use appropriate lifting equipment and adopt all the safety precautions needed for moving and handling the equipment.

2.4 Preinstallation (See Figure 1)

The HP dust collector is usually mounted on a reinforced concrete foundation. However, roof mounting is also possible. When calculating for foundation or roof mounting, the weight of both the dust collector, the material being collected, and all auxiliary equipment must be considered together with wind, seismic and other live loads. See the Specification Control Drawing for the dust collector weight.

CAUTION

- **Location must be clear of all obstructions such as utility lines or roof overhang (see Specification Control Drawing).**
- **A crane must be used to move the collector into position.**

To avoid delay, install foundation in the proper location. Pay particular attention to the anchor bolt location. Anchor bolts must extend at least 1-3/4" above foundation. The collector should be located with consideration for emptying hopper storage area, shortest runs of inlet and outlet ductwork, electrical and compressed air connections, and convenience of maintenance. In case of hazardous dust collection, consult with local authorities for the proper location of the dust collector.

2.5 Assembly of Standard Equipment (See Figure 1)

CAUTION

- **A crane is recommended for the unloading, assembly, and installation of the dust collector.**
- **Connect lifting sling to a minimum of 4 lifting lugs. Distribute loads equally. Use clevices, not hooks, on lifting sling. Use spreader bars on lifting sling.**

Remove all crating and strapping from the unit. Remove all miscellaneous parts (bolts, nuts, etc.) before lifting unit off of the truck. Check the parts received against the packing slips. If there are parts missing, the carrier and your local Torit Representative should be notified immediately.

NOTE

Each item to be attached to your collector is accompanied by a drawing that shows the attachment process. Refer to both the drawing and this manual when erecting your collector.

2.5.1 General Safety Precautions

1. Be certain that the crane has sufficient capacity to lift sections, sub-assemblies and complete units, if that applies. Check weights and dimensions of dust collector components on specification drawings furnished by Torit. Spreader bars are recommended between lifting cables; shallow cable angles should be avoided.
2. No person shall operate the crane or other erection equipment except those qualified by training and experience.
3. Do not install during gusty or heavy winds.
4. Note location of adjacent structures, power lines, traffic, unstable ground, and ground obstacles in the erection area.
5. Never swing loads over personnel.
6. Use conventional hand signals for crane operators.
7. Always consider electrical lines to be live (hot).
8. Provide an observer to assist crane operator for periods of impaired visibility.
9. Refer to applicable OSHA regulations and local rules in using cranes, forklifts, and other erection equipment.
10. Make liberal use of drift pins to align holes in section flanges during assembly.
11. Wear appropriate safety gear including hard hats and safety glasses.

2.5.2 Erection (Major Collector Components)

CAUTION

Do not disconnect crane until the lifted component is securely fastened in place.

The following general procedure is recommended for assembly:

NOTE

- **If the dust collector is shipped preassembled, including support legs, it may be lifted directly from the truck onto the foundation.**
- **If the dust collector is shipped unassembled, see Specification Control Drawing for correct orientation and location of components.**
- **All flanged connections of components providing air seals, including clean air plenum, tube section, and hopper, must be sealed before assembly with sealant as shown in Figure 5, Sealing Details unless they are factory assembled.**
- **Use spreader bars for lifting sections of collector.**
- **Use drift pins to align holes during erection.**
- **Filter tubes and cages can be installed before or after collector is erected.**

HPT/W Units Only - (Hopper & Legs)

1. The HPT/HPW hopper/leg arrangements come totally assembled.

2. Lift the hopper/leg assembly, using a crane, into position over the anchor bolts and lower down onto the anchor bolt pads. Fasten the legs to the anchor bolts with washers and nuts (provided by customer). Level the hopper at the top flange in all directions by placing solid steel shims under the leg pads. **Tighten** the nuts on the anchor bolts. Re-check level and adjust as required. Remove the crane from the hopper.

3. Apply 1/4" diameter sealant to the top flange all around toward the inside edge of the bolt pattern (see Figure 5, Sealing Details).

HPH Units Only - (Hopper & Legs)
(See Figures 3 and 4)

1. HPH units have unassembled leg sets. Locate and identify all legs, bracing, and hardware required for leg set. Organize the legs and bracing for assembly.

2. Lift the hopper using a crane and position over the four legs. Stand each leg up on its pad, one at a time, and position the hopper gusset holes to line up with the holes in the leg. Use a drift pin to assist in hole alignment. Fasten each leg using the proper bolts, washers, and nuts provided. **Do not tighten any hardware at this time. Do not disconnect the crane.**

3. Position the inside angle of the cross bracing and bolt in place using the proper bolts, washers, and nuts provided. **Do not tighten.** Position the outside angle of the cross bracing and bolt in position. Where the two angles cross, bolt through each hole with a bolt, washers, and nut. Repeat this sequence on the opposite side of the hopper. **Do not tighten hardware.**

4. Lift the hopper leg assembly into position over the anchor bolts and lower down onto the anchor bolt pads. Fasten the legs to the anchor bolts with washers and nuts (provided by customer). Level the hopper at the top flange in all directions by placing solid steel shims under the leg pads. **Tighten all hardware** on the gussets, cross bracing, and anchor bolts. Re-check level and adjust as required. Remove the crane from the hopper.

5. Apply 1/4" diameter sealant to the top flange all around toward the inside edge of the bolt pattern (see Figure 5, Sealing Details).

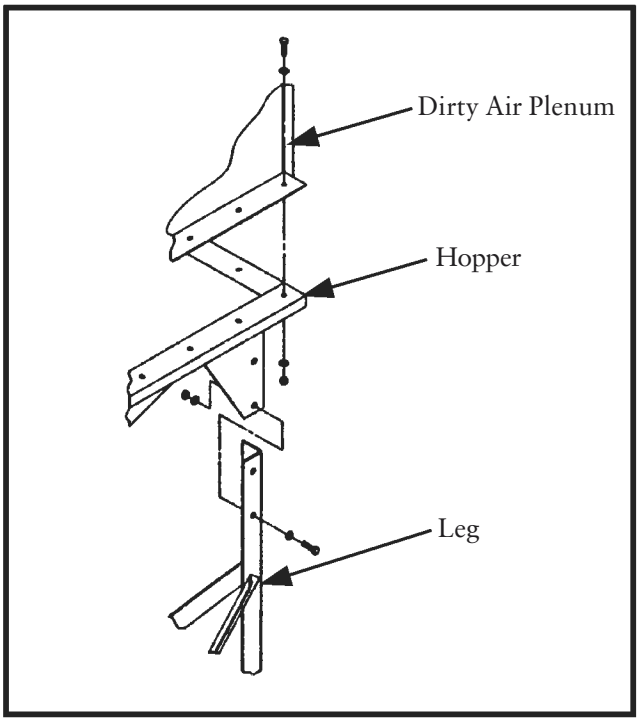


Figure 3
Hopper Joint and Leg Attachment
(HPH Only)

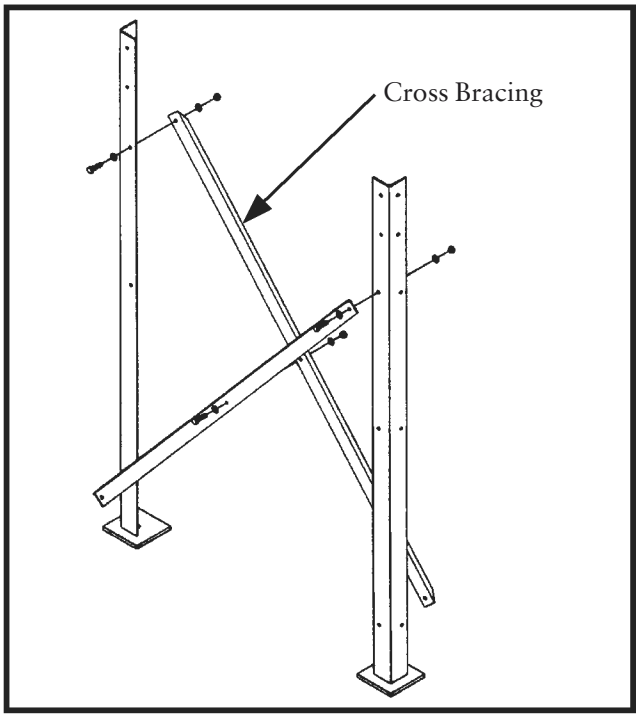


Figure 4
Leg Bracing
(HPH Only)

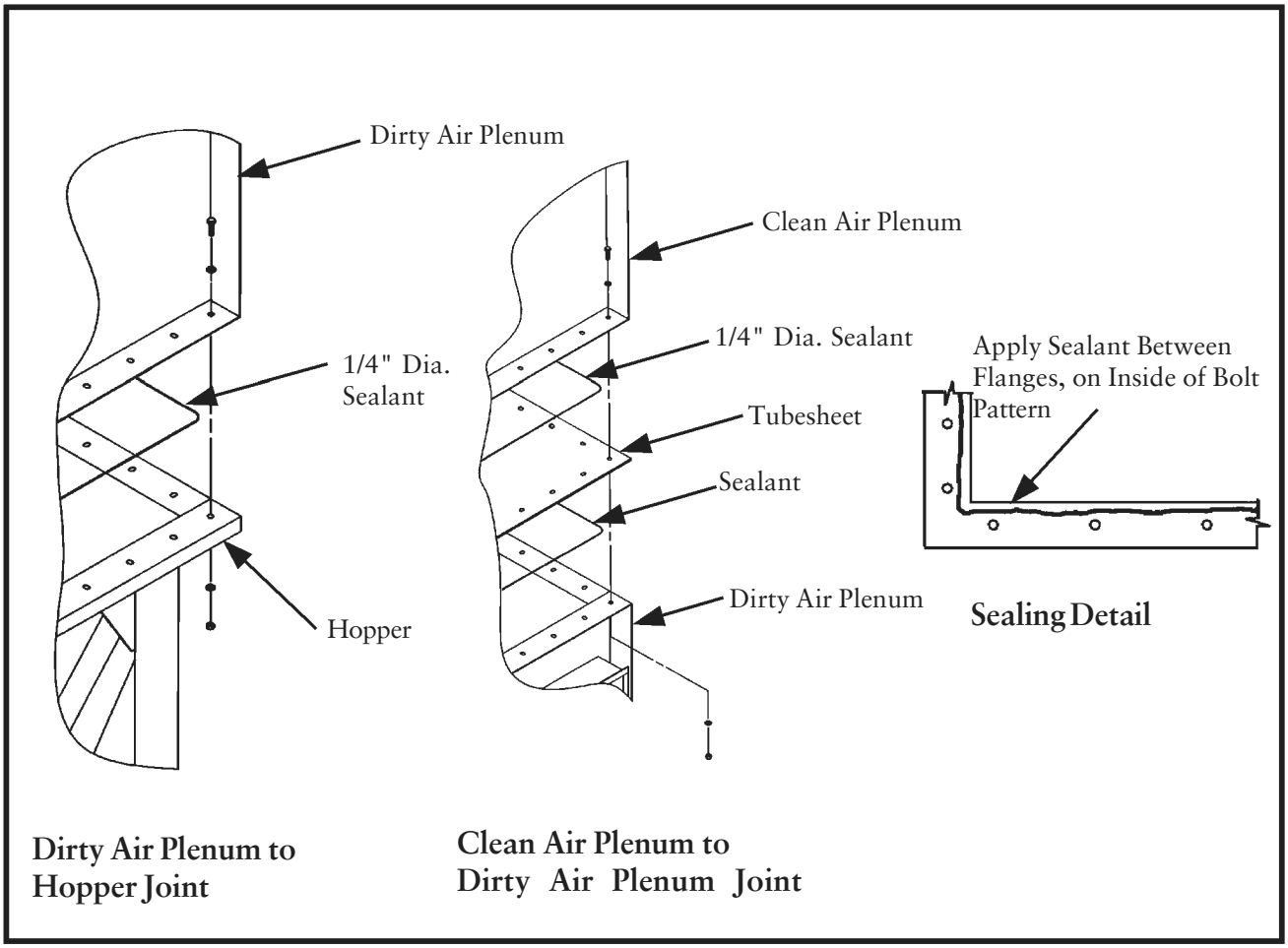


Figure 5
Sealing Details

2.5.3 Filter Tube Installation (See Figure 6)

Several filter medias are available to meet the filtration needs for many different types of dust. Contact your local Torit representative for assistance in choosing the correct media for your dust collection requirements.

The cages will arrive on site packaged in crates. The filters will arrive on site packaged in boxes. Choose a clean area for pre-assembly of the filters onto the cages.

Installing the filters before the filter section is raised will be easier and save time. Install the filter tubes as shown in Figure 6, Filter Tube Installation. Slip the filter tube over the filter tube frame until it touches the top flange of the frame. Slide this filter assembly through the tubesheet. Align the two bolts with the threaded inserts in the tubesheet. Secure each filter tube and frame assembly with the Boltsafe™ hardware provided.

NOTE

- **Use a speed wrench to tighten the screws. Do not use a power driver or impact nut driver. These may strip threads or shear screws.**
- **Only tighten screws until the top flange rests on the tubesheet, about 8-10 ft. lbs torque.**

HPH Cabinet Assembly

If a platform or handrail is going to be attached to the collector, refer to Section 2.6.7, Platform and Handrails before continuing.

1. Using a crane, lift the assembly into position over the hopper. Using drift pins, align the holes in the cabinet-hopper flanges and lower the cabinet onto the hopper.

2. Fasten the flanges together using the bolts, washers, and nuts provided. Tighten all hardware.

3. Remove the crane from the collector.

HPT/HPW Cabinet Assembly

If a platform or handrail is going to be attached to the collector, refer to Section 2.6.7, Platform and Handrails before continuing.

1. Lift the filter section from the truck and lower down to a cleared assembly area. Remove the crane. Remove the lifting lugs.

2. Remove the bolts, washers, and nuts that hold the tubesheet in place.

NOTE

- **HPT Model Only - In some instances it may be preferable to assemble the top railings to the clean air/dirty air plenum before hoisting it onto the hopper. If you choose to do so, take care not to damage the railings with the lifting sling or the spreader bars.**

- **When lowering the clean air plenum onto the filter section, be sure to locate the blowpipe air manifold over the blank end of the tubesheet.**

CAUTION

Do not use railings for lifting any part of the collector.

3. Apply 1/4" diameter sealant all around toward the inside edge of the bolt pattern on top of the tubesheet (see Figure 5, Sealing Details).

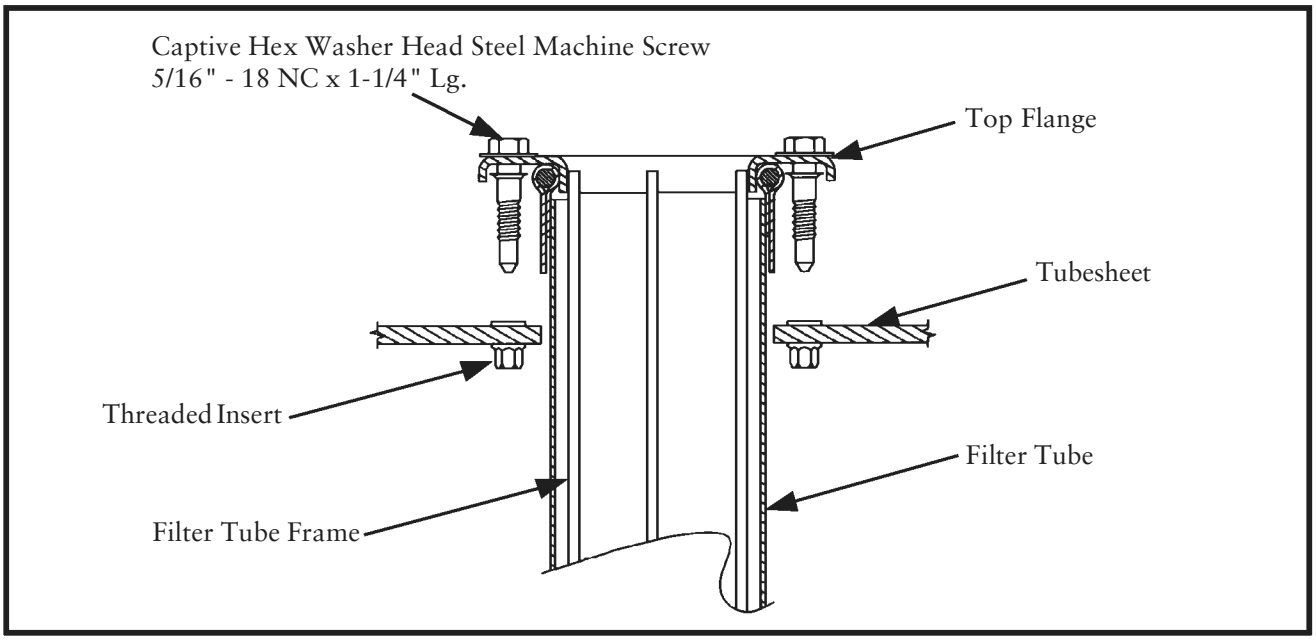


Figure 6
Filter Tube Installation

4. Using a crane, lift the clean air plenum into position over the filter section. Using drift pins, align the holes in the flanges of the filter and clean air sections and lower onto the filter section. Fasten the flanges together using the bolts, washers, and nuts provided. Tighten all hardware.

5. Lift the cabinet into position over the hopper. Using drift pins, align the holes in the cabinet-hopper flanges and lower the cabinet onto the hopper.

6. Fasten the flanges together using the bolts, washers, and nuts provided. Tighten all hardware.

7. Remove the crane from the collector.

2.6 Assembly of Optional Equipment

2.6.1 55-Gallon Drum Cover Pack With or Without Slide Gate (See Figures 7 and 8)

The 55-gallon drum attachments are designed to fit a 55-gallon drum that measures approximately 24" diameter x 33" tall. These drums are supplied by the customer. The flexible hose attachment allows for easy drum installation and removal. A pallet under the drum will allow heavier product to be removed by a lift truck. If a pallet is used, the length of hose or clearance under the unit may have to be modified by customer.

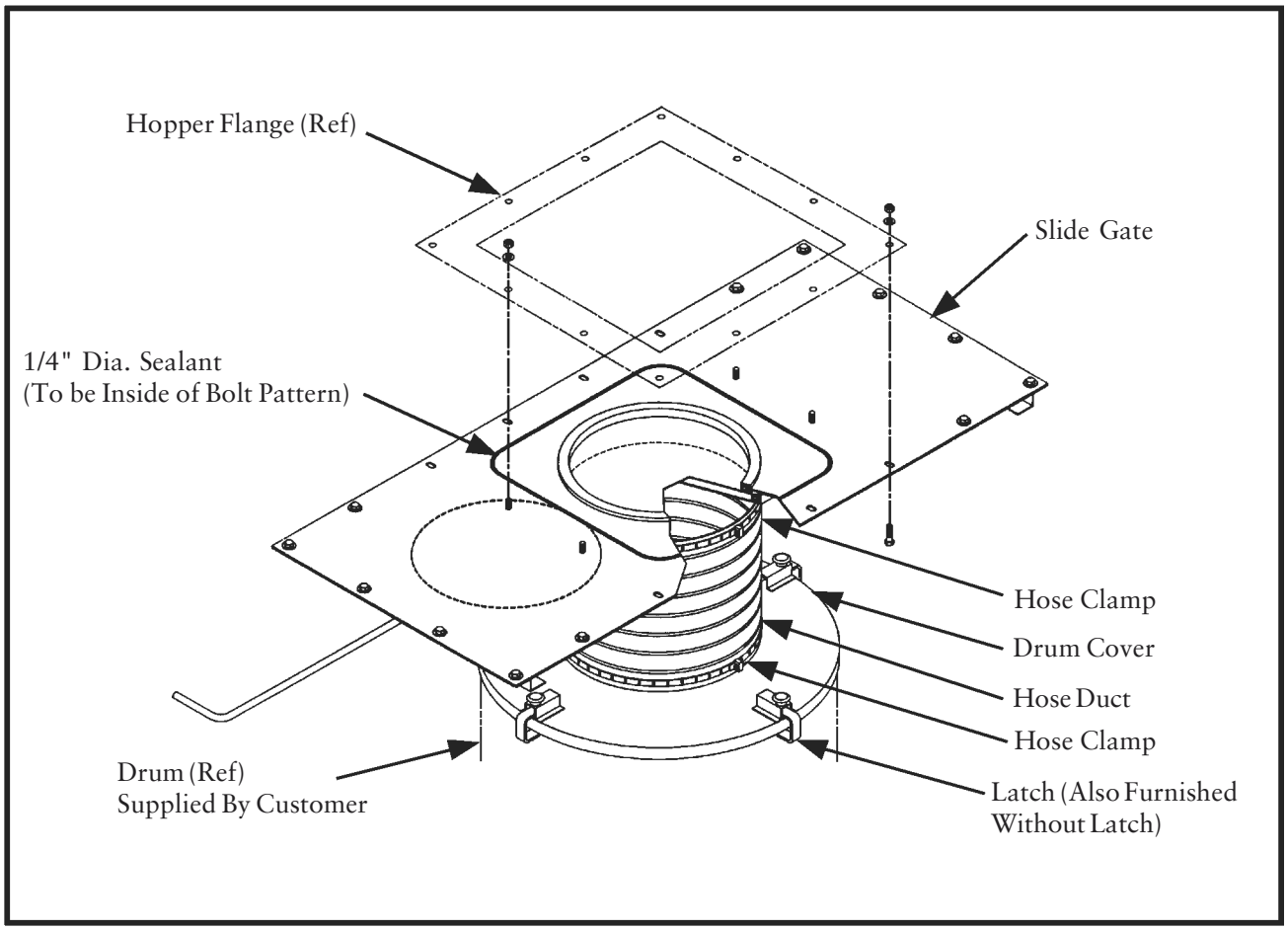


Figure 7
Hose Drum Cover Pack with Gate

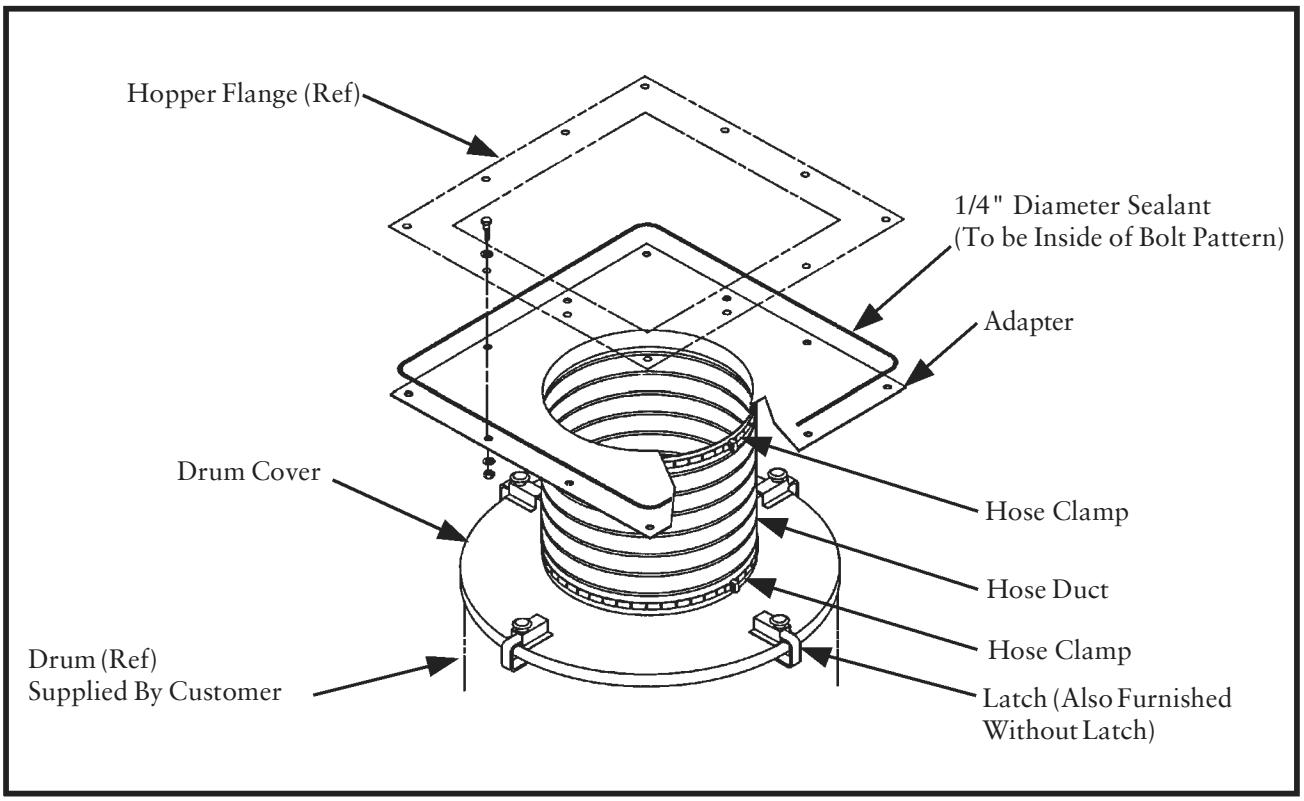


Figure 8
Hose Drum Cover Pack without Gate

1. Apply 1/4" diameter sealant between the hopper flange and the slide gate as shown in Figure 7, Hose Drum Cover Pack with Gate or between the hopper flange and the adapter as shown in Figure 8, Hose Drum Cover Pack without Gate.

2. Fasten the drum cover pack and slide gate to the hopper flange using 3/8" bolts, washers, and nuts as shown in Figure 7, Hose Drum Cover Pack with Gate. Fasten the adapter to hopper flange, as shown in Figure 8, Hose Drum Cover Pack without Gate, if the slide gate is not included.

3. Attach the drum cover to 55-gallon drum as shown in both illustrations. If the latches are included, use them to hold the cover to drum as shown.

2.6.2 Transition Pack (See Figure 9)

Do not use a transition pack on a single opening trough outlet hopper.

The transition is designed specifically as a connection between the bottom of the hopper and the AN valves built by Torit. There are four sizes available 18" to 8", 18" to 10", 18" to 12", and 18" to 16". These transitions are all 7" tall flange to flange.

1. Apply 1/4" diameter sealant between the hopper flange and the transition as shown in Figure 9, Transition Pack, Transition, and Airlock.

2. Fasten the transition to the hopper flange using 3/8" bolts, washers, and nuts as shown in Figure 9, Transition Pack, Transition, and Airlock.

2.6.3 Transition and Airlock (See Figure 9)

Do not use a transition and airlock on a single opening trough outlet hopper.

The transition and airlock are designed to fit the standard opening on the bottom of the HP series. The sizes available are the 8", 10", 12", and 16". Sizes are based on product loading and determined at the time of order.

1. Apply 1/4" diameter sealant between the hopper flange and transition as shown.

2. Fasten the transition to the hopper flange using 3/8" bolts, washers, and nuts as shown.

3. Determine the proper position required for the rotary airlock. Allow for clearance, electrical connections, and future maintenance of the rotary airlock.

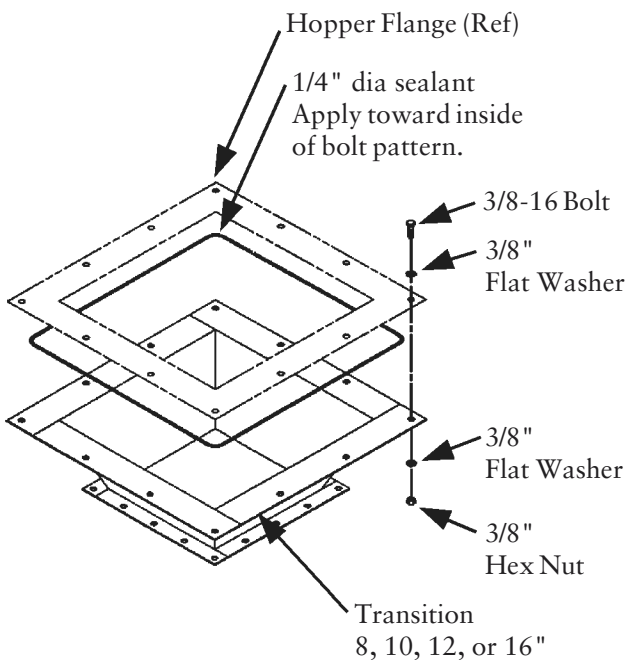
4. Apply the sealant supplied with the rotary airlock to the top flange.

5. Fasten the rotary airlock to the transition flange using 3/8" bolts, washers, and nuts as shown.

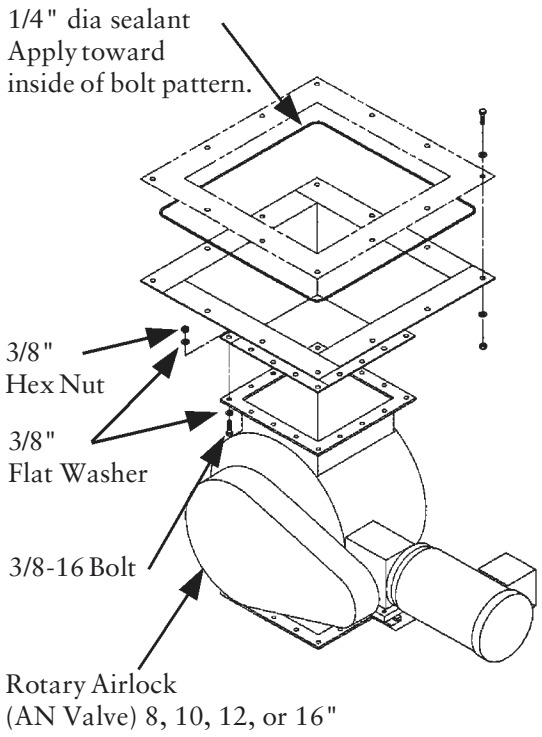
6. Electrical connections should be made by a qualified electrician. Refer to the motor nameplate for specifications of voltage, amperage, cycle, and proper wiring sequence. Follow all local codes for wiring.

CAUTION

Disconnect all power to the rotary airlock before servicing. Never allow any objects to be placed in any opening of the rotary airlock during operation.



Transition Pack



Transition and Airlock

Note: Bolts, washers, and nuts are same for both Transition Pack and Transition and Airlock.

Figure 9
Transition Pack, Transition, and Airlock

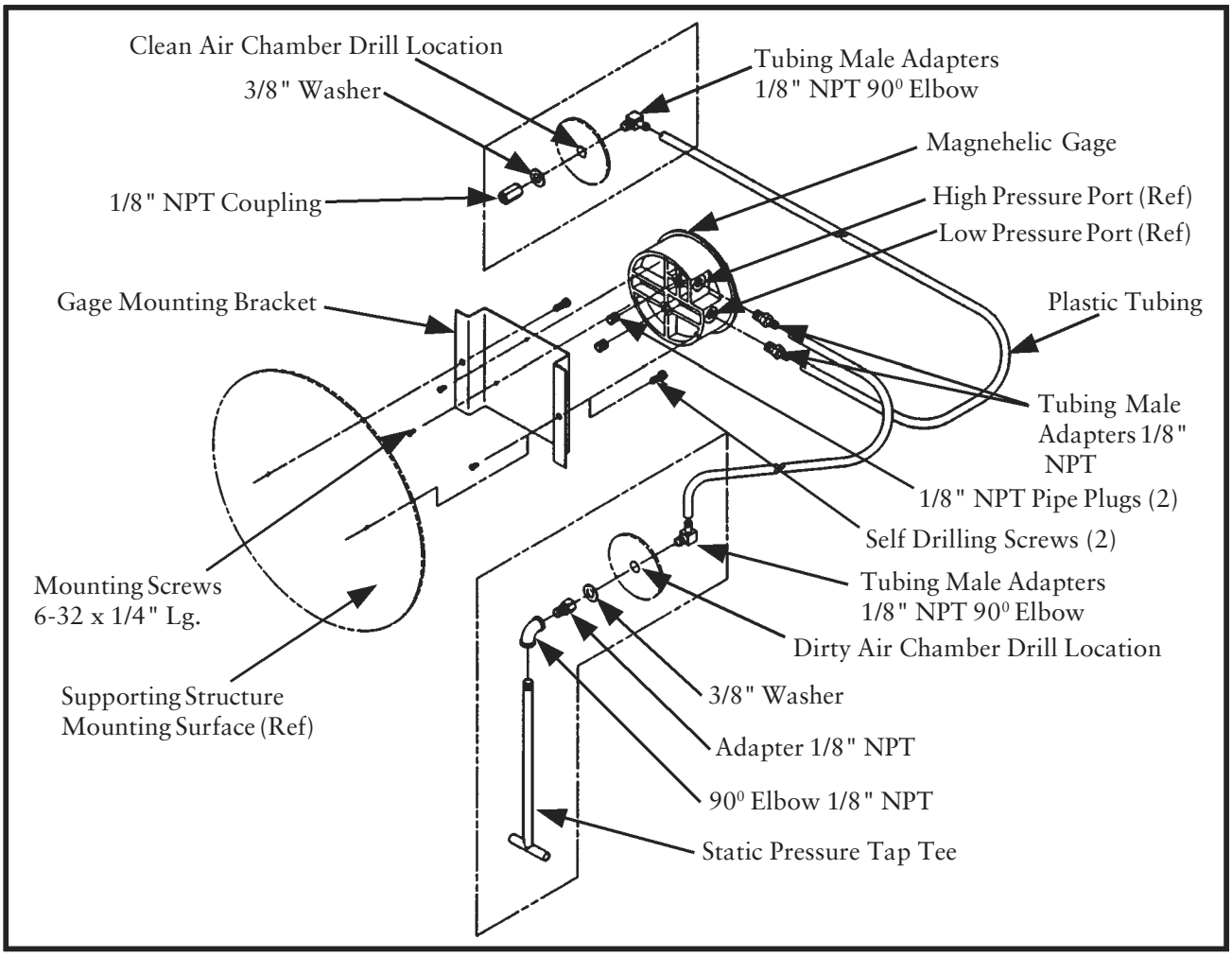


Figure 10
Installation of Magnehelic Gage

2.6.4 Magnehelic Gage (See Figure 10)

The Magnehelic gage is a standard feature on the HP series collector. The pressure taps for this gage are factory installed.

1. After unpacking the Magnehelic parts, choose a convenient accessible location on or near the unit for mounting the gage.

2. Prior to mounting, plug the pressure ports on the back of the Magnehelic gage using the two 1/8" NPT pipe plugs supplied with the gage. Install the two 1/8" NPT male adapters supplied with the gage into the openings on the side of the gage marked high and low pressure. Mount the gage to the mounting bracket with three, #6-32 x 1/4" long screws (supplied with the gage) as shown in Figure 10, Installation of Magnehelic Gage.

3. Locate the Magnehelic gage and mounting bracket assembly for the best visual advantage. The plastic tubing will determine the maximum distance away from the collector that the mounting bracket and gage can be located (35 feet of tubing is supplied). Remember that the tubing will have to be cut and that one piece may be longer than the other. If more tubing is required, please contact your local Torit representative. Once the mounting bracket assembly position is determined, mount this assembly to the supporting structure using the two self-drilling screws.

4. Connect the tubing to the high pressure and low pressure port fittings located on the Magnehelic gage. The high pressure port tubing is attached to the pressure fitting mounted in the dirty air chamber (filter section). The low pressure port is attached to the fitting in the clean air chamber (see Figure 10, Installation of Magnehelic Gage).

5. Zero and maintain the Magnehelic gage per operating and maintenance instructions provided by the manufacturer of the Magnehelic gage.

2.6.5 Photohelic Gage (See Figures 11, 12, and 13)

The Photohelic gage is an optional feature on the HP series collector. The pressure taps for this gage are factory installed.

1. After unpacking the Photohelic parts, choose a convenient accessible location on or near the unit for mounting the gage.

2. Mount the gage to the panel with mounting ring, retaining ring, and four #6-32 x 1-1/4" long screws. Before tightening the screws, assemble the two 1/8" NPT x 1/4" O.D. male tube adapters supplied with the gage into the openings on the side of the gage marked high or low pressure. Align the gage so that the two 1/8" NPT male tube adapters and the 2.375" hole diameter in the

