

**Supplement
to
TESTING STANDARD**

**Method to Determine
PERFORMANCE OF
INDIRECT-FIRED WATER HEATERS
March 2003 Edition**

[NOTE: This supplement incorporates testing and calculations to determine heat source friction loss for indirect-fired water heaters.]

3.1 NOMENCLATