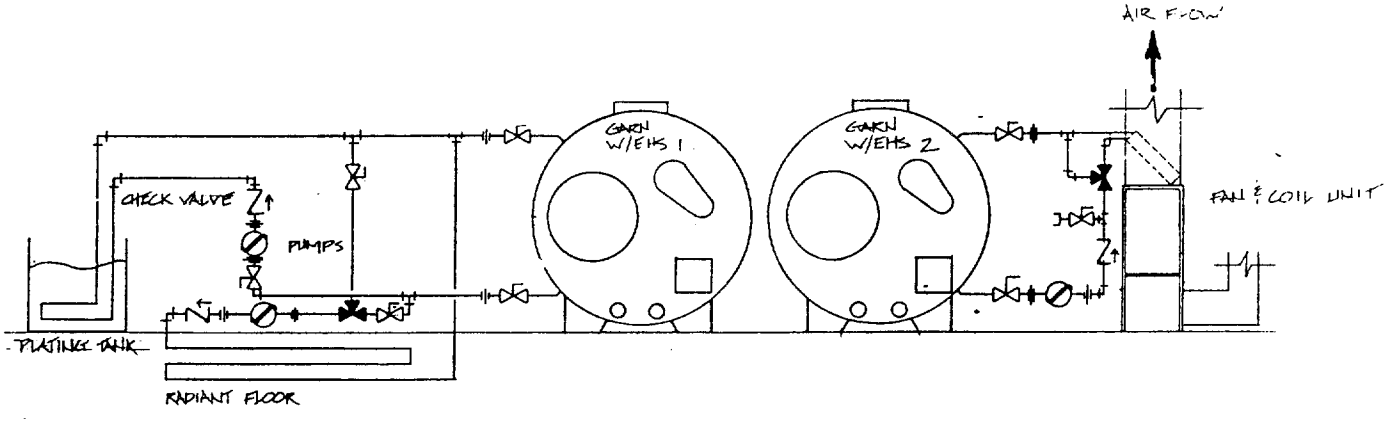
UNPACKING AND ASSEMBLY MANUAL

FOR

GARN® MODELS WHS 1450, 1500, 1900 and 2000



GARN®

Innovators in affordable energy systems.

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LISTED

UNPACKING AND ASSEMBLY INSTRUCTIONS

GARN® MODELS WHS 1450, 1500, 1900 and 2000

Thank you for purchasing **GARN® WHS** equipment. Carefully read the following pages for additional specific information and instructions. A photocopy of your original Purchase Contract has been included at the end of this document. Please compare your Purchase Contract and shipping list with the **delivered** items. Please contact your dealer, the factory and shipper **immediately** if any of the items are missing or damaged.

Because specific components **may** be damaged in shipment, they are shipped unassembled. This manual is devoted to the documentation, unpacking and minor assembly associated with those components. These components include:

- Welcome to the World of **GARN® WHS** equipment.
- Fire brick.
- Secondary reaction chamber and Material Safety Data Sheet.
- Induced draft blower motor, gasket and wheel.
- Manway cover and gasket.
- Round dial thermometers.
- Sensor stem.
- Controls and related labels.
- Shipping list.
- Copy of the Original Purchase Contract

The combustion chamber is used as a weatherproof shipping container for all of the above components **except** the manway cover. This item is shipped "sandwiched" between the inner door assembly and the outer door skin on the front of the unit. Refer to the instructions on the following pages as to the removal and installation of the manway cover.

SAVE THIS MANUAL FOR FUTURE REFERENCE

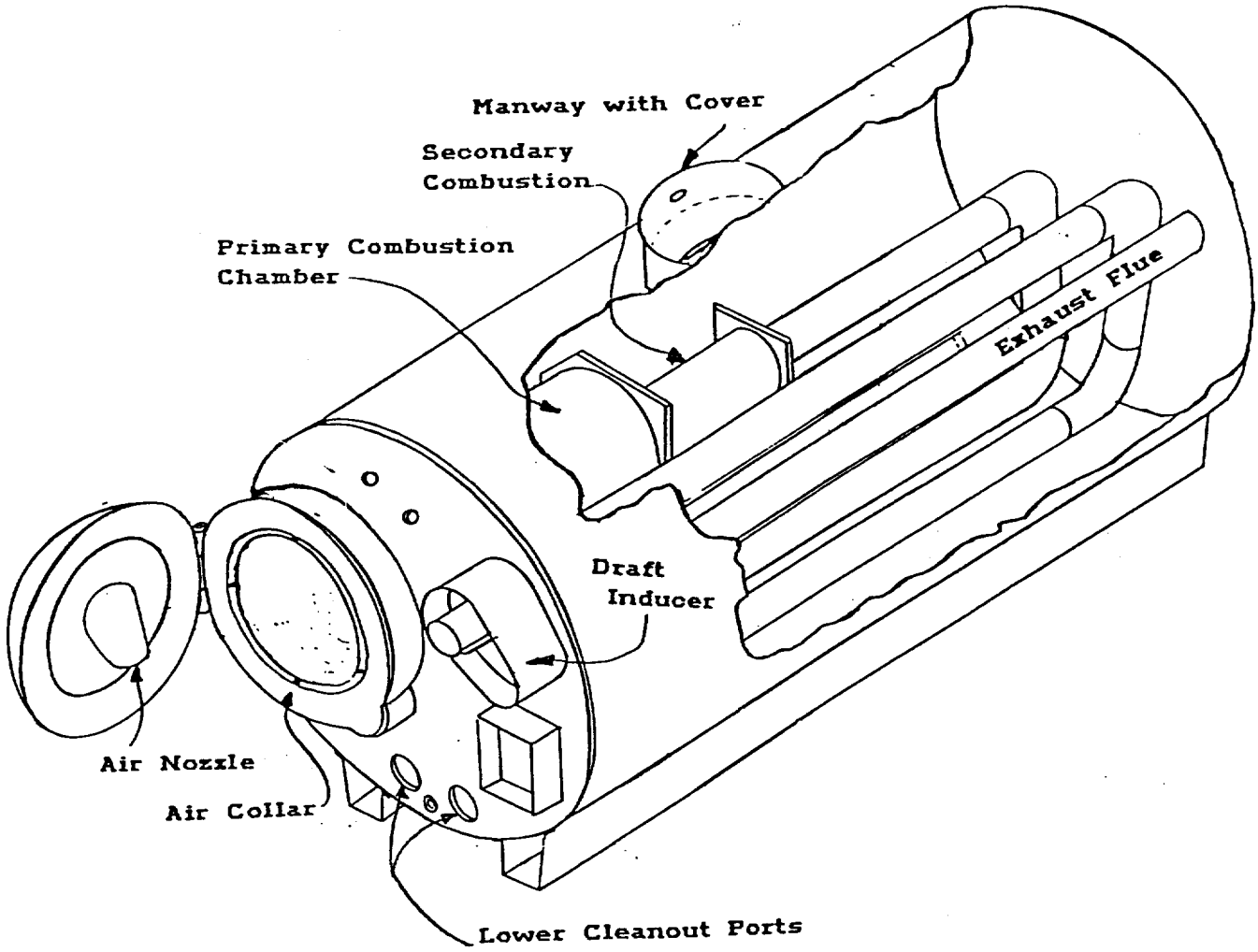
DECTRA CORPORATION @ 3425 33rd Avenue Northeast, St Anthony, Minnesota 55418
Phone: 612-781-3585 Fax: 612-781-4236 Web Site: www.garn.com

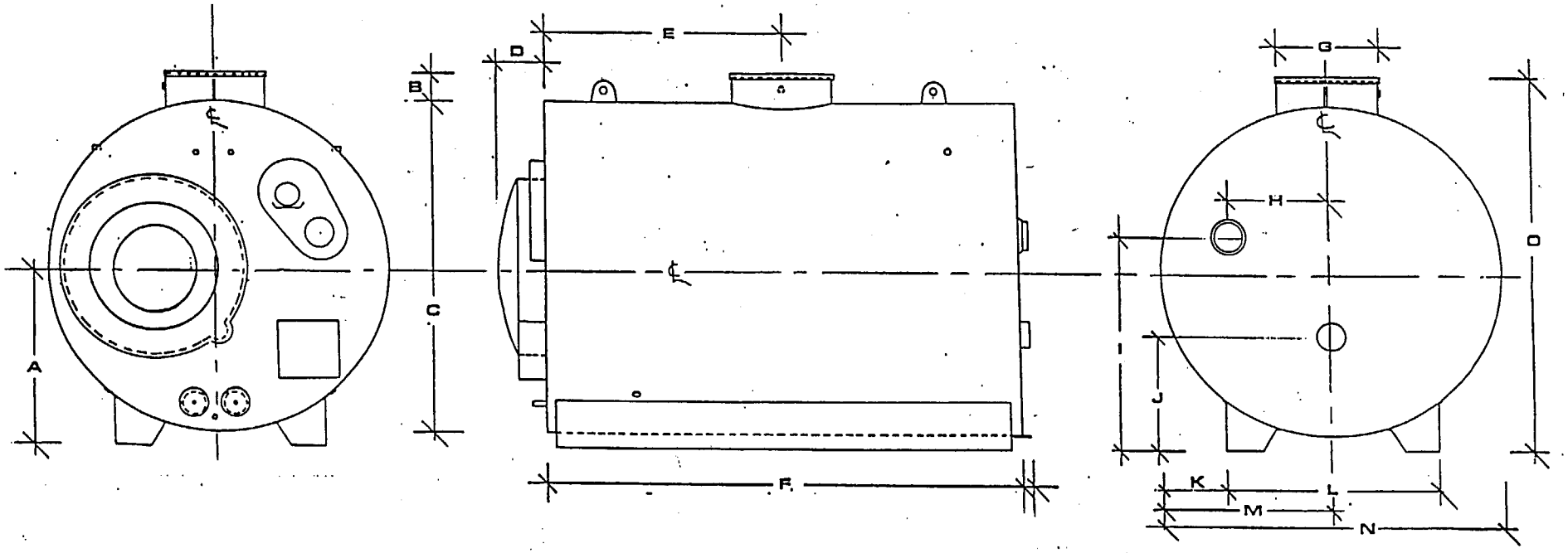
WELCOME TO THE WORLD OF GARN® WHS EQUIPMENT

GARN® WHS equipment is unlike all other "outdoor" wood heating equipment in that it incorporates clean, high efficiency combustion with thermal energy storage. As you use your **GARN® WHS unit,** you will come to appreciate its quality construction, unique features and many benefits. The following pages contain the unpacking and assembly instructions for the standard **GARN® WHS Heat Storage** unit without the electric heat back up option.

The **GARN® WHS** unit is non-pressurized. As such, the gasketed manway cover is simply set upon the top surface of the manway access ring. **DO NOT FASTEN OR OTHERWISE FASTEN** the cover to the tank or access ring; likewise, **DO NOT ADD WEIGHT** to the cover after the cover is in its final position.

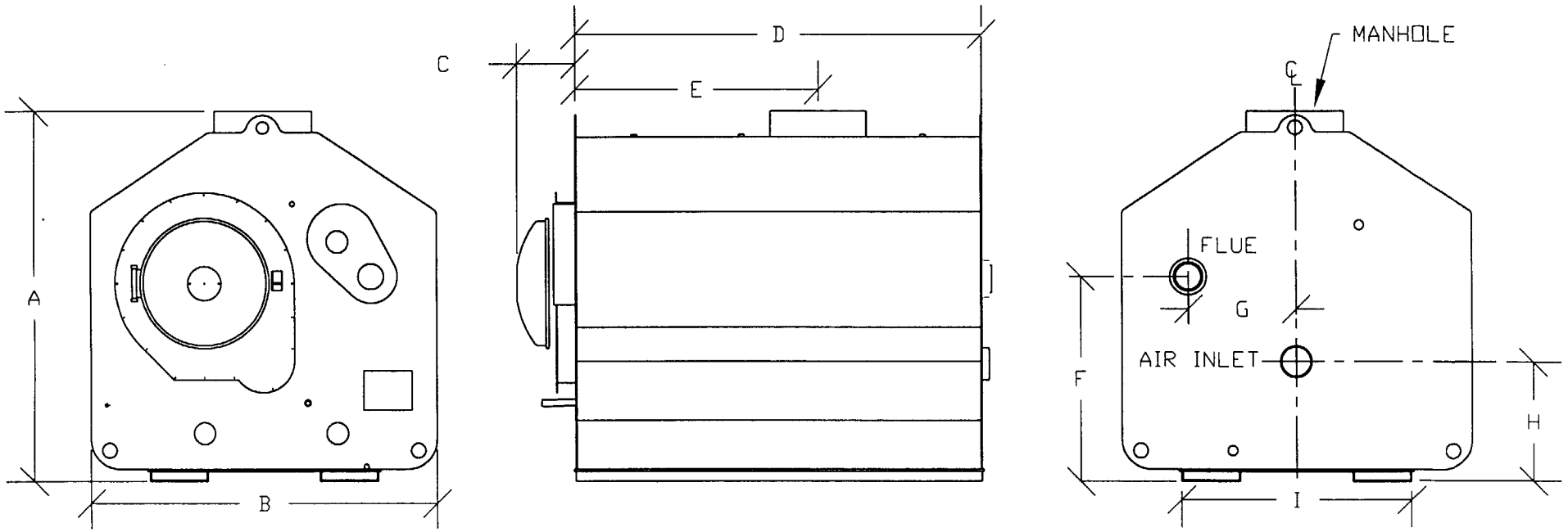
An internal overflow/vent will prevent the development of internal pressure that could result from the gentle expansion and contraction associated with the varying temperature of water storage. In cases when accidental over firing results in rapid boiling, the manway cover is designed to raise slightly to relieve internal pressure and vent water vapor.