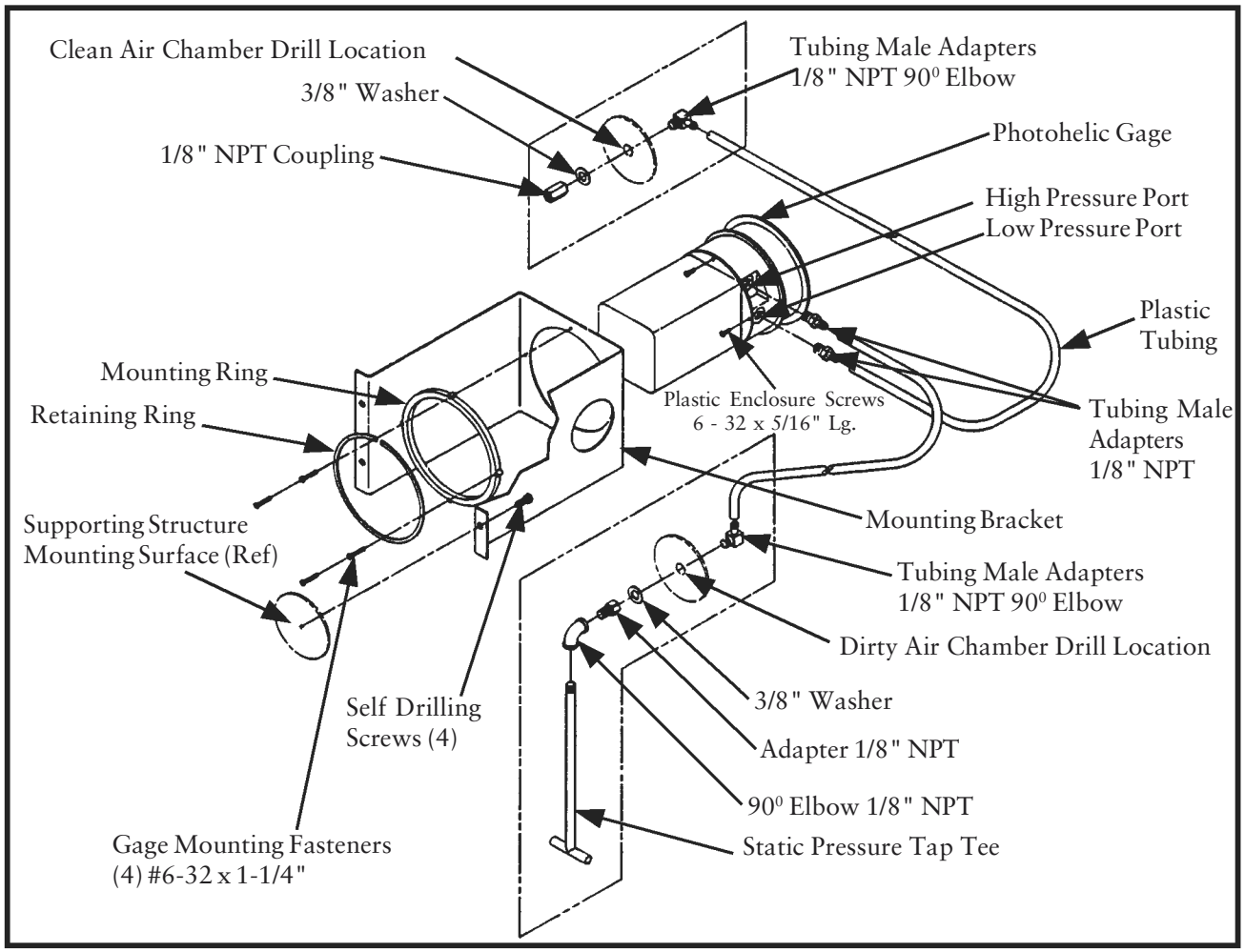


Figure 11
Installation of Photohelic Gage

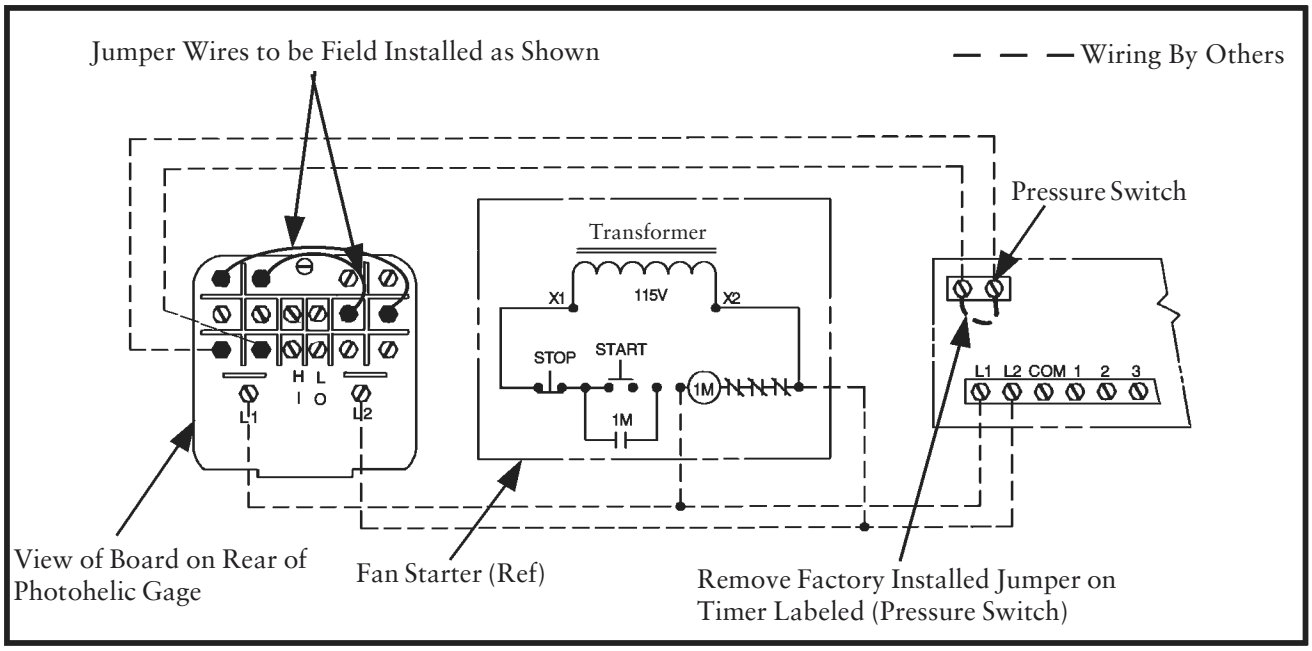


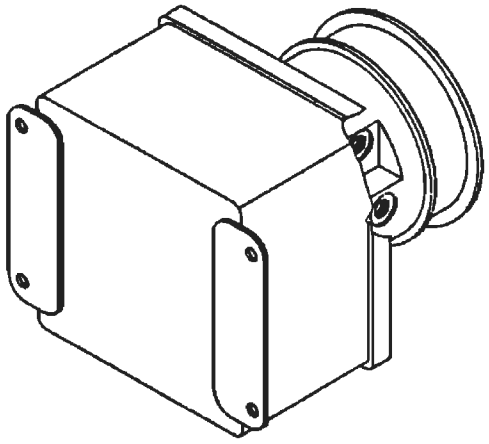
Figure 12
Photohelic Gage Wiring Diagram

mounting bracket are in line and then tighten the four #6 - 32 x 1-1/4" long screws.

3. Remove the four #6 - 32 x 5/16" long screws and plastic enclosure on back of the Photohelic gage and set aside. Add the two jumper wires–supplied by customer–and wire the gage as shown in Figure 11, Photohelic Wiring Diagram, using 3/4" conduit opening. Reassemble plastic enclosure and fasten securely using the #6 - 32 x 5/16" long screws previously removed.

4. Locate the Photohelic gage and mounting bracket assembly for the best visual advantage. The plastic tubing will determine the maximum distance away from the collector that the mounting bracket and gage can be located (35 feet of tubing is supplied). Remember that the tubing will have to be cut and that one piece may be longer than the other. If more tubing is required, please contact your local Torit representative. Once the mounting bracket assembly position is determined, mount this assembly to the supporting structure using the two self-drilling screws.

5. Connect the tubing to the high pressure and low pressure port fittings located on the Photohelic gage. The high pressure port tubing is attached to the pressure fitting mounted in the dirty air chamber.



All parts shown in Figure 11 (except mounting bracket) are included in the Weatherproof NEMA 4 Enclosure package.

Figure 13
Weatherproof NEMA 4 Enclosure

6. Zero and maintain Photohelic gage per operating and maintenance instructions provided by the manufacturer of the Photohelic gage.

7. Refer to Figure 12, Photohelic Gage Wiring Diagram for the proper wiring of the Photohelic gage.

8. The Photohelic gage weatherproof pack comes assembled in a NEMA 4 enclosure. All of the hookups are identical to the Photohelic gage pack. Follow all of the directions as stated in Steps 1 through 7.

2.6.6 Level Indicator

The level indicator is factory installed when ordered with the collector. The indicator is located in the hopper side wall and extends inward.

The level indicator may be used to start the rotary valve or screw conveyor to evacuate dust from the hopper on light dust load applications. However, for normal to heavy dust loads, it is recommended to interlock the dust removal equipment, such as the rotary valve or screw conveyor, with the dust collector fan to allow continuous dust removal from the hopper.

Consequently, the level indicator is normally used to sense a plugged hopper condition due to excessive dust loads or malfunctioning dust removal equipment. All electrical connections are to be made by a qualified electrician according to local codes. Wiring is supplied by customer.

2.6.7 Platform and Handrails

The platform is offered on the HPH and HPW collectors. Mounting brackets have been supplied which are used to attach the platform to the collector. Before lifting the collector onto the hopper, the platform should be installed. A crane or fork lift may be used to lift and position the platform during assembly. An assembly drawing has been sent with the platform which calls out the proper size and location of hardware to be used.

HPH & HPW Platform

1. Position the platform for mounting and align the holes in the brackets and platform with drift pins. Fasten the platform to the collector using the bolts, washers, and nuts supplied.

2. After the platform has been attached to the collector and all hardware has been tightened, the collector may be lifted onto the hopper-leg assembly.

CAUTION

Do not lift the collector using any portion of the platform to bear weight.

HPT Handrail

A handrail is offered on the HPT collectors. After the clean air plenum has been assembled to the filter section, install the handrails before lifting the collector onto the hopper. The handrails will have to be lifted into place using a crane or fork lift. An assembly drawing is included with the handrails which calls out the proper size and location of hardware to be used.

1. Position the handrails for mounting. Remove any bolts, washers, and nuts from the flange where the railing pads will be attached. Align the holes in the pads and flanges and fasten the handrails using the bolts, washers, and nuts supplied.

2. After the handrail has been attached to the collector and all hardware has been tightened, the collector may be lifted onto the hopper-leg assembly.

CAUTION

Do not lift the collector using any portion of the handrail.

2.6.8 Ladder/Cage

The ladders offered with the HP collectors may be knocked down for shipping. All brackets and hardware to assemble the ladder, cage, and braces to the collector are supplied. A crane is required to lift the ladder assembly into position and attach to the platform or handrail. An assembly drawing is included with the ladder/ cage which calls out the proper size and location of hardware to be used.

1. Preassemble the ladder or ladder with cage when the parts are lying on the ground. Use the bolts, washers, and nuts called out on the assembly drawing.

2. After the ladder of ladder with cage have been assembled, attach the crane lifting slings to the top four ladder rungs so the weight of the assembly can be distributed evenly.

3. Lift the assembly into position, align all holes, and attach the ladder to the collector. Position all braces and attach them between the ladder and the collector.

4. Recheck all hardware for tightness. Remove the lifting slings.

2.6.9 Light Pack (HPW Only)

The light pack is offered for use in the walk-in section of the HPW collector. The weatherproof light switch is located outside of the collector. The light is located inside the clean air plenum and is attached to a bracket located in the ceiling of the plenum. all hardware used to attach the light and switch is included. The wiring, conduit, and electrical connectors are supplied by the customer. All wiring must comply with local codes and must be done by a qualified electrician.

2.6.10 Blower Fan Mounting Instructions (HPH Only) (5, 7-1/2, 10, and 15 HP) (See Figure 14)

The 5 through 15 HP power packs are designed to fit on the side of your HPH collector. This is specified when placing the order. Larger, remote mounted power packs are available.

NOTE

When installing your blower:

- **Use proper equipment and safety guidelines when lifting and installing.**
- **Rotate the fan wheel before and after installing into the blower housing to assure proper clearance.**
- **Wiring of this motor must be done by a qualified electrician.**
- **Rotation of the fan wheel is clockwise when viewed from the top.**
- **If you experience difficulty when installing your blower, contact your local Torit representative .**

CAUTION

The collector must be anchor-bolted in place before the blower assembly is attached.

General Instructions

1. Attach the motor to the motor mounting plate with four bolts and internal tooth lockwashers.
2. Loosen the two (2) set screws in the fan wheel and slip them onto the motor shaft with the key in the motor shaft lined up with the slot in the fan wheel. Adjust for .125" clearance between the fan wheel and the motor mounting plate bolts and tighten the set screws.
3. Set the transition down on its rectangular plate side. Apply 1/4" diameter sealant all around toward the inside edge of the bolt pattern.

NOTE

Torque: 5/16" - 18 bolts to 10 lbs./ft.
3/8" - 16 bolts to 19 lbs./ft.
1/2" - 13 bolts to 40 lbs./ft.

4. Set the blower housing onto the round flange of the transition and align all holes. The direction of the exhaust may be pointed in 45° increments. This should be determined before bolting. Fasten the blower housing and transition together using the bolts, washers, and nuts supplied.
5. Apply 1/4" diameter sealant all around toward the inside edge of the bolt pattern on the top of the blower housing.
6. Lift the motor wheel assembly into position over the housing and lower. Determine the proper location for the electrical junction box on the side of the motor. Align the holes in the motor mounting plate and blower housing and fasten together using the bolts and washers supplied.
7. Lift the entire transition blower assembly, using a crane or a forklift, into position. Align the holes in the plate and collector, and fasten together using the bolts and washers supplied.
8. Recheck all hardware for tightness. Disconnect crane or forklift.