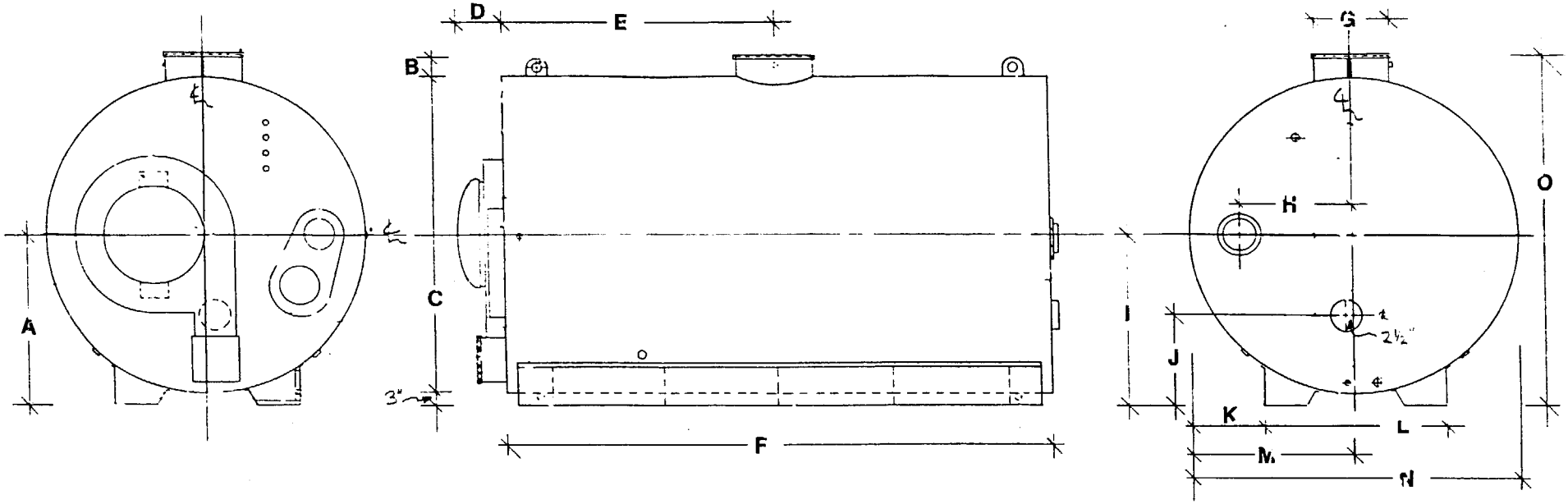
DIMENSION	WHS-1500	WHS-2000
A	37"	37"
B	5"	5"
C	69 1/2"	69 1/2"
D	12"	12"
E	48"	48"
F	96"	120"
G	20"	20"
H	22"	22"
I	44" w/o foam	44" w/o foam
J	24" w/o foam	24" w/o foam
K	13 3/4"	13 3/4"
L	42"	42"
M	34 3/4"	34 3/4"
N	69 1/2"	69 1/2"
O	78"	78"
Fuel opening diameter	18"	18"
Overall Length	110"	134"

WHS SPECIFICATIONS		
	WHS - 1500 (Round)	**WHS-2000 (Round)**
Diameter	69 1/2 "	69 1/2 "
Height	78 "	78 "
Tank Length	96 "	120"
Overall Length	110"	134"
Recommended wood length	24" to 32"	24" to 32"
Recommended wood diameter	3" to 10"	3" to 10"
Weight - empty	3,000 lbs.	3,900 lbs.
Weight - filled	15,500 lbs.	20,600 lbs.
Nominal gallons of storage	1,496 gallons	1,870 gallons
NPT Supply and return flanges	1 1/2" or 2"	1 1/2" or 2"
Draft inducer motor	1/2 HP	3/4 HP
Electrical requirements	115 VAC, 9 amps	115 VAC, 11 amps
Flue collar and flue	6" dia. DuraTech Class A, 2100F HT	6" dia. DuraTech Class A, 2100F HT
Air intake fitting	7" dia. screened hood	7" dia. screened hood
Combustion chamber length	42"	42"
Nominal Combustion chamber diameter	25" firebrick lined	25" firebrick lined
Height to chamber opening	39"	39"
Average BTH/HR into storage	350,000 (fuel dependent*)	425,000 (fuel dependent*)
Approx. BTU's/degree of water temperature change	12,476	15,270
*Figures based on split, 24" oak with 17% moisture and reloading once/hour.		
MATERIAL SPECIFICATIONS		
Tank shell - mild steel (MS)	7 GA	7 GA
Front and back heads - MS	3/16"	3/16"
Combustion chamber shell - MS	3/16"	3/16"
Blower housing components - MS	3/16"	3/16"
Door spinnings		
Outer - MS	12 GA	12 GA
Middle - Galvanized Steel	16 GA	16 GA
Inner - 304 Stainless Steel	16 GA	16 GA
Element box - MS	3/16"	3/16"
Skids - MS	10 GA	10 GA
Heat exchanger tubing	Welded Steel Boiler Tube	Welded Steel Boiler Tube
All welding conforms to AWS specifications. All seams, joints, etc., exposed to water are welded to prevent crevice corrosion.		



DIMENSION	WHS-1450	WHS-1900
A	75 1/4"	75 1/4"
B	71 1/4"	71 1/4"
C	12 1/2"	12 1/2"
D	84 1/2"	108 1/2"
E	50 1/2"	50 1/2"
F	42"	42"
G	22 7/8"	22 7/8"
H	24 1/2"	24 1/2"
I	47"	47"
Fuel Opening Diameter	18"	18"
Overall Length	100"	121"

WHS SPECIFICATIONS		
	WHS - 1450 (Rectangular)	**WHS-1900 (Rectangular)**
Over Width	72"	72"
Overall Height	77"	77"
Tank Length	84 1/2"	108 1/2"
Overall Length	101"	125"
Recommended wood length	24" to 32"	24" to 32"
Recommended wood diameter	3" to 10"	3" to 10"
Weight - empty	4,100 lbs.	5,000 lbs.
Weight - filled	16,100 lbs.	20,900 lbs.
Nominal gallons of storage	1,427 gallons	1,906 gallons
NPT Supply and return flanges	1 1/2" or 2"	1 1/2" or 2"
Draft inducer motor	1/2 HP	3/4 HP
Electrical requirements	115 VAC, 9 amps	115 VAC, 11 amps
Flue collar and flue	6" dia. DuraTech Class A, 2100F HT	6" dia. DuraTech Class A, 2100F HT
Air intake fitting	7" dia. screened hood	7" dia. screened hood
Combustion chamber length	42"	42"
Nominal Combustion chamber diameter	25" firebrick lined	25" firebrick lined
Height to chamber opening	38"	38"
Average BTH/HR into storage	350,000 (fuel dependent*)	425,000 (fuel dependent*)
Approx. BTU's/degree of water temperature change	11,900	17,012
*Figures based on split, 24" oak with 17% moisture and reloading once/hour		
MATERIAL SPECIFICATIONS		
Tank shell - mild steel (MS)	7 GA	7 GA
Front and back heads - MS	1/4"	1/4"
Bottom	1/2"	1/2"
Combustion chamber shell - MS	1/4" and 3/16"	1/4" and 3/16"
Blower housing components - MS	3/16"	3/16"
Door spinnings		
Outer - MS	12 GA	12 GA
Middle - Galvanized Steel	16 GA	16 GA
Inner - 304 Stainless Steel	16 GA	16 GA
Element box - MS	16 GA	16 GA
Skids - MS	3/16"	3/16"
Heat exchanger tubing	Welded Steel Boiler Tube	Welded Steel Boiler Tube
All welding conforms to AWS specifications. All seams, joints, etc., exposed to water are welded to prevent crevice corrosion.		



DIMENSION	WHS-3200
A	46"
B	5"
C	86"
D	15"
E	72"
F	146" +/-
G	20"
H	30"
I	46" w/o foam
J	25" w/o foam
K	19"
L	48"
M	43"
N	86"
O	94"
Fuel opening diameter	25.5"
Overall Length	162" +/-

PLACEMENT OF FIREBRICK

WHS units manufactured **after December 31, 1988** incorporated an improved **"truncated V"** shape in the lower 30 degree portion of the combustion chamber. The upper portion of the new chamber remained identical to the original **WHS** chamber. The improved units were shipped with two sizes of fire brick:

- Eighteen (18) #1 splits, each brick measuring 4½" x 9" x 1¼" thick, **part #9405-1.**
- Nine (9) #2 splits, each brick measuring 4½" x 9" x 2" thick, **part #9405-2.**
- One (1) #2 split control brick measuring 4½" x 9" x 2" thick, **part #9405-2.**

Firebrick was installed at the factory. **There is no need to remove them from the unit.** Simply check to confirm that they are in proper position and have sustained no shipping damage. The thicker #2 splits were positioned on the flat bottom of the truncated V; thus, minimizing breakage due to log impact during fuel loading. The thinner #1 splits were positioned on both inclined sides of the truncated V. Three ¼" thick, flexible high temperature pads were placed between the steel combustion chamber and the fire brick. The pads provide:

- **Thermal insulation** to maintain high combustion temperatures.
- A compressible **"cushion"** to minimize brick fracture over time.

Nevertheless, some fire brick breakage will still occur as it is **normal** for brick to become more fragile with age and continued use. When significant breakage has occurred, it is necessary to replace the **old fire brick and pads** with new material (contact your GARN dealer or **DECTRA CORPORATION** for replacement items). Replacement consists of:

- **Proper** removal and disposal of existing materials. This is **NOT** to be attempted with a bed of hot coals and ash; rather, should occur only after all coals and ash have cooled to a point where they can be safely handled and removed.
- Combustion chamber cleaning.
- Installation of one new bottom and two new side pads, each measuring 12" x 40" x ¼"
- Installation of 27 new fire brick.

To install the new firebrick, begin at the front of the combustion chamber and position the 9 - #2 splits into an arrangement the measures 40½" front to rear and 9" side to side (essentially the bricks are placed transversely on the flat). The bricks are to be **centered** on the flat bottom portion of the truncated V. Next placed 9 - #1 splits on **each side** to the truncated V; the bricks should lie **against** the sloped sides of the truncated V and measure 9" in the "vertical sloped" dimension. The base of the side bricks will settle to a point approximately 1/8" below the top corner of the #2 splits. Ash will fill in any small gaps between bricks; hence, small gaps are **not** critical. After installation of the fire brick, any exposed pad can be trimmed flush with the brick utilizing a sharp knife.

Refer to the Operation Manual for the proper placement and use of the one control brick.

Review the attached multiple page MATERIAL SAFETY DATA SHEET (MSDS) regarding the safe handling of the SRC and miscellaneous gasket materials. Be sure to utilize the specified 3M or equivalent air purifying respirator while handling any of this material. Only work with these materials outdoors as the resultant powder can be extremely irritating.

SECONDARY REACTION CHAMBER – part #9300

The Secondary Reaction Chamber (SRC) is manufactured from a vacuum formed, machined and cured high temperature, low mass fibrous material (**not** asbestos) with the following approximate dimensions: 10" OD; 8" ID; and overall length of 24" or 32" (depending upon WHS model). The SRC is located at the **rear** of the primary combustion chamber and may be composed of one, two or three sections; however, it will **always** have a total length of approximately 24" to 32". The SRC performs a number of critical functions for **WHS** equipment:

- It **insulates** the unburned hot flue gasses from the relatively cool temperature of the water storage.
- It induces proper **turbulent mixing** of the unburned hot flue gasses with secondary air so that secondary combustion can occur.
- It provides significant **retention time** for the unburned hot flue gasses and secondary air to flash into flame, consuming smoke and releasing additional energy thus increasing overall efficiency.