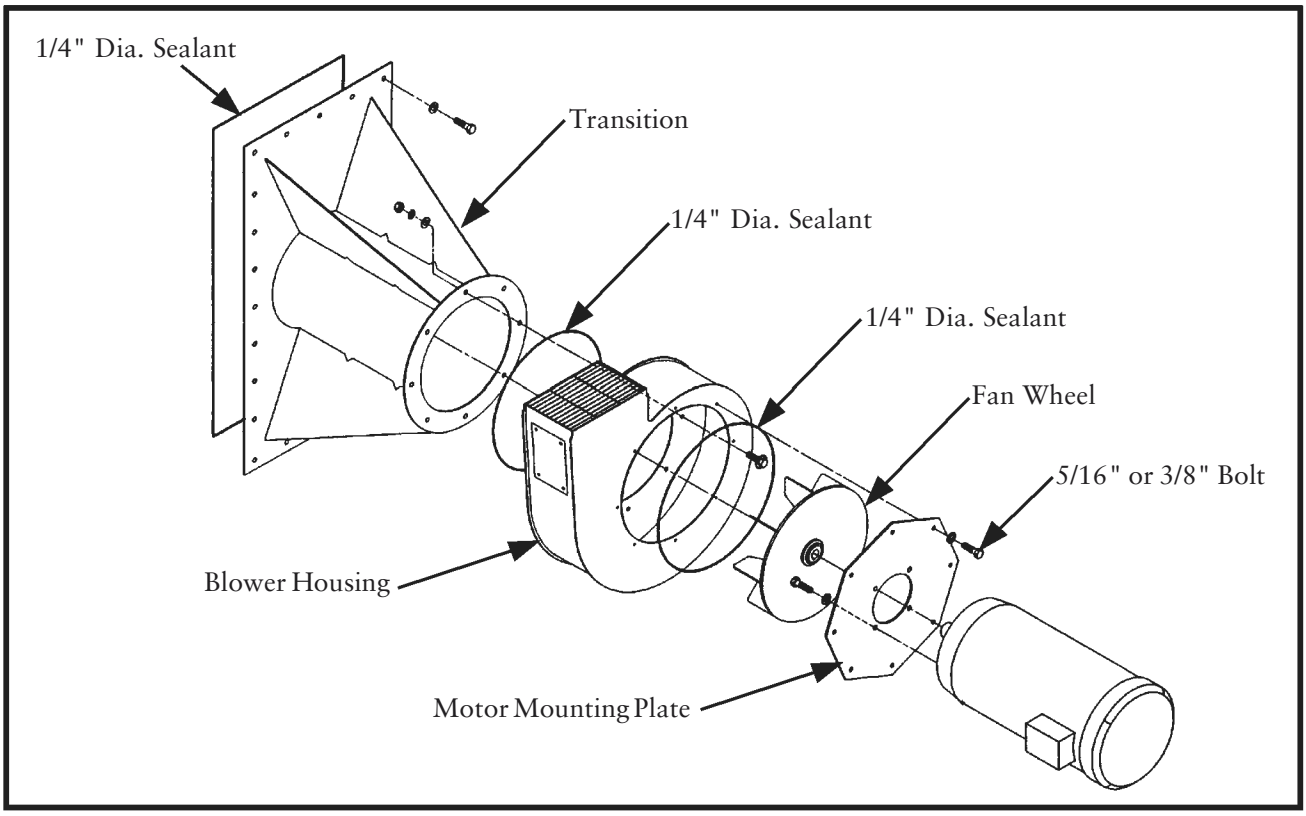


Figure 14
Blower Transition Assembly (HPH Only)

2.6.11 Damper Pack (See Figure 15)

The damper pack is offered for all Torit power packs. The damper fastens to the exhaust side of the power pack and is used to adjust the blower air volume. By limiting the flow through the damper, the motor is protected from over horsepower conditions. In addition, the filter bags are not exposed to greater-than-designed velocities (air-to-media ratio). When the filter bags are clean, the damper should be adjusted to provide the designed airflow. When the filters become coated with dust, the damper may need to be adjusted to maintain designed airflow.

1. The damper comes with self drilling screws. Use a drill with a hex socket to propel the self-drilling screw.
2. Align the damper onto the edge of the blower housing. The damper has predrilled holes which should be used as pilot holes to locate the self-drilling screws. Attach the damper to the housing.
3. Adjust the damper by loosening the wingnut on the lever. When the lever is in position, retighten the wingnut.

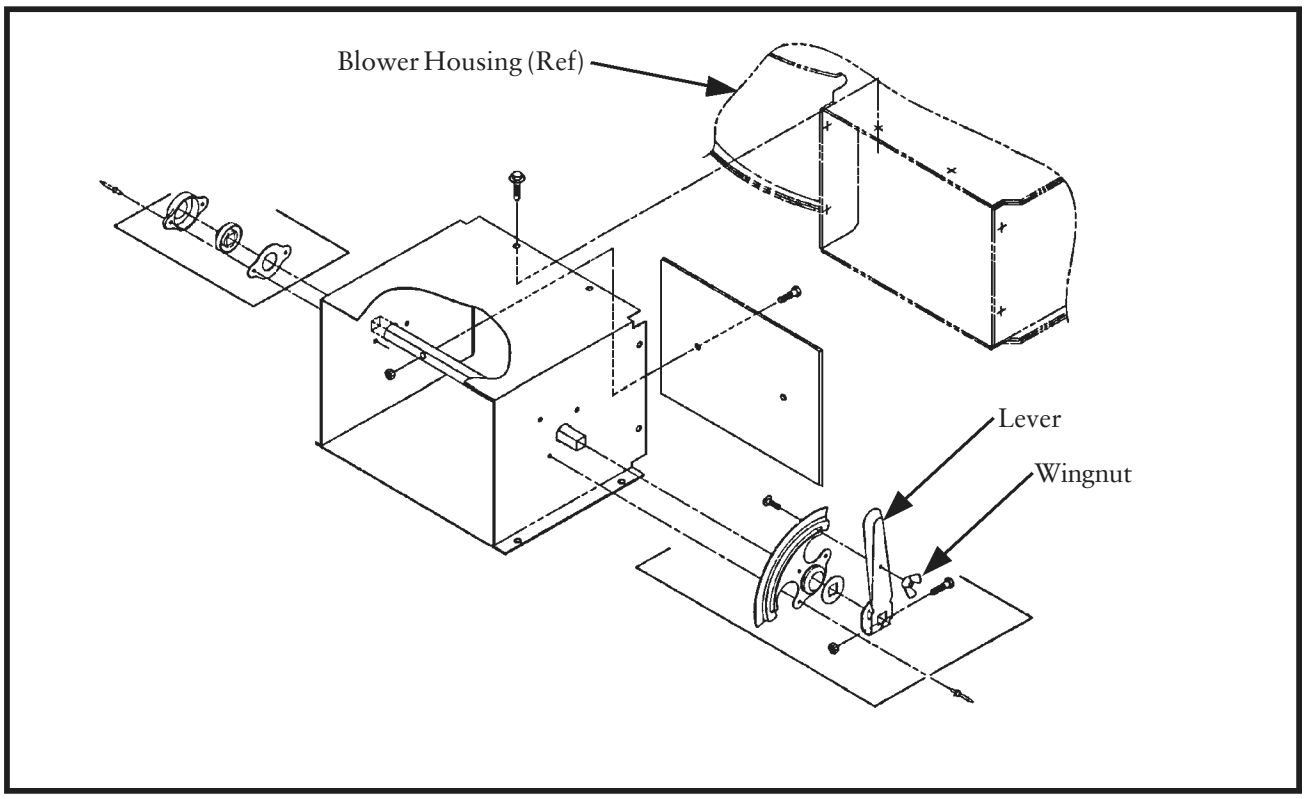


Figure 15
Damper Assembly

2.7 Electrical Installation (See Figure 16)

CAUTION

- **All electrical work must be done by a qualified electrician according to local codes.**
- **Do not mount solid-state control timer box on dust collector. Mechanical vibration can damage collector controls.**

Mount the proper size motor starter with low voltage control circuit for blower motor in a convenient location.

Mount the solid-state control timer box either near the starter or at a location convenient for accessibility and maintenance.

Using wiring diagram supplied with control timer, make proper connections to blower motor starter, solid-state control timer, and solenoid valves. All electrical apparatus should be properly sized for the required voltage. See Figure 16, Solid-State Timer Wiring Diagram and Figure 1, Typical Installation.

If a Photohelic or similar remote control device is used to control the solid-state timer, the valves will pulse only when the differential pressure reaches the high set point and will continue the pulse sequence until the low pressure set point is reached (see Figure 11, Installation of Photohelic Gage and Figure 12, Photohelic Gage Wiring Diagram).

2.7.1 Electrical Operation

Each HP dust collector comes equipped with 115-VAC solenoid valves that control the pulse cleaning valves.

Three different types of solenoid enclosures are offered on the HP: the NEMA 4 with 3D2 solenoids, the NEMA 7 with 5D2 solenoids, or the NEMA 9 with 5D2 solenoids. The NEMA 4 enclosure is weatherproof. The NEMA 7 and 9 enclosures are explosion proof. NEMA 7 is only available as a special order. These enclosures come fully assembled and are mounted near the manifold.

The solenoids must be connected electrically to the solid-state control timer. A wiring diagram for each size of HP is supplied with the unit. Filter life and proper cleaning will be affected if the wiring is incorrect.

2.7.2 Solid-State Control Timer Specifications (See Figure 16)

CAUTION

Solid-state control timer requires a low voltage (105 to 135 VAC) control circuit in the fan starter, supplied by customer.

Components: Standard HP dust collectors are equipped with 115 volt AC solenoid valves rated at 19.7 watts each and a solid-state electronic 115 VAC/ 50-60 Hz/1 ph control timer.

The timer is factory adjusted at 100 milliseconds (1/10 second) pulse time and a 10 second duration (elapsed time) between pulses.

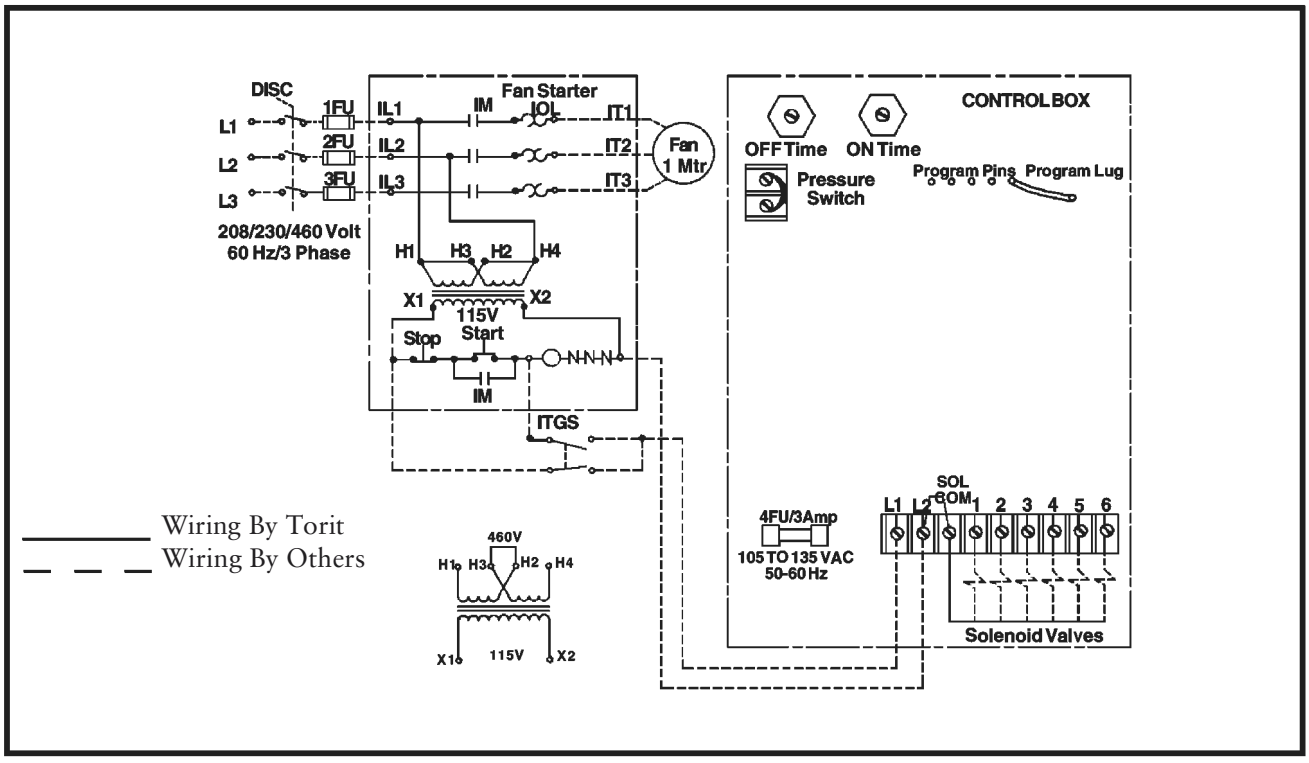


Figure 16
Solid-State Control Timer Wiring Diagram

Input power to the solid-state control timer is applied to the L1 and L2 terminals on the timer control circuit board, which is in parallel with the low voltage (115/60/1) coil of the blower fan magnetic starter (see Figure 16, Solid-State Control Timer Wiring Diagram). Upon fan start-up, power is supplied to the control timer and the preset OFF time is initiated. At the end of the OFF time, the control timer will energize a corresponding solenoid valve to provide the ON time cleaning pulse for one row of filter tubes and then steps to the next row.

This cycle is continuous unless an auxiliary control such as the Photohelic pressure switch or a 1TGS toggle switch is used to control the timer (see Figure 16, Solid-State Control Timer Wiring Diagram). When all of the available outputs are not required, program the control timer for fewer outputs. Reset the program pin selection wire on the solid-state control timer to the correct number of solenoid valves being used (see Figure 16, Solid-State Control Timer Wiring Diagram). The 1TGS is an optional switch, supplied by customer, which provides a manual method of starting the timer cleaning sequence, independent of blower operation. Consult your local Torit representative before using this method.

In grounded systems, neutral to control box must be connected to L2.

Input Operating Voltage: 105-135 VAC/50-60 Hz/1 Ph

Output Type: Solid-state switch rated at 200 VA maximum load per output.

Pulse Width (On Time): Factory set at 100 milliseconds (1/10 second).

CAUTION

Do not adjust ON time unless the proper test equipment is used. Too much or too little ON time can cause shortened filter tube life. Consult with your local Torit representative.

Off Time: Adjustable - 1.5 to 30 seconds, factory set at 10 seconds.

Operating Temperature Range: -400 F to +1500 F.

Transient Voltage Protection: 30 Joule Varistor.

Solenoid Valves: 115 VAC at 19.7 watts each.

2.8 Installation — Compressed Air Supply (See Figures 1 and 17)

NOTE

- **It is important that the compressed air supply be both oil and moisture free. Contamination in the compressed air that is used to clean filter tubes will result in poor cleaning, cleaning valve failure, and/or poor collector performance.**
- **Purge compressed air lines to remove debris before connecting to the compressed air manifold on the HP dust collector.**

CAUTION

Shut off and bleed compressed air supply before doing any work.

Remove the plastic pipe plug from the end of the dust collector compressed air manifold and connect the compressed air supply line. Use thread-sealing tape or pipe sealant on all compressed air connections. The compressed air shut-off valve, bleed type regulator with gage, filter and automatic condensate valve (not supplied by Torit) should be installed in the compressed air supply line. Locate these components for convenient service, start-up and shut down of the HP dust collector.

Be sure that all compressed air components are adequately sized to meet the maximum system requirements of 1.1 scf per pulse at 90 psig supply pressure.

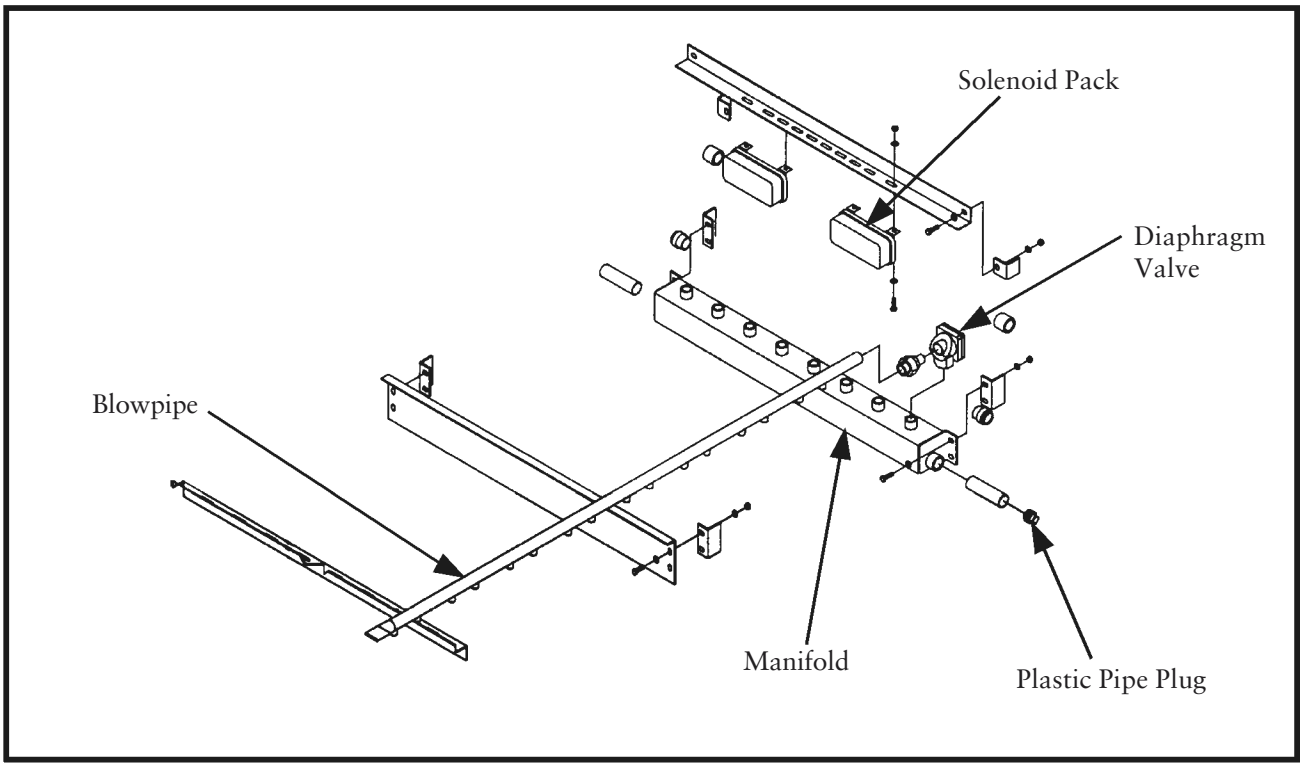


Figure 17
Compressed Air Manifold (HPT/W Shown)

3.0 Prestart-Up Check (See Figure 1)

CAUTION

Check to be sure the blower fan exhaust is free of debris before starting.

4.0 Start-Up

1. Turn on the compressed air supply to the HP dust collector compressed air manifold. Adjust to 90 psig of pressure with the compressed air regulator. Pressure of 90 to 100 psig is the most typical setting for satisfactory cleaning performance (see Section 5.0, Routine Maintenance). The lower the compressed air setting, the lower the pulse valve air consumption.

2. Turn on the hopper discharge system where equipped and if on a separate control. The hopper discharge system must always be operating while the dust collector is operating. On hoppers with drum arrangements, make sure all the connections are airtight (see Figure 7, Hose Drum Cover Pack with Gate, Figure 8, Hose Drum Cover Pack without Gate, and Figure 9, Transition Pack, Transition, and Airlock).

NOTE

- **Make sure the hopper discharge opening is sealed off.**
- **Too much airflow to the blower fan will cause electrical failure.**

3. Turn on the blower fan. Check fan rotation by looking down from the top of the blower fan motor, referencing the rotation direction sticker on the blower fan housing. Rotation should be clockwise.

CAUTION

Stand clear of the blower fan exhaust area when the blower is running. Debris can be exhausted and cause injury.

4. Adjust the blower fan for the desired airflow by adjusting the volume control damper on the blower fan exhaust discharge if applicable.

5.0 Routine Maintenance

The recommended setting for compressed air is 90 psig. The control timer is factory set to clean one row of filter tubes every 10 seconds.

If the HP filter tubes are operating at a higher than design pressure drop*, it may be lowered by increasing the frequency of cleaning. The minimum OFF time, or elapsed time, between pulses is three seconds. Additional cleaning energy may be obtained by adjusting the pressure upward to a maximum of 100 psig. Pulse ON time can be checked or adjusted by consulting your local Torit representative.

NOTE

- **Do not increase compressed air pressure beyond 100 psig. Component damage may result.**
- **Do not increase or decrease the pulse ON time on the solid state control timer. Longer or shorter pulse ON times do not aid in cleaning filter elements. They waste compressed air and cause shortened filter tube life.**

**Pressure drop across filter elements in "wg.*

At a low operating pressure drop, you may want to raise to a higher pressure drop level. Increase the OFF time between pulses on the solid-state control timer. This will reduce compressed air consumption. However, the Photohelic gage, an optional pressure switch control, is the pressured, more dependable method. This controls the solid-state control timer to only pulse at the desired high and low pressure drop setpoint and continues until the low setpoint is reached, at which point the pulse cycle stops. Using the Photohelic gage can save additional compressed air, especially when the HP is not collecting contaminants.

Blower fan adjustments can be made by testing the duct system flow rate and adjusting the volume control damper to the desired system flow rate.

NOTE

Check the blower fan motor amperage draw against motor manufacturer's nameplate amperage rating. Amperage over manufacturer's recommended rating of motor will cause damage.

5.1 Operating Checks (Monitoring Process)

Monitor exhaust after the filters have been exposed to dust and maintained a dust cake. Exhaust should be visibly clean. If a leak develops, it will be first noticed as a visual puff of dust immediately after a cleaning pulse.

Monitor filter tube pressure drop. Equilibrium pressure drop (stabilized Delta P) is generally 3-4 "wg on a Magnehelic or Photohelic for seasoned filters, but 1 to 6 "wg is considered normal.

NOTE

At initial start-up with any new filter tubes, the fan motor may overload because of airflow higher than design level. If this happens, partially close a volume control damper and check blower fan amperage draw.

6.0 Service

CAUTION

- **Disconnect electrical power before servicing any electrical components.**
- **Shut off and bleed compressed air before servicing any compressed air components.**
- **No welding should be performed either on or inside the unit.**

6.1 Dust Removal (55-Gallon Drum Only)

NOTE

Do not let the dust storage containers overfill. It can cause poor collector performance and create an extensive clean up due to overflow of dust when removing the container(s). In addition, it can cause dust to accumulate in the collector hopper. This should NEVER happen.