The reaction chamber was installed at the factory. **There is no need to remove it from the unit**. Simply check to confirm that it is in proper position and has sustained no shipping damage.

Without the SRC (or with a severely damaged SRC), overall efficiency would drop, the **WHS** unit would smoke continuously and produce significant creosote. The SRC is always installed at the factory; however, it should be checked to confirm that it is in proper position and has sustained no shipping damage.

The SRC will last many years; however, during the course of normal use it may be accidentally damaged during wood fuel loading. When the front 2" to 3" of the SRC is significantly damaged the front (8", 12" or entire 24" or 32") section should be replaced. Contact the manufacturer or your local dealer to obtain OEM replacement parts – **DO NOT SUBSTITUTE** as a hazardous condition may result.

Refer to the next Section for detailed information regarding replacement of the SRC.

REPLACING THE SECONDARY REACTION CHAMBER (SRC)

The reaction chamber consists of a 24" to 36" long vacuum formed, dried and hardened ceramic tube that is inserted within a steel cylinder at the back of the primary combustion chamber. Occasionally, the ceramic reaction chamber may have to be replaced due to the physical damage that results from the impact of thrown wood during fuel loading. Because of thoughtful good design, replacement is a **very easy process.** In many instances, only the first 12" long section (nearest the main combustion chamber) of the reaction chamber will require replacement.

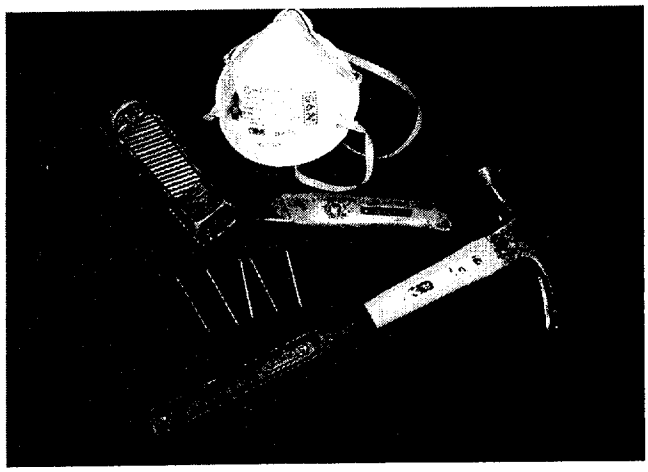
Replace the ceramic reaction chamber with one specifically manufactured for the GARN WHS equipment that you have. Replacements may be obtained from a GARN dealer at moderate cost.

DO NOT INSTALL REACTION CHAMBERS THAT ARE INCORRECTLY SIZED, DAMAGED OR ADAPTED FROM OTHER HEATING PRODUCTS BECAUSE OF POSSIBLE CREOSOTE FORMATION AND FIRE HAZARDS.

DO NOT OPERATE THE GARN UNIT WITHOUT A REACTION CHAMBER BECAUSE OF CREOSOTE FORMATION AND FIRE HAZARDS.

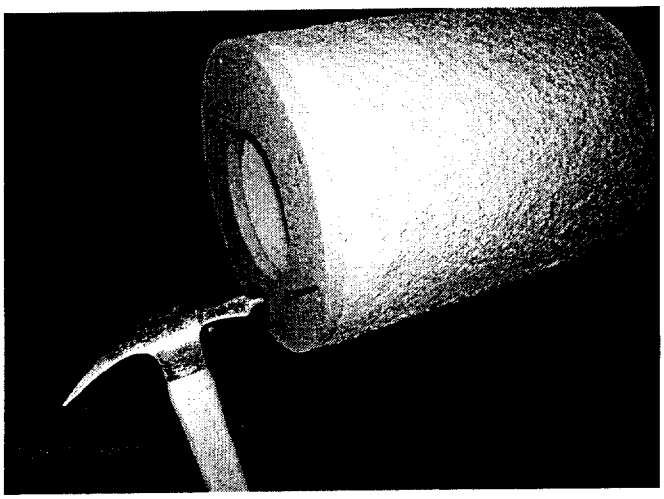
The reaction chamber is manufacture in 8" to 12" long sections. These ceramic inserts are designed to allow a **maximum 1/8" to 3/16" total OD clearance** between the OD of the ceramic and the ID of the steel cylinder. Because of the manufacturing process involved, the ID is controlled precisely. The OD is much more difficult to control; thus, some field "trimming and fitting" may be required in order to have the cylinders slide into the steel tube. Trimming of the OD is easily accomplished with coarse sand paper (40 grit), a rough file or a SUR-FORM® file. If the OD is such that the ceramic cylinders slide into place **easily,** then no trimming is required. The tools that may be required are shown below:

- 3M or equivalent face mask
- SUR-FORM® file
- Hammer
- 4 to 6 nails
- Utility knife
- Sand paper or
- File

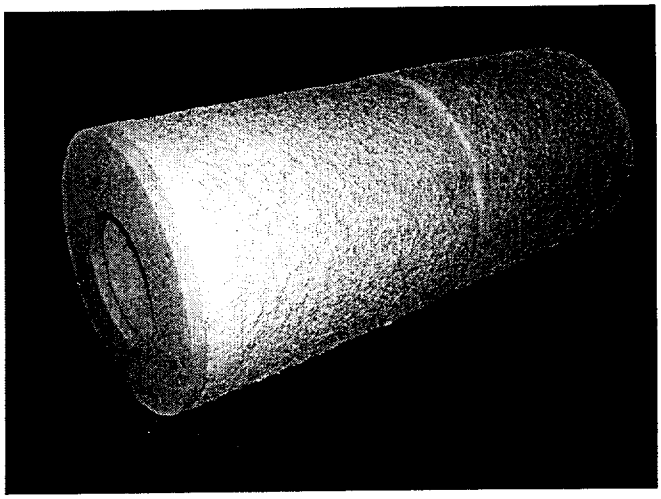


Review the attached multiple page MATERIAL SAFETY DATA SHEET (MSDS) regarding the safe handling of the gasket material. Be sure to utilize the specified 3M or equivalent air purifying respirator while handling and fabricating this material. All trimming or cutting must be done outdoors and NOT in a closed area or indoors.

Reaction Chamber End Gasket: The body of the cylindrical reaction chamber insert is supplied in two to three preformed, cylindrical sections. However, the doughnut shaped end gasket must be cut from the 1/2" thick, flat gasket material (10" OD and 5" ID). Using a sharp knife or a hack saw blade, simply cut a new end gasket to match the existing end gasket. Use masking tape or several 1.5" long nails to fasten the end gasket to the reaction chamber insert. Slide the unit into final position. Once in place, neither the tape nor the nails are required to align the end plate. Refer to picture below:



When sections of the reaction chamber are set end-to-end the grouping should look like this:



Procedure for Replacement: Remove all ash from the combustion chamber in **strict compliance** with the Maintenance Section of the Operator's Manual. Remove the damaged sections of the reaction chamber by sliding them forward into the combustion chamber. Properly dispose of the damaged pieces. Use a brush or a shop vac to clean the steel tube in which the ceramic chamber rests. Insert the new chamber be simply sliding the sections into the steel tube. The sections should slide easily and are held in place by gravity. Slide each section into the steel tube individually. The SRC section with the attached end plate should be slide into the steel tube first, followed by the other sections.

DO NOT INSTALL replacement ceramic sections that allow greater clearances then defined above as hot flue gas by-pass may occur leading to the formation of creosote and fire hazards.

DO NOT install a replacement reaction chamber without an end piece as creosote may form and a hazardous condition may result.

SOHIO CARBORUNDUM

MATERIAL SAFETY DATA SHEET

Sohio Emergency Phone (Toll-Free)
In Ohio: 800-362-8059
Outside Ohio: 800-321-8642
CHEMTREC Assist: 800-424-9300
Other Product Safety Info.: 216-575-8024

MANUFACTURER: Sohio Engineered Materials Company - Fibers Division
ADDRESS: P.O. Box 808, Niagara Falls, New York 14302

PRODUCT IDENTIFICATION

TRADE NAME: FIBERFRAX®

CAS NUMBER: NA
SYNONYM(S): Ceramic Fiber; Refractory Fiber; MMVF
CHEMICAL FAMILY: Vitreous Aluminosilicate Fibers
MOLECULAR FORMULA: NA
MOLECULAR WEIGHT: NA
SOHIO PRODUCT CODE: NA HIERARCHY: NA
MSDS NUMBER: AV2

PRODUCT HAZARD SUMMARY

HEALTH — WARNING!
MAY BE HARMFUL IF INHALED
MAY BE IRRITATING TO THE SKIN, EYES AND RESPIRATORY TRACT
POSSIBLE CANCER HAZARD BASED ON TESTS WITH LABORATORY ANIMALS

FIRE — NON-COMBUSTIBLE

REACTIVITY — STABLE

PRODUCT HEALTH HAZARD INFORMATION

ROUTE OF EXPOSURE — EFFECTS OF OVEREXPOSURE

INGESTION:
May cause gastrointestinal disturbances. Symptoms may include irritation, nausea, vomiting and diarrhea.

SKIN:
SLIGHTLY TO MODERATELY IRRITATING. May cause irritation and inflammation due to mechanical reaction to sharp, broken ends of fibers.

EYE:
SLIGHTLY TO MODERATELY IRRITATING. Abrasive action may cause damage to the outer surface of the eye.

INHALATION:
May cause respiratory tract irritation. Pre-existing medical conditions may be aggravated by exposure: specifically, bronchial hyper-reactivity and chronic bronchial or lung disease.

SPECIAL TOXIC EFFECTS:
Currently, there are no known chronic health effects in humans from long-term exposure to ceramic fibers.

In animal studies, refractory ceramic fibers injected into the peritoneal (abdominal) cavity have caused acute abdominal hemorrhage in hamsters but not in rats. Such injections have also produced tumors in life-time rat studies. In fact, similar results have been observed with numerous other fibrous materials. In such experiments, this abnormally sensitive injection technique is a non-physiological method of exposure, bypassing both normal pulmonary protective and clearance mechanisms.

Recently published inhalation studies have provided contradictory results. One study, which used rats as the experimental animal, reported lung damage consisting of alveolar proteinosis and interstitial fibrosis, whereas, another study using a different strain of rat, showed no similar effects.

Similarly, the pulmonary tumor-causing potential of refractory ceramic fibers in animals when inhaled is unclear. Two studies suggest a low-order potential in inducing pulmonary tumors in animals, while two other studies suggest ceramic fibers are not tumorigenic in animals.

Further animal and human health studies are planned. Pending the results of these studies, strict adherence to recommended safe work practices described elsewhere in this data sheet is advised.

FIRST AID

INGESTION:
Do not induce vomiting. Get medical attention if irritation persists.

SKIN CONTACT:
Wash area of contact thoroughly with soap and water. Do not rub or scratch exposed skin. Using a skin cream or lotion after washing may be helpful. Get medical attention if irritation persists.

EYE CONTACT:
Flush immediately with large amounts of water. Eye lids should be held away from the eyeball to ensure thorough rinsing. Do not rub eyes. Get medical attention if irritation persists.

INHALATION:
Remove affected person from source of exposure. Get medical attention.

ND = No Data
NA = Not Applicable

PERSONAL PROTECTION INFORMATION

The following personal protective guidelines should be followed, especially where engineering controls (e.g. mechanical dust collection and other means of exhaust ventilation) are not technically feasible or do not reduce airborne fiber concentrations to below 2 fibers/cc.

EYE PROTECTION:
Wear safety glasses or chemical goggles to prevent eye contact. Do not wear contact lenses when working with this substance. Have eye baths readily available where eye contact can occur.

SKIN PROTECTION:
Wear gloves, hats and full body clothing to prevent skin contact. Use separate lockers for work clothes to prevent fiber transfer to street clothes. Avoid taking unwashed work clothes home or provide disposable work clothing. Wash work clothes separately from other clothing. Rinse washing machine thoroughly after use. If clothing is to be laundered by someone else, inform launderer of proper procedures.

RESPIRATORY PROTECTION:
Use NIOSH or MSHA approved equipment when airborne exposure limits are exceeded. NIOSH/MSHA approved breathing equipment may be required for non-routine and emergency use. Ventilation may be used to control or reduce airborne concentrations. Acceptable respirators recommended for airborne ceramic fiber concentrations exceeding 2 fibers/cc are:

Concentration	Respirator Type
2.0 - 5.0 f/cc	3M 8710 or equivalent.
5.0 - 50.0 f/cc	Survivair full face piece with high efficiency filter 1090-00 or equivalent.
> 50.0 f/cc	MSA 01-00-06 full face piece type C supplied-air or equivalent. OSHA approved air source required.

Pending the results of long-term health effects studies, engineering control of airborne fibers to the lowest levels attainable is advised.

PHYSICAL PROPERTIES

BOILING POINT, C (F): NA
MELTING POINT, C (F): ND
VAPOR PRESSURE, mm Hg: NA
VAPOR DENSITY (AIR=1): NA
SOLUBILITY IN WATER, %: NA

APPEARANCE/ODOR: ND

SPECIFIC GRAVITY: ND
% VOLATILE: NA
EVAPORATION RATE (BUTYL ACETATE=1): NA
VISCOSITY, SUS: NA
POUR POINT: NA
pH: NA

FIRE AND EXPLOSION DATA

FLASH POINT, C (F): None
AUTOIGNITION TEMPERATURE, C (F): None

FLAMMABILITY LIMITS IN AIR (% BY VOL.): LOWER: NA UPPER: NA
BASIC FIREFIGHTING PROCEDURES: Use extinguishing agent suitable for type of surrounding fire.
UNUSUAL FIRE AND EXPLOSION HAZARDS: NA

REACTIVITY DATA

STABILITY/INCOMPATIBILITY:
Stable under normal conditions of use. Incompatible with hydrofluoric acid and concentrated alkali.

HAZARDOUS REACTIONS/DECOMPOSITION PRODUCTS:
NA

ENVIRONMENTAL INFORMATION

SPILL OR RELEASE TO THE ENVIRONMENT:
Where possible, use vacuum suction to clean up spilled material. Use dust suppressant where sweeping is necessary. Avoid clean up procedures that may result in water pollution. Personal safety and exposure recommendations described elsewhere in this data sheet apply to exposure during clean up of spilled material.

WASTE DISPOSAL:
This substance, when discarded or disposed of, is not specifically listed as a hazardous waste in Federal regulations; however it could be hazardous if it is considered toxic, corrosive, ignitable, or reactive according to Federal definitions (40 CFR 261). Additionally, it could be designated as hazardous according to state regulations. This substance could also become a hazardous waste if it is mixed with or comes in contact with a hazardous waste. If such contact or mixing may have occurred, check 40 CFR 261 to determine whether it is a hazardous waste. If it is a hazardous waste, regulations at 40 CFR 262, 263, and 264 apply.

The transportation, storage, treatment, and disposal of this waste material must be conducted in compliance with all applicable Federal, state, and local regulations.

ADDITIONAL ENVIRONMENTAL REGULATORY INFORMATION:
There may be specific regulations at the local, regional or state level that pertain to this material.

SPECIAL PRECAUTIONS/SUPPLEMENTAL INFORMATION

HANDLING/STORAGE:
Product which has been in service at elevated temperatures (greater than 1600 F) may undergo partial conversion to cristobalite, a form of crystalline silica which can cause severe respiratory disease--"Pneumoconiosis". The amount of cristobalite present will depend on the temperature and length in service.

The permissable exposure limit (PEL) for mineral dusts containing cristobalite is determined by one half the value calculated from the mass formula, $(10\ mg/M^3)/(\%\ SiO_2 + 2)$, i.e. 18% cristobalite; $1/2(10)/(18+2) = 0.25\ mg/M^3$ (OSHA 1978). Particular care should be taken when working with "used" material to minimize generation of dust. When

removing and handling ceramic fiber used in high temperature applications, special caution should be taken to avoid unnecessary cutting and tearing of the used material to minimize generation of airborne dust. Use NIOSH or MSHA approved equipment when airborne exposure limits may be exceeded, especially in confined areas with inadequate ventilation or other areas. Acceptable respirators recommended for given airborne cristobalite concentrations are:

Concentration	Respirator Type
Up to 10 times PEL	3M 8710 or equivalent.
10 to 100 times PEL	Survivair full face piece with high efficiency filter 1090-00 or equivalent.
> 100 times PEL	MSA 01-00-06 full face piece type C supplied-air or equivalent. OSHA approved air source required.

TRANSPORTATION REQUIREMENTS

D.O.T. HAZARD CLASS (49 CFR 172.101): NA
D.O.T. PROPER SHIPPING NAME (49 CFR 172.101): NA
D.O.T. LABELS REQUIRED (49 CFR 172.101): NA
D.O.T. PLACARDS REQUIRED: NA
BILL OF LADING DESCRIPTION: ND
UN/NA CODE: NA

INGREDIENT/HEALTH HAZARD INFORMATION

COMPONENT	CAS NO.	%	EXPOSURE LIMITS - REFERENCE
Aluminosilicate (vitreous)	NA	99+	2 fibers/cc TWA (SOHIO)*; 10 fibers/cc CL (SOHIO)*
Remaining components not determined hazardous and/or hazardous components present at less than 1.0% (0.1% for carcinogens).	Mixture	Trace	NA

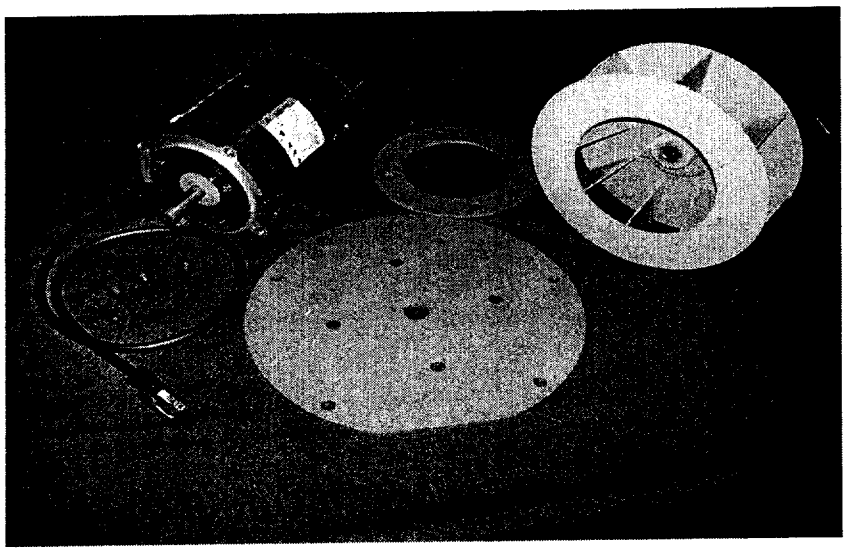
*Pending the results of chronic health effects studies, airborne exposures should be controlled at or below the SOHIO recommended exposure limit listed above.

REVISION DATE: 9/20/85 COMPLETED BY: G. R. Krautter
REPLACES SHEET DATED: 2/15/85 APPROVED BY: RWMast

ND = No Data
NA = Not Applicable

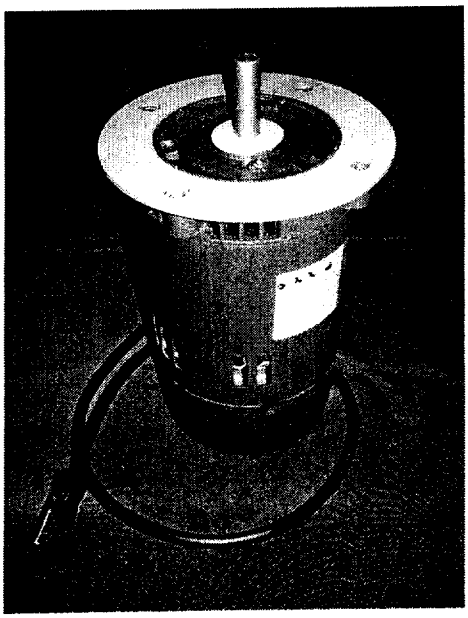
INDUCED DRAFT FACE MOUNTED BLOWER ASSEMBLY – part #8100F

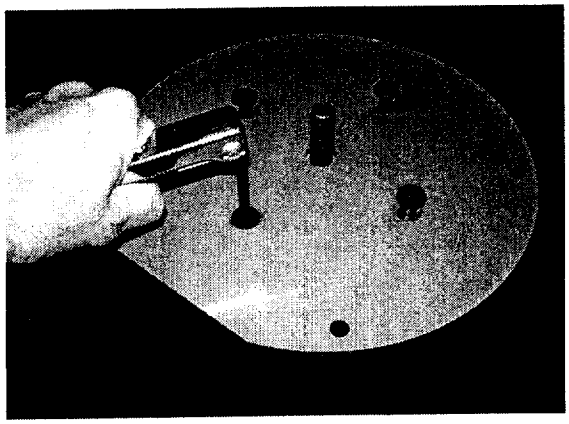
Locate, carefully unpack, layout and become familiar with the following bower assembly components: motor; motor mount plate; motor mount spacer ring (donut); four (4) motor mounting screws (flat allen head screws); radial blade blower wheel; power cord – attached to the motor; motor mount gasket (approximately 12" in diameter x ½" thick); upper clean out cover; upper clean out gasket (approximately 9" in diameter x ½" thick); and exhaust gas thermometer (50 F to 550 F temperature range). **DO NOT DROP THE MOTOR or BLOWER WHEEL** as permanent **non-repairable** damage will occur.



Place the motor mount spacer ring over the shaft end of the motor aligning the bolt holes with the threaded sockets n the motor body. See below.

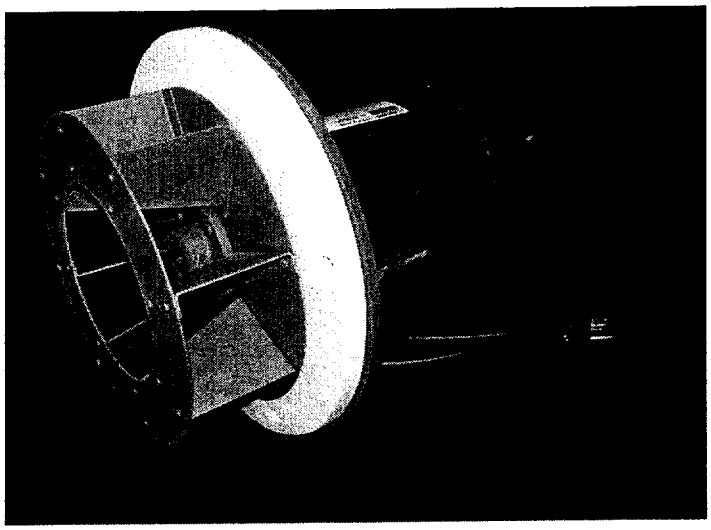
Place the motor mount plate over the shaft end of the motor and align the counter sunk holes with the motor spacer ring and the threaded sockets n the motor body. The prime painted face of the plate and the counter sunk holes should be facing **AWAY** from the motor body. Insert the four (4) allen had screws and tighten securely. See below.





Slide the motor mount gasket over the shaft so that it aligns with the holes and perimeter flat of the motor mount plate.

Apply high temperature anit-seize lubricant to the motor shaft and slide the blower wheel onto the shaft, making sure that the keyway notch in the blower wheel hub aligns with the key on the motor shaft. Position the blower wheel so that the back surface of the hub is 1/8" clear of the motor mount gasket. The blower wheel should turn freely without touching the gasket. Tighten the wheel to the shaft with the appropriate allen wrench (not supplied). Note that there are two (2) allen screws to be tightened, located 90 degrees apart in the blower hub. **BOTH ALLEN SCREWS MUST BE TIGHTENED.** See below.



Align the perimeter flat of the motor mount gasket with the flat of the motor mount plate. Lift and position the blower assembly and slide it into position on the five (5) mounting studs in the blower housing located on the front head of the GARN WHS unit. Be very careful as the assembly is awkward and very heavy. Hold the assembly in place and install the five (5) 3/8" x 16 castellated nuts. Tighten the nuts securely, compressing the motor mount gasket **SLIGHTLY**.

At this point **DO NOT** connect the motor to a power source. Manually rotate the blower wheel by hand (access is through the upper clean out port) to make sure there is no contact between the blower wheel and the blower housing. If there is contact, remove the blower assembly and repeat the assembly procedure, adjusting the clearance between the blower wheel and the motor mount gasket to prevent blower wheel to blower housing interference.

After the blower assembly is mounted properly in the blower housing, the motor shaft should rotate **CLOCKWISE** when observed from the front of the GARN WHS unit.