1. Turn off the dust collector and empty as necessary. Empty the 55-gallon drum when 2/3 full.

2. If the hopper has a gate attachment, close the gate before servicing the drum. Remove and empty the drum and open the gate. The collector fan does not have to be shut off if this procedure is followed.

6.2 Compressed Air Components

CAUTION

Compressed air can be dangerous. Before attempting service, shut off plant air supply to dust collector and depressurize air manifold. Disconnect and lock out electric power to dust collector, fan, and rotary valve. Do not operate the dust collector with the inspections or access doors removed.

The HP dust collector is relatively maintenance-free. The following items should be checked weekly:

1. Pressure Drop–ranging from 1 - 6 "wg. (Check Daily per usage)

2. Air Pressure–90-100 psig at air manifold.

Check the following items every three-to-four months:

1. Check the condition of the clean air section for dust. There should be no dust accumulations on the tubesheet. If dust is present, check the surrounding filter tubes for rips or loose seals. Shining a light down the center of the tube will usually reveal any dust leaking through the tube.

2. Proper operation of solenoid and diaphragm valves.

3. Check seals on the door and adjust or replace as necessary.

Daily Record Keeping:
- Record W.G. Daily each time the machine is used
- In the event the W.G. reading is not withing the allowable levels. Stop operation and call the maintenance department for assistance. Create a work order so the corrective maintenance can be documented with the equipment device.

7.0 TROUBLESHOOTING GUIDE

TROUBLE	POSSIBLE CAUSE	REMEDY
A. Blower fan and motor do not start.	1. Wiring.	
	a. Proper wire size not used for motor.	1a. Rewire per local and national codes for proper wire size.
	b. Not wired correctly.	1b. Check and correct internal motor wiring for proper connections for your voltage (reference Motor Manufacturer Wiring Diagram on motor).
	c. Power circuit down.	1c. Check for voltage on all leads.
	d. Motor starter circuit down.	1d. Check the electrical supply circuit for proper output voltage, fuse, circuit breaker, and leads to motor.
B. Blower fan and motor start, but do not keep running.	1. Starter kicks out.	
	a. Incorrect starter heater elements are installed.	1a. Check for proper motor starter heater elements. Replace with proper value heater elements if needed.
	b. Collector access doors are off or not closed tight.	1b. Tighten access door(s) by hand securely.
	c. Hopper discharge open to atmosphere.	1c. Install slide gate, drum cover arrangement, or other accessories to hopper discharge. See Section 2.6, Assembly of Optional Equipment.

7.0 TROUBLESHOOTING GUIDE

TROUBLE	POSSIBLE CAUSE	REMEDY
B. Blower fan and motor start, but do not keep running (contd).	1. Starter kicks out (contd).	
	d. Blower fan damper control not adjusted properly.	1d. Check airflow in ducting for proper requirements. Adjust the damper control until the proper airflow is achieved and the blower fan motor amperage draw is within manufacturer motor ratings.
	e. Electrical circuit overload.	1e. Check that the supply circuit has sufficient power to run all equipment.
C. Dust discharge out of clean air outlet.	1. Filter tubes installed improperly.	1. Check that all filter tubes are secured and bolts are tight (see Section 2.5.2, Filter Tube Installation and Figure 6, Filter Tube Installation).
	2. Filter tube damage, tears, or holes in the fabric.	2. Replace the filter tubes. Use only Torit filter tubes (see Section 2.5.2, Filter Tube Installation, Figure 6, Filter Tube Installation and reference Replacement Parts List).

7.0 TROUBLESHOOTING GUIDE

TROUBLE	POSSIBLE CAUSE	REMEDY
D. Insufficient airflow.	1. Fan rotation backwards.	1. Check fan rotation. The fan rotation should be clockwise, looking down at the top of the blower fan motor (see Section 4.0, Start-Up and Figure 14, Blower Transition Assembly).
	2. Collector openings not tight or closed.	2. Check access doors, that they are in place and tightened securely. Also check hopper discharge area that openings are closed off and that the optional hopper attachments are installed (see Section 4.0, Start-Up, Figure 7, Hose Drum Cover pack with Gate, Figure 8, Hose Drum Cover Pack without Gate, and Figure 9, Transition Pack, Transition, and Airlock).
	3. Fan exhaust area is restricted.	3. Check fan exhaust area for blockage. Remove material or debris that is blocking the fan exhaust area or adjust damper flow control on fan exhaust area.

7.0 TROUBLESHOOTING GUIDE

TROUBLE	POSSIBLE CAUSE	REMEDY
D. Insufficient air flow (contd).	4. Filter tubes plugged with particulate.	
	a. Filter tubes need to be replaced.	4a. Remove and replace using only Torit filter tubes (see Figure 6, Filter Tube Installation and Replacement Parts List).
	b. Lack of compressed air.	4b. Check compressed air supply for 90 psig minimum (see Figure 1, Typical Installation). Increase pressure as described in Section 5.0, Routine Maintenance.
	c. Pulse cleaning not energized.	4c. Check supply voltage to the timer board with a volt ohm meter. Check the fuse on the timer board. If the fuse is blown, replace it with one of equal value (see Section 2.7.2, solid-State Control Timer Specification and Figure 16, Solid-State Timer Wiring Diagram).
	d. Dust storage area is too full or plugged.	4d. Clean out dust storage area as described in Section 6.1, Dust Removal.

7.0 TROUBLESHOOTING GUIDE

TROUBLE	POSSIBLE CAUSE	REMEDY
D. Insufficient airflow (contd).	5. Pulse valves are not functioning.	
	a. Pulse valves are leaking compressed air.	5a. Lock out all electrical power to the HP and bleed off the compressed air supply. Check for debris, valve wear or diaphragm failure by removing the diaphragm cover on the pulse valves. Also check for solenoid leakage and/or damage. If pulse valves or solenoid valves and solenoid tubing are damaged, replace part(s) (refer to Replacement Parts List).
	b. Pulse control solid-state control timer board has failed.	5b. Check supply voltage to the timer board with a volt ohm meter. Check the fuse on the timer board. If the fuse is blown, replace it with one of equal value. If the fuse and input power to the control board is okay, but there is not any output voltage to the solenoid pulse control valves, replace the pulse control timer board (reference Section 2.7.2, Solid-State Control Timer Specifications, Figure 16 Solid-State Control Timer Wiring Diagram, and Replacement Parts List).
	c. Pulse control timer board is out of adjustment.	5c. Refer to the Section 2.7.2, Solid-State Control Timer Specifications, and Figure 16, Solid-State Timer Wiring Diagram.

Notes

The Torit® Warranty

Donaldson Company, Inc. warrants to the original purchaser that for a period of ten (10) years from the date of shipment, the product described herein shall be free from defects in materials and workmanship if properly installed, maintained and operated under normal conditions. Donaldson Company makes no warranty against damage due to corrosion, abrasion, normal wear and tear, modification or misapplication and makes no warranty whatsoever as to any goods manufactured or supplied by others. After Donaldson Company has been given adequate opportunity to remedy any defects in material or workmanship, Donaldson Company retains the option to accept the return of the product, with return freight paid by the purchaser, and to refund the purchase price for the product after confirming the product is returned undamaged and in usable condition. Such a refund will be the full extent of Donaldson Company's liability and Donaldson Company shall not be liable for any other costs, expenses or damages whether direct, indirect, consequential or otherwise. The terms of this warranty may be modified only by a special warranty document signed by a Director, General Manager or Vice President of Donaldson Company. Failure to use genuine Donaldson replacement parts will cancel this warranty. THERE EXIST NO OTHER REPRESENTATIONS, WARRANTIES OR GUARANTEES EXCEPT AS STATED IN THIS PARAGRAPH AND ALL OTHER WARRANTIES INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHETHER EXPRESS OR IMPLIED ARE HEREBY EXPRESSLY EXCLUDED AND DISCLAIMED.

Parts and Service Program

For genuine Torit-Built® replacement filters and parts, call the Torit Express Line:

800-365-1331

Parts Ordering Information

When ordering parts, give model number and serial number, part number, description, and quantity of parts desired.

Donaldson Company, Inc.
Dust Collection Group
P.O. Box 1299
Minneapolis, MN 55440-1299
dustmktg@mail.donaldson.com

IOM-29349-00
Revision 5 November 2000

Donaldson Company, Inc.
Industrial Air Filtration
1400 West 94th Street
Bloomington, MN
55431-2370

Mailing Address:
P.O. Box 1299
Minneapolis, MN
55440-1299 U.S.A.

Tel 952-887-3847
Fax 952-698-2479
www.Donaldson.com
www.donaldsontorit.com

Donaldson Company, Inc. Emissions Statement for Industrial Dust Collectors with Dura-Life™ Filter Media

Donaldson Company, Inc. offers an extensive variety of dust collectors and filter media designs to the market to address the wide variety of dust control applications and project needs.

Because dust control projects sometimes demand unique collector selection or location strategies or may involve complex filter media performance considerations it is difficult to make general statements of emission performance. However, Donaldson generally expects total (filterable) particulate emissions from Continuous-Duty Baghouse Collectors using Donaldson Dura-Life filter media to be capable of achieving average emission levels of no more than 0.004 grains per dry standard cubic foot. This level of performance expectation excludes any contributions to emissions from condensable materials (*which will pass through filter media in a vapor state*), and it assumes filters are installed properly and are operated and maintained in accordance with industry best practice and in accordance with the manufacturer's Installation, Operation, and Maintenance manuals for the collector.

Factors which may contribute to unexpected collector emissions include: misuse, accident, abuse, modification, improper installation or operation, inadequate maintenance, and operation beyond recommended selection/sizing guidance or useful life. Emissions may also occur as a result of damage to collectors or filters due to accidents, fires, corrosion, abrasion, or other physical abuse.

Emission performance is also influenced by the style or size of collector selected, by the selection of filter media, and by choices in accessories or features for collectors.

Important Notice: Many factors beyond the control of Donaldson can affect the use and performance of Donaldson products in a particular application, including the conditions under which the product is used. Since these factors are uniquely within the user's knowledge and control, it is essential the user evaluate the Donaldson products to determine whether the product is fit for the particular purpose and suitable for the user's application. This Emissions Statement shall not be construed as or relied upon as a health and safety statement. Donaldson does not require or recommend exhausting emissions into the indoor environment without consultation with a qualified professional to evaluate and address all attendant health and safety risks. It shall be the end user's continued and sole responsibility to provide a safe and healthful environment for its employees.

Donaldson's terms and conditions of sale, as stated in our current quotation, contain the sole obligation and exclusive remedy for any issues that arise regarding information that Donaldson provides in this statement.