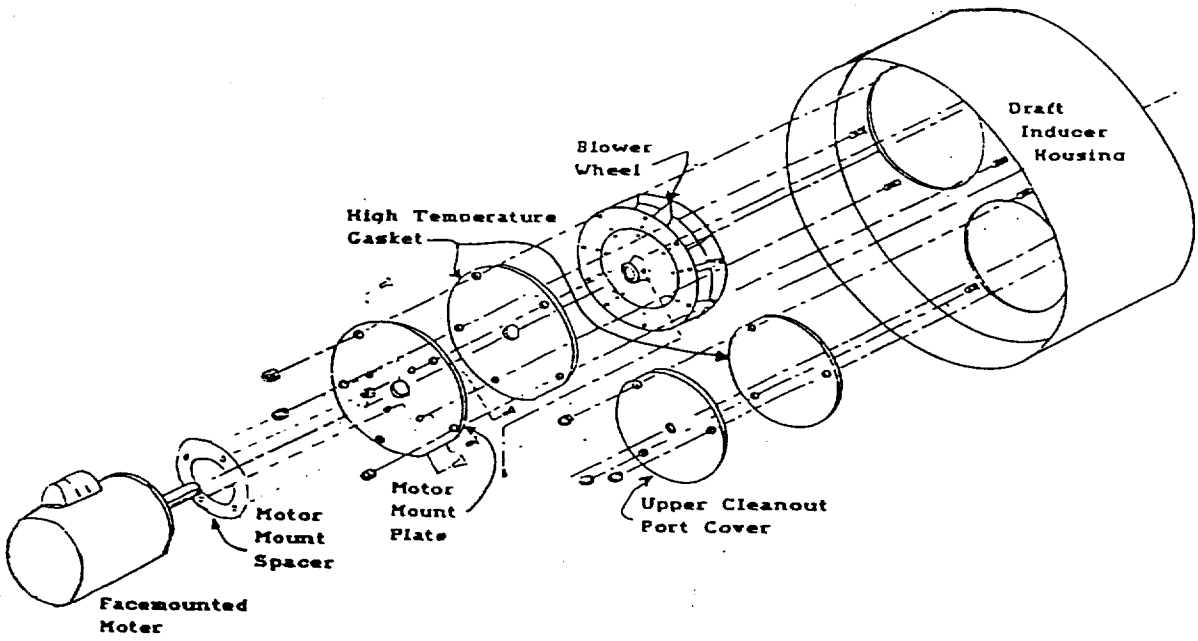
Position the upper clean out gasket and upper clean out cover on the blower housing (this assembly can only fit onto the blower housing in one position because of the unequal stud spacing). Hold the assembly in place and install the three (3) 3/8" x 16 castellated nuts. Tighten the nuts securely, compressing the gasket **SLIGHTLY**. The exhaust gas thermometer should be threaded into the NPT flange located in the center of the upper clean out cover plate. Hand tighten snugly, but do not over tighten as damage to the thermometer will occur.

It is now safe to temporally plug the blower motor into a 15 amp 120 vac power source to check motor operation. The motor and blower should operate at 3450 rpm without any rubbing noise. **Significant** air flow should be felt exiting from the exhaust flue at the rear of the GARN WHS unit.

The part numbers of the induced face mount blower assembly components are:

• Motor, ½ hp x 3540 rpm	8026
• Power Cord, 14/3 type SJ x 44" long	8028
• Blower wheel, 8 3/16" diameter x 3"	8073
• Motor mount plate, 12" diameter	5116
• Motor mount spacer ring	5117
• Upper clean out cover plate, 9" diameter	5120
• Motor mount screws, 4 total - 3/8" x 16	8223
• Motor mount gasket, 12" x ½"	9131
• Upper clean out gasket, 9" x ½"	9135

A rough isometric of the assembly sequence is shown below:

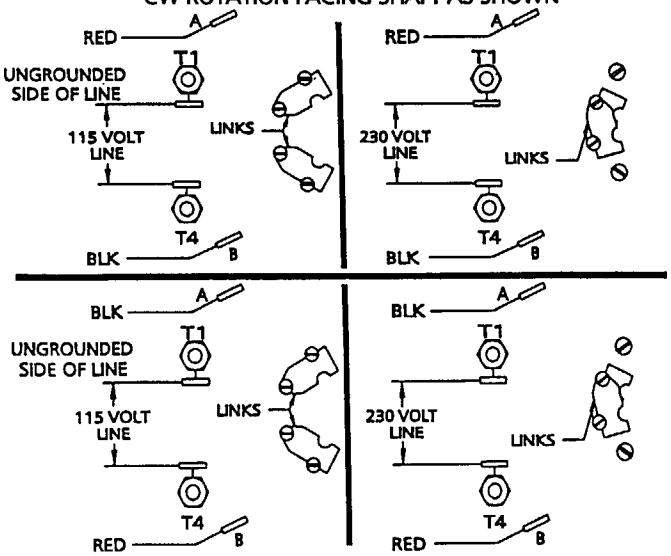


READ THIS FIRST !!

Read enclosed "Motor Installation and Maintenance" Pamphlet.
Read entire nameplate carefully.
Heed all Warnings.
This motor not suitable for use in hazardous or explosive locations.
Always be sure that motor is connected for proper voltage and rotation before energizing.

Motor Connection Diagrams

CW ROTATION FACING SHAFT AS SHOWN



CCW ROTATION FACING SHAFT AS SHOWN

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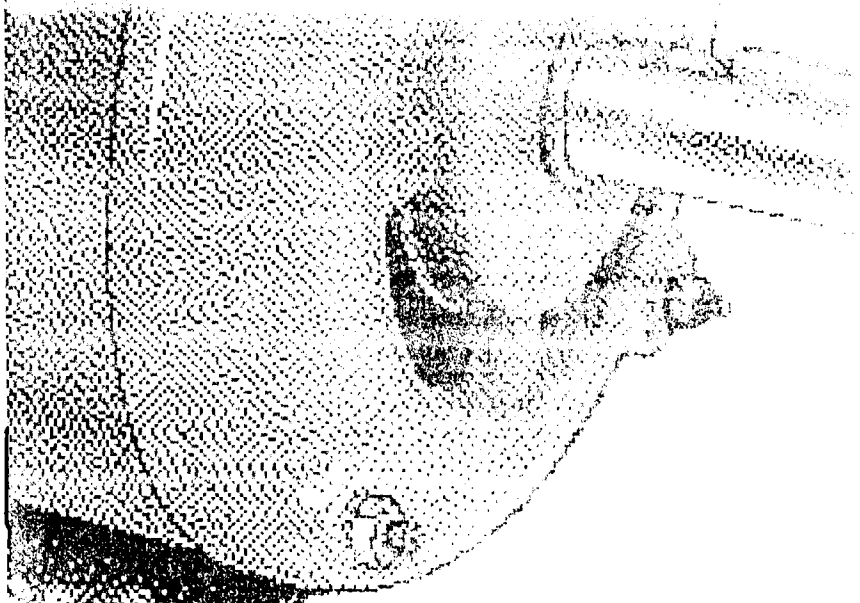
Dayton Fractional HP Motors

ENGLISH

Motor Installation and Maintenance Information



Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

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Initial Inspection and Handling

- After opening carton, look for concealed damage. If concealed damage is found, immediately file claim with carrier.
- Check the nameplate to verify that data conforms to specifications of motor ordered.

⚠ DANGER ***High voltage and moving parts around motors and motor driven equipment can cause serious or fatal injuries. Always disconnect power source before working on a motor or its connected load. Installation must conform to all OSHA requirements, and the National Electrical Code (NEC) in the United States, and all local codes.***

Electrical – Motor must be securely and adequately grounded by wiring with a grounded metallic conduit, or other grounding method approved by the NEC and local codes.

Insulate all connections carefully to prevent grounding or short circuits. Reinstall all conduit and terminal box covers. Do not force connections into the conduit box.

Thermal Protection – Use thermally protected motors or a motor starter incorporating thermal overload protection wherever required by safety regulations such as NEC or Underwriters Laboratories (UL) Standards in the United States; or where overloading, jamming or other abnormal operating conditions may occur. Under low temperature conditions, manual reset protectors may reset automatically, causing motor to start unexpectedly. **Always disconnect power before working on equipment.**

Mechanical – Guard all moving parts. Remove the shaft key before running the motor without a connected load. Be careful when touching the exterior of an operating motor! Motor may be hot enough to be painful or cause injury. This condition is normal for most motors when operated at rated load and voltage. Do not use the motor in a hazardous location as defined by Article 500 of the National Electrical Code (NEC).

Storage – Motor should be stored indoors in a clean, dry location.

Location

- Open, Dripproof Motor – Clean dry locations with access to an adequate supply of cooling air.
- Totally Enclosed Motor – Harsher environments where damp and dirty conditions may exist. Totally enclosed motors are not water-proof.
- Use only UL listed Hazardous Location motors for service in Hazardous Locations as defined in Article 500 of the NEC.
- Temperature around the motor should not exceed 104°F (40°C). Minimum temperature is –20°F (–29°C).
- If the motor nameplate indicates "Air-Over, Cont. A.O.,' etc., the motor must be mounted in the air stream of an air moving device.

⚠ CAUTION ***Not for fans in unattended areas. Refer to the following for proper thermal protection, and other motor selection information.***

UL 507 STANDARD – FANS FOR USE IN UNATTENDED AREAS (PARAGRAPHS 125 & 126)

Any motor used in a fan product, such as bathroom exhaust fans, wall-insert fans, ceiling-insert fans, attic exhaust fans, whole house fans and duct fans, etc., which are built into or within the building structure and which are likely to operate unattended or in situations in which the operator may not detect a locked rotor (stalled motor) condition must have either a manual reset thermal protector or a thermal cut-off (one-shot) device. Rangehoods, circulating fans, pedestal fans and ceiling suspended fans are not included. Agricultural fans are included, if they are built into the building structure and are likely to operate unattended or in situations in which the person operating the fan may not detect a locked rotor (stalled motor) condition.

Power Source

- Voltage, frequency and phase of the power supply must correspond to that shown on the motor nameplate. Low voltage can reduce performance and cause overheating.
- On three-phase power, voltages on all three lines should be balanced within 1%. Unbalanced voltages cause motor overheating and poor performance.

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Motor Control Devices

- Use of a suitable motor starting device is advisable and usually required by local electrical codes.
- Power supply must have fuses or circuit breakers to provide short circuit protection for the motor and controller.
- Where a motor starter is used, follow the control manufacturer's recommendations on heater selection or setting. If an existing controller is to be used with a replacement motor, new heaters may be required.
- Any switching device used to control motor must have a horsepower rating equal to or greater than the motor.
- An electronic adjustable speed control must not be used unless the motor has been specifically designed for such applications.

Motor Mounting

Motor must be securely fastened to prevent vibration and minimize noise. For secure mounting use high-quality bolts of the largest possible diameter.

Where possible, sleeve bearing motors should be mounted with oil ports up and accessible.

Belt-drive sheaves must be in-line. Use a straight edge to check. Do not overtighten belts.

Direct-coupled installations require a careful check of shaft and coupling alignment. Shim motor base as necessary. Do not depend on a flexible coupling to compensate for misalignment.

Table A – Minimum Wire Sizes for Three-Phase Motors

Motor	25 to 50 Feet			100 Feet			150 to 200 Feet		
HP	200V	230V	460V	200V	230V	460V	200V	230V	460V
1/8	14(18)*	14(18)*	14(18)*	14(18)*	14(18)*	14(18)*	14(16)*	14(16)*	14(18)*
1/6	14(18)*	14(18)*	14(18)*	14(18)*	14(18)*	14(18)*	14	14(16)*	14(18)*
1/4	14(18)*	14(18)*	14(18)*	14(16)*	14(18)*	14(18)*	14	14	14(18)*
1/3	14(18)*	14(18)*	14(18)*	14(16)*	14(16)*	14(18)*	12	14	14(18)*
1/2	14(16)*	14(18)*	14(18)*	12	14(16)*	14(18)*	10	12	14(18)*
3/4	14(16)*	14(16)*	14(18)*	12	14	14(18)*	10	10	14(16)*
1	14	14(16)*	14(18)*	12	12	14(18)*	8	10	14(16)*
1½	12	14	14(18)*	10	10	14(16)*	6	8	14
2	12	12	14(18)*	8	10	14(16)*	6	6	12
3	10	12	14(18)*	6	8	14	4	6	12

NOTE: NEC Article 310-5 Minimum conductor size for General Wiring at 115-440VAC is No. 14AWG.

Connecting Power to Motor

To connect motor for proper voltage and rotation, refer to the connection diagram on the nameplate or inside the terminal/conduit box.

Table B – Minimum Wire Sizes for Single-Phase Motors

Motor	25 Feet		50 Feet		100 Feet		150 feet		200 feet	
HP	115V	230V	115V	230V	115V	230V	115V	230V	115V	230V
1/8	14(18)*	14(18)*	14	14(18)*	12	14(18)*	10	14(16)*	8	14
1/6	14(16)*	14(18)*	12	14(18)*	10	14(16)*	6	14	6	12
1/4	14	14(18)*	10	14(16)*	8	14	6	12	4	10
1/3	14	14(18)*	10	14(16)*	8	14	6	12	4	10
1/2	12	14(18)*	8	14	6	12	4	10	3	8
3/4	10	14(16)*	6	12	4	10	2	8	1	6
1	10	14(16)*	6	12	4	10	2	8	1	6
1½	8	14	6	12	3	8	1	6	1/0	6
2	8	14	4	10	2	8	1/0	6	2/0	4
3	6	12	3	8	1/0	6	2/0	4	4/0	3

NOTE:

- NEC Article 310-5 — Minimum conductor size for general wiring at 115-440VAC is No. 14AWG.
- Above wire sizes based on approximate 5% voltage drop during starting; copper conductors; and 75°C type THHW, THW, THWN, RH, RHW insulation, etc. For aluminum wire, increase two wire size steps minimum. See NEC Article 310 for ampacities of aluminum conductors.
- Type S, SO, SJ, SJO, etc. flexible cable wire sizes. See NEC Article 400 for ampacity.

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⚠WARNING ***All aspects of the installation must conform to the requirements of the NEC, including Article 430 (Motor Circuits and Controllers), and all local codes.*** *Wherever possible, each motor should be powered from a separate circuit of adequate capacity to keep voltage drop to a minimum during starting and running. Increase wire size where motor is located a distance from the power source. Wire size must be adequate to minimize voltage drop during starting and running. Refer to Tables A and B for suggested wire sizes. Distances shown are one-way between source and motor. Portable cords, if used, should be as short as possible to minimize voltage drop. Long or inadequately sized cords, especially on hard starting loads, can cause motor failure. All electrical connections in system must be secure to prevent voltage drop and localized heating.*

- Determine direction of rotation before connecting driven equipment to prevent damage.
- To prevent bearing damage, do not strike shafts with hammer or other tool.
- If the motor has been damp or wet, have motor serviced by a qualified motor repair shop before operating.

Starting Motor

Be sure motor is properly grounded.

Connect motor to load and run briefly. Check for unusual noises and vibration (see Troubleshooting). Check motor current; it should be close to nameplate.

Visually re-inspect the installation. Make sure that the guards and other protective devices are securely in place. All covers and gaskets must be re-installed to minimize the entry of dirt and moisture.

⚠ DANGER ***Before performing any maintenance, disconnect power and allow motor to come to a complete stop. Discharge capacitors, if any, for safety.***

Recommended Maintenance

Remove dirt accumulations in and around vent openings, by vacuuming. Dirt **accumulations can cause motor overheating and a fire hazard.** Enclosed motors can be cleaned with an air jet; wear eye protection.

Periodically inspect the installation. Check for dirt accumulations; unusual noises or vibration; overheating; worn or loose couplings, sheaves and belts; high motor current; poor wiring or overheated connections; loose mounting bolts or guards; and worn motor starter contacts.

Exercise caution with solvents; some solvents may attack motor insulation, finish or bearing lubricants; some are highly flammable. If solvents are used, make sure area is well ventilated.

Sleeve bearing motors require periodic reoiling. Follow reoiling instructions on the motor (See nameplate or terminal box cover). If instructions are not included, re-oil continuous duty units once a year, intermittent duty units every two years and occasional duty units every five years with 30 to 35 drops of SAE No. 20 non-detergent or electric motor oil. Do not overlubricate.

Dayton ball bearing motors are pre-lubricated at the factory and do not require relubrication.

Troubleshooting

This chart suggests common answers to electric motor problems. The information is not all-inclusive and does not necessarily apply in all cases. When unusual operating conditions, repetitive failures, or other problems occur, consult an electric motor service firm for assistance.

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Symptoms	Possible Cause(s)	Corrective Action
Motor fails to start	Blown fuses	Replace with time-delay fuses. Check for grounded winding
	Tight shaft	Occasionally during shipment a sleeve bearing motor may be received with a shaft which does not rotate freely. It may be necessary to strike the motor, at the shell/endshield rabbet, with a rawhide or plastic mallet to align the bearings
	Voltage too low at motor terminals due to line drop	Consult local power company. Increase wire size (refer to Tables A & B). Check for poor connections
	Overload in motor starter tripped	Check and reset overload relay in starter. Check heater rating against motor nameplate current rating
	Overload (internal thermal protector) tripped	Check motor load. If motor has an automatic or manual reset thermal protector, check if tripped
	Improper line connections	Check connections against diagram supplied with motor
	Motor may be overloaded	Reduce load or increase motor size
	Defective motor or starter	Repair or replace
	Not applied properly	Consult motor service firm for proper type. Use larger motor
Motor does not come up to speed or takes too long to accelerate	Voltage too low at motor terminals	Increase wire size (refer to Tables A & B). Check for poor connections. Check for voltage unbalance (3-phase)
	Starting load too high	Check load motor is carrying at start
	Excess loading; tight belts	Reduce load; increase motor size. Adjust belts
	Defective motor	Repair or replace
	Inadequate starting torque. High inertia load	Replace with larger motor
Motor stalls during operation	Overloaded motor	Reduce load or increase motor size
	Low motor voltage	Verify that nameplate voltage is maintained
Motor vibrates or is excessively noisy	Motor shaft misaligned	Realign
	Three-phase motor running single phase	Check for open circuit, blown fuses or unbalanced voltages
	High or unbalanced voltages	Check wiring connections. Consult local power company
	Worn, damaged, dirty or overloaded bearings	Repair or replace motor; check loading and alignment
	Defective winding. Bent or bowed shaft	Repair or replace
	Loose sheave or misaligned coupling	Tighten setscrew(s); realign coupling

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Symptoms	Possible Cause(s)	Corrective Action
Motor overheats while running under load	Overloaded	Reduce load; increase motor size; belts may be too tight
	Dirt blocking ventilation openings	Clean motor
	If three-phase, one phase may be open	Check lines for open phase. Check voltage with motor disconnected, one fuse may be blown
	Unbalanced supply voltage	Check for faulty connections. Voltage on all three lines should be balanced within 1%. Excessive single phase loads
	Faulty connection	Clean, tighten, or replace
	High or low voltage	Check voltage at motor, should not be more than 10% above or below rated
	Defective motor	Repair or replace

Order Replacement Parts By Calling Toll Free 1-800-323-0620

Please provide following information:

- Model Number
- Serial Number (if any)
- Part Description and Number as shown in Parts List.

Address parts correspondence to:
Grainger Parts Operations
P.O. Box 3074
1657 Shermer Road
Northbrook, IL 60065-3074

READ THIS FIRST!!

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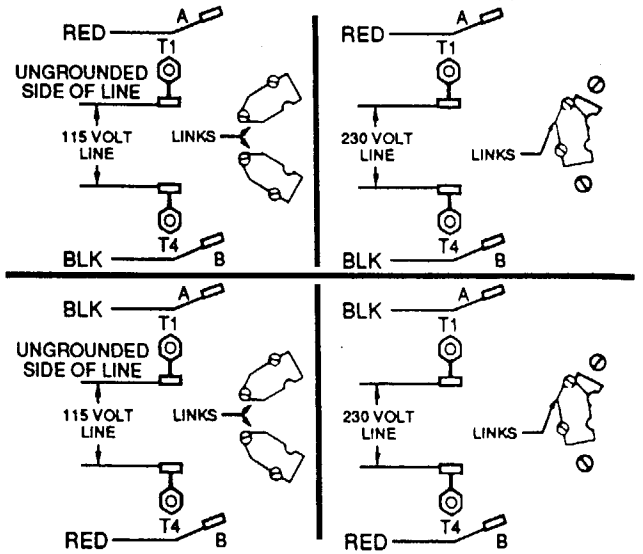
Always be sure that motor is connected for proper voltage and rotation before energizing.

Motor Connection Diagrams

CW ROTATION FACING SHAFT AS SHOWN



CCW ROTATION FACING SHAFT AS SHOWN

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Limited Warranty

ENGLISH

Dayton One-Year Limited Warranty. Electric motors are warranted by Dayton Electric Manufacturing Company (Dayton) to the original user against defects in workmanship or materials under normal use for one year after date of purchase. Any part which is determined to be defective in material or workmanship and returned to an authorized service location, as Dayton designates, shipping costs prepaid, will be, as the exclusive remedy, repaired or replaced at Dayton's option. For limited warranty claim procedures, see "PROMPT DISPOSITION" below. This limited warranty gives purchasers specific legal rights which vary from jurisdiction to jurisdiction.

Limitation of Liability. To the extent allowable under law, Dayton's liability for consequential and incidental damages is expressly disclaimed. Dayton's liability in all events is limited to and shall not exceed the purchase price paid.

Warranty Disclaimer. Dayton has made a diligent effort to illustrate and describe the products in this literature accurately; however, such illustrations and descriptions are for the sole purpose of identification, and do not express or imply a warranty that the products are merchantable, or fit for a particular purpose, or that the products will necessarily conform to the illustrations or descriptions.

Except as provided below, no warranty or affirmation of fact, expressed or implied, other than as stated in the "LIMITED WARRANTY" above is made or authorized by Dayton.

Product Suitability. Many jurisdictions have codes and regulations governing sales, construction, installation, and/or use of products for certain purposes, which may vary from those in neighboring areas. While Dayton attempts to assure that its products comply with such codes, it cannot guarantee compliance, and cannot be responsible for how the product is installed or used. Before purchase and use of a product, please review the product application, and national and local codes and regulations, and be sure that the product, installation, and use will comply with them.

Certain aspects of disclaimers are not applicable to consumer products; e.g., (a) some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you; (b) also, some jurisdictions do not allow a limitation on how long an implied warranty lasts, consequentially the above limitation may not apply to you; (c) by law, during the period of this limited warranty, any implied warranty of implied merchantability or fitness for a particular purpose applicable to consumer products purchased by consumers, may not be excluded or otherwise disclaimed.

Prompt Disposition. Dayton will make a good faith effort for prompt correction or other adjustment with respect to any product which proves to be defective within limited warranty. For any product believed to be defective within limited warranty, first write or call dealer from whom the product was purchased. Dealer will give additional directions. If unable to resolve satisfactorily, write to Dayton at address below, giving dealer's name, address, date, and number of dealer's invoice, and describing the nature of the defect. Title and risk of loss pass to buyer on delivery to common carrier. If product was damaged in transit to you, file claim with carrier.

Manufactured for Dayton Electric Mfg. Co.
5959 West Howard Street
Niles, Illinois 60714 U.S.A.

Dayton®

8S469

GARN® MANWAY COVER AND GASKET

A galvanized, spun steel manway cover **(part number 9202)** is provided with all **GARN® WHS** equipment. This manway cover serves several critical functions:

- It provides an accessible, durable **mounting** for the sensor stem.
- It is a **debris cover** for the unit.
- It is the **primary pressure relief** for the unit.
- It **minimizes evaporation** of the storage water.

An adhesive backed foam gasket (part number 9201) was factory installed on the manway cover.

The **GARN® WHS** unit is non-pressurized. As such, the gasketed manway cover is simply set upon the top surface of the manway access ring. **DO NOT FASTEN OR OTHERWISE ADHERE** the cover to the tank or access ring; likewise, do not add weight to the cover after the cover is in its final position.

An internal overflow/vent will prevent the development of internal pressure that could result from the gentle expansion and contraction associated with the varying temperature of water storage. In cases when accidental over firing results in rapid boiling, the manway cover is designed to raise slightly to relieve internal pressure and vent water vapor.

SHIPPING POSITION OF THE GARN® MANWAY COVER

In order to prevent loss and/or shipping damage, the manway cover is shipped "sandwiched" between the inner door assembly and the outer door skin on the front of the **GARN® WHS** unit.

To remove the manway cover from its shipping "position," simply grasp the inner stainless door assembly and rotate it **counterclockwise** until the assembly is free of the unit (approximately 3 to 10 full revolutions). **BE CAREFUL as this inner door assembly is very heavy – 35 to 60 pounds. DO NOT DROP** this inner door assembly as you may significantly damage the inner door. Carefully set the assembly aside and remove the manway cover. Reinstall the inner door assembly by threading it (rotating clockwise) back onto the large bolt that protrudes from the center, inside face of the outer door skin.

REPLACEMENT OF THE GARN® MANWAY COVER GASKET

Occasionally the manway cover gasket may require replacement. Carefully and fully remove the old gasket. Use a solvent such a lacquer thinner to remove all traces of the old adhesive. Carefully follow all safety precautions when using any solvent; dispose of cleaning materials such as rags so as not to create a fire hazard. **USE ONLY METAL CONTAINERS FOR THE DISPOSAL OF RAGS, ETC.**

After the flat of the manway cover is cleaned of all old gasket and adhesive, remove the paper backing for a distance of about 2" from one end of the new gasket. Align the end of the new gasket and firmly press it into position. Carefully install the remainder of the gasket around the flat while simultaneously removing the paper backing. As the gasket is slightly longer than required, cut the free end after all but the last 2" of the gasket is in position. Be sure that both ends of the gasket meet **without a gap** (a gap will leak moisture and air, significantly increasing evaporation).

ROUND DIAL THERMOMETERS

One or two thermometers will be provided with each **GARN WHS** unit. Thermometers are individually boxed and set inside of the combustion chamber for shipment. **DO NOT DROP** the thermometers as permanent internal physical damage may occur.

Water Temperature Thermometer

Is a **50F to 300 F** bi-metal, back connection unit with a 9" stem, 3" diameter dial and ½" NPT threads. This unit is to be threaded into the female flange fitting located on the front face of the tank above the air collar and fuel loading door. Install a 5" to 6" section of black steel pipe with a coupling between the thermometer and the tank flange in order for the thermometer to protrude outside of the insulation enclosure. Use pipe dope on all threads in contact with water.

OPTIONAL Flue Gas Temperature Thermometer

Is a **100 to 800 F** bi-metal, back connection unit with a 9" stem, 3" diameter dial and ½" NPT threads. This unit is to be screwed into the center ½" diameter hole in the upper clean out cover plate, just below the blower motor. **Do not use pipe dope** on this thermometer.

GARN SENSOR STEM – part #6902 for GARN WHS/ETS Controller

This sensor stem incorporates the following component into a single ½" diameter brass stem:

- UL listed float switch

This stem is used where off peak electric back up is **not** desired at the time of **GARN WHS** unit installation. If off peak is desired at some future date this stem must be replaced with **GARN Sensor Stem part #6902**. Refer to drawing on the next page for additional stem #6902 specifics.

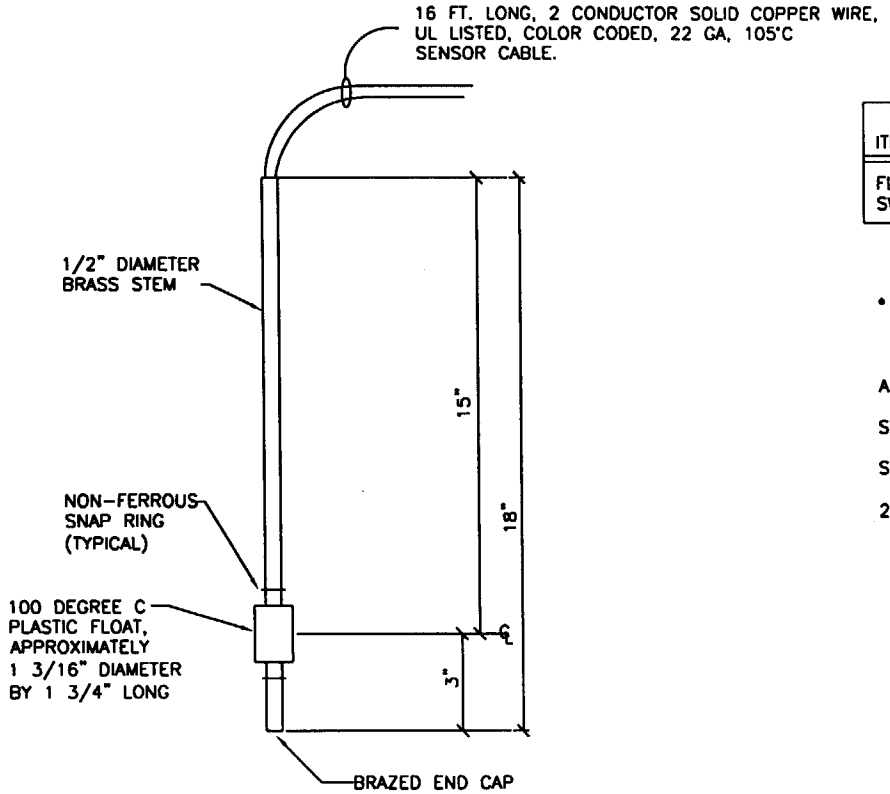
The stem is to be inserted into the 7/8" diameter hole in the center of the dished manhole cover. Simply unscrew the hexagonal plastic nut from the plastic fitting at the top of the stem, slide the nut off the black cable and insert the free end of the cable through the manhole cover from the convex side (bottom). Next, insert the threaded portion of the plastic stem fitting into the manhole cover, slide the hexagonal plastic nut back over the black cable onto the fitting and tighten snuggly.

DO NOT OVER TIGHTEN; snug is good. DO NOT DROP OR BANG the stem as permanent internal physical damage to the stem may occur.

A maximum 24 VAC operates the sensor stem. The sensor stem is to be connected as shown on the appropriate control schematic (refer to installation instructions). The 16' long black cable is rated at 104 degrees C, is to be installed **outside** of the insulation envelope and is to connect the stem with the controls (located near the induced draft blower housing). **DO NOT** kink or otherwise damage the cable during installation and check for incorrectly connected wires **before** activating the electrical power supply. **Incorrectly connected wires will cause permanent electrical damage to the stem on electrical startup.**

Tighten all wiring connections firmly. Loose connections may allow corrosion to form inhibiting good connectivity thus preventing correct component function. This sensor stem's **ONLY** function is one of safety.

- The float switch will terminate induced draft blower operation if the water level within the **GARN** unit **drops below** a non-adjustable, factory pre-set level.



ITEM	SPECS	WIRE COLOR
FLOAT SWITCH*	5 AMP, 24 VAC 100,000 CYCLES	RED AND BLACK

* FLOAT SWITCH – NORMALLY CLOSED MAGNETIC CONTACTS, OPEN UPON LIQUID LEVEL FALL.

ALL SWITCHES TO BE UL LISTED.

STEM IS USED TO MONITOR LIQUID LEVEL.

STEM IS IMMERSED IN WATER, +40°F TO +210°F.

2 CONDUCTOR CABLE SHALL BE BELDEN #9576.

SENSOR STEM

NO SCALE

6902	GARN SENSOR STEM	08/13/00	THE INFORMATION CONTAINED WITHIN THIS DRAWING IS CONFIDENTIAL. REPRODUCTION OF OR USE OF THIS DOCUMENT BY UNAUTHORIZED PERSONNEL IS STRICTLY PROHIBITED. MARTIN LUNDE	Dectra CORPORATION 3425 33RD. AVE. N.E., ST. ANTHONY, MN. 55418 612-781-3585

GARN SENSOR STEM – part #6901 for GARN WHS/ETS Controller

This sensor stem incorporates the following components into a single ½" diameter brass stem:

- UL listed float switch;
- UL listed operating thermostat;
- UL listed high limit thermostat;

This stem is used where off peak electric back up is desired either at the time of **GARN WHS** unit installation or is desired to be added at a later date. Refer to drawing on the next page for additional stem #6901 specifics.

The stem is to be inserted into the 7/8" diameter hole in the center of the dished manhole cover. Simply unscrew the hexagonal plastic nut from the plastic fitting at the top of the stem, slide the nut off the black cable and insert the free end of the cable through the manhole cover from the convex side (bottom). Next, insert the threaded portion of the plastic stem fitting into the manhole cover, slide the hexagonal plastic nut back over the black cable onto the fitting and tighten snuggly.

DO NOT OVER TIGHTEN; snug is good. DO NOT DROP OR BANG the stem as permanent internal physical damage to the stem may occur.

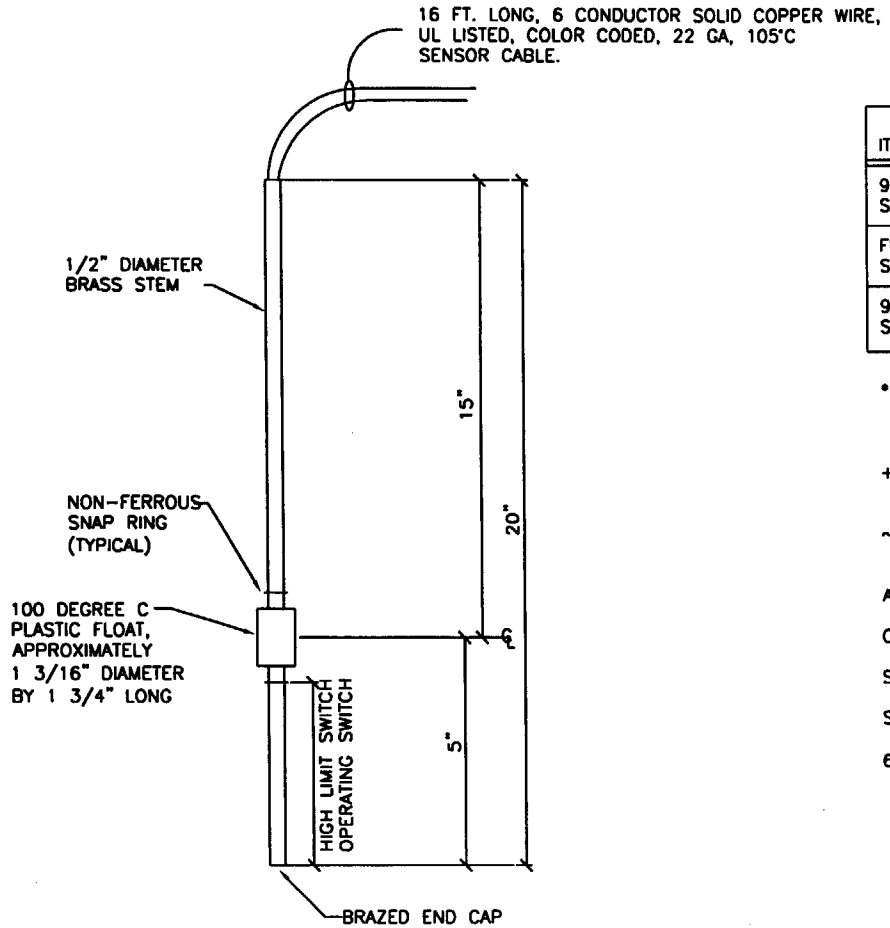
A maximum 24 VAC operates the sensor stem. The sensor stem is to be connected as shown on the appropriate control schematic (refer to installation instructions). The 16' long black cable is rated at 104 degrees C is to be installed **outside** of the insulation envelope and is to connect the stem with the controls (located near the induced draft blower housing). **DO NOT** kink or otherwise damage the cable during installation and check for incorrectly connected wires **before** activating the electrical power supply. **Incorrectly connected wires will cause permanent electrical damage to the stem on electrical startup.**

Tighten all wiring connections firmly. Loose connections may allow corrosion to form inhibiting good connectivity thus preventing correct component function. This sensor stem's main function is one of safety; however, it is not its only function:.

- The float switch will terminate induced draft blower and off peak electric back up operation, if the water level within the **GARN** unit **drops below** a non-adjustable, factory pre-set level.

- The operating thermostat will cycle the off peak electric back up elements to maintain a maximum water temperature of 90 degrees C.

- The high limit thermostat will terminate operation of the off peak electric back up elements at a maximum temperature of 95 degrees C. This would only occur if the operating thermostat fails.



ITEM	SPECS	WIRE COLOR
95°C HI LIMIT SWITCH~	5 AMP 24 VAC 100,000 CYCLES	YELLOW AND BLUE
FLOAT SWITCH*	5 AMP, 24 VAC 100,000 CYCLES	RED AND BLACK
92°C OPERT SWITCH+	5 AMP, 24VAC 100,000 CYCLES	YELLOW AND BLUE

* FLOAT SWITCH – NORMALLY CLOSED MAGNETIC CONTACTS, OPEN UPON LIQUID LEVEL FALL.

+ OPERT. SWITCH – NORMALLY CLOSED CONTACTS, OPEN UPON TEMP. RISE ABOVE 90°C.

~ HI LIMIT SWITCH – NORMALLY CLOSED CONTACTS, OPEN UPON TEMP. RISE ABOVE 95°C.

ALL SWITCHES TO BE UL LISTED.

CONNECT THE HI LIMIT SWITCH AND OPERATING SWITCH IN SERIES.

STEM IS USED TO MONITOR LIQUID TEMPERATURE AND LEVEL.

STEM IS IMMERSED IN WATER, +40°F TO +210°F.

6 CONDUCTOR CABLE SHALL BE BELDEN #9576.

SENSOR STEM

NO SCALE

6901	GARN SENSOR STEM	08/13/00	THE INFORMATION CONTAINED WITHIN THIS DRAWING IS CONFIDENTIAL. REPRODUCTION OF OR USE OF THIS DOCUMENT BY UNAUTHORIZED PERSONNEL IS STRICTLY PROHIBITED. MARTIN LUNDE	Dectra CORPORATION 3425 33RD. AVE. N.E., ST. ANTHONY, MN. 55418 612-781-3585

GARN® WHS/ETS CONTROLLER– part #6600

This is a factory assembled controller that is to be mounted slightly above and to the right of the blower housing. It is connected to a breaker protected 15 amp, 120 vac single phase dedicated circuit. Sensor stem #6901 or #6902 must be connected to this controller in order for the **GARN® WHS** unit to function as designed. This controller will **not** function unless one of the two sensor stems is properly connected and in good working order.

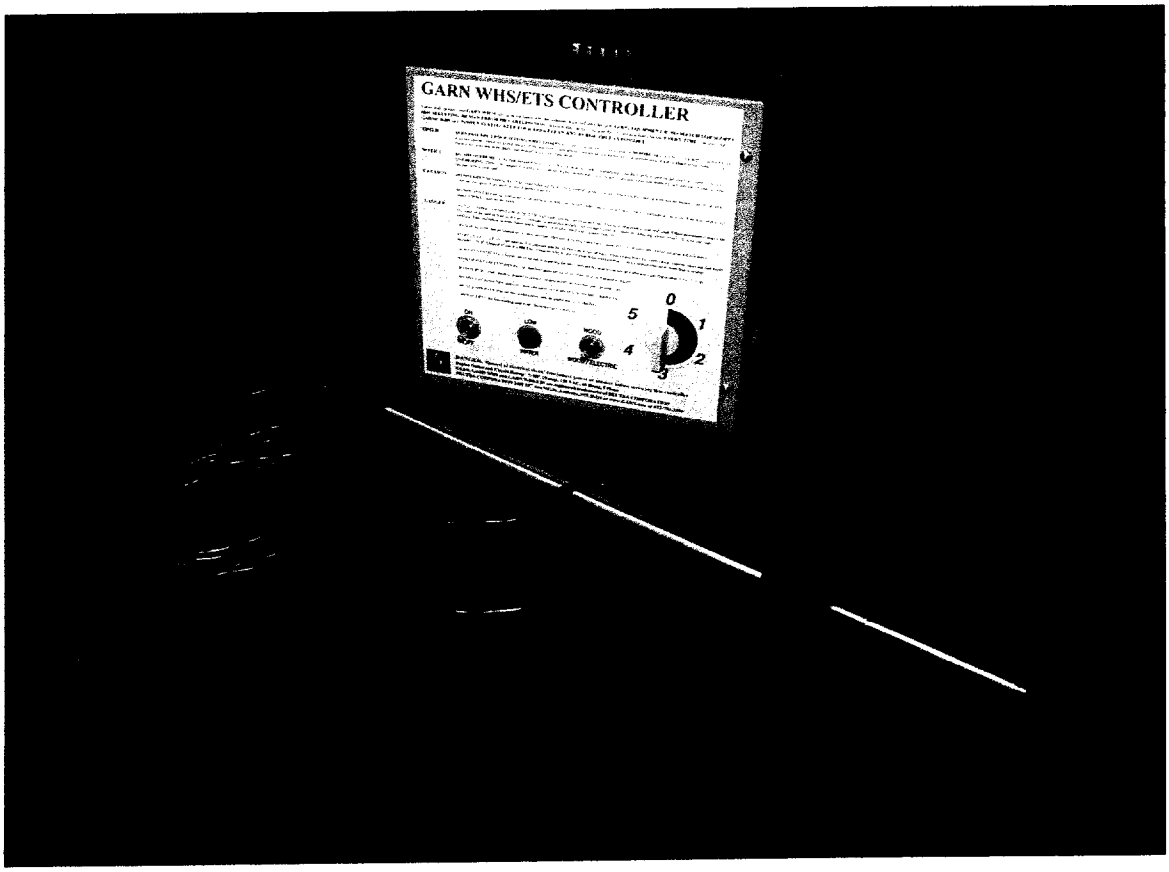
Unpacking and Assembly consist simply of removing the control from its shipping carton, carefully inspecting for damage, securely mounting the unit and connecting it to a power source. Immediately notify your GARN dealer if the controls are either missing or have been damaged in shipment.

DO NOT DROP THE CONTROLS AS PERMANENT INTERNAL DAMAGE MAY OCCUR

Installation and wiring of the controller or any electrical equipment is to be completed by a currently Licensed Electrician. All electrical equipment, fixtures and wiring must be installed in fully compliance with the National Electric Code.

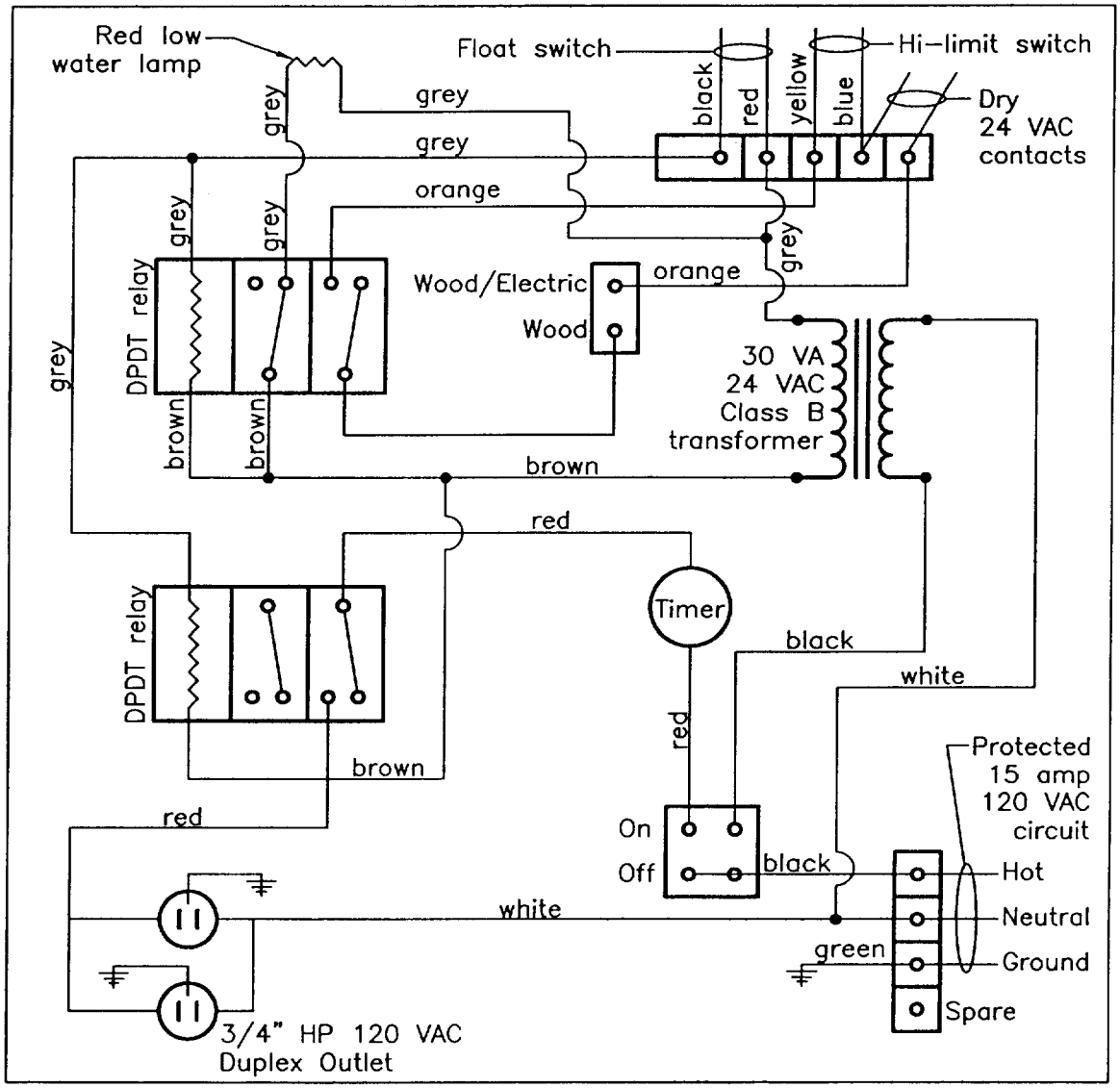
Tighten all wiring connections firmly. Loose connections may allow corrosion to form inhibiting good connectivity thus preventing correct component function.

Proper and secure grounding of **GARN® WHS** equipment is required and may prevent certain types of corrosion. Refer to the Water Treatment Chemical section of the Installation Instructions for further information.



A schematic of the controller is shown below.

DANGER: Hazard of electrical shock! Disconnect power at breaker before servicing any part of or component attached to this controller.



GARN® WHS PACKING LIST FOR MODEL _____

ORDER NUMBER_____ **SHIP DATE** _____

SERIAL NUMBER _____ **LISTING NUMBER**_____

SHIP TO: _____

STREET ADDRESS _____

CITY, STATE, ZIP _____

Component	Quantity	Shipped
• **GARN® WHS/ETS** controller	1	_____
• **GARN®** Sensor stem (float switch only)	1	_____
• **GARN®** Sensor stem (float switch and stats)	1	_____
• Plastic compression fitting and nut set	1	_____
• Water temperature thermometer, 50F to 300F	1	_____
• Blower exhaust temperature thermometer,100F to 800F	1	_____
• Manhole cover	1	_____
• Black, self adhesive 1/4" x 1" manhole cover gasket	1	_____
• Motor mounting plate with nuts and 1/2" thick gasket	1	_____
• Upper cleanout plate with 1/2" thick gasket	1	_____
• Lower cleanout plate with 1/2" thick gasket	2	_____
• Secondary combustion chamber sections	(10 1/4" OD x 12" long)	_____
• Secondary combustion chamber end plate	1	_____
• #2 fireplace splits - 4 1/2" x 2" x 9"	10	_____
• #1 fireplace splits - 4 1/2" x 1 1/4" x 9"	18	_____
• #2 fireplace split control brick	1	_____
• 550K firebrick pad, 1/4" x 9" x 41"	1	_____
• 550K firebrick pad, 1/4" x 10 1/2" x 41"	2	_____
• Steel heat shield for lower nozzle with 1/4" insulation	1	_____
• 1/2 HP face mounted motor w/4 socket head cap screws	1	_____
• Radial blade blower wheel, 9 3/16" X 3 1/4"	1	_____
• 3/4 HP face mounted motor w/4 socket head cap screws	1	_____
• Radial blade blower wheel, 9 15/16" X 3 1/4"	1	_____
• 3 wire 120 vac power cord with molded plug	1	_____
• Power cord fitting	1	_____
• Anti-seize lubricant	dabble	_____
• Door latch	1	_____
• Door latch bolt, nut and lock washer (5/8 NC x 3")	1	_____
• Water filter housing w/replaceable 5 micron sediment cartridge	1	_____
• Magnesium anode rods with 3/4" NPT thread	2 or 3	_____
• Galvanized combustion air inlet hood	1	_____

GARN® WHS PACKING LIST CONTINUED

• Warnoch Hersey listing label	1	_____
• Patent label	1	_____
• **GARN®** nameplate oval with 3 push clips	1	_____
• Operation of **GARN® WHS** Equipment laminated card	1	_____
• **GARN®** Unpacking Manual	1	_____
• **GARN®** Installation Manual	1	_____
• **GARN®** Operator's Manual	1	_____
• Electric element box and cover	1	_____
• Electric element box labels	2	_____
• 240 vac single phase 5.5 KW immersion elements with O rings	9 maximum	_____
• Off peak electric relays and controls	1	_____

ACCESSORIES

- Water treatment chemical – # of 5 gallon pails _____
- 6" Class A flue (18" long) _____
- 6" Class A flue (24" long) _____
- 6" Class A flue (36" long) _____
- 6" Class A flue (48" long) _____
- SS flue elbow _____
- Class A wall shield _____
- Class A insulated Tee with insulated bottom cap _____
- Wall support for Tee _____
- Roof flashing and support _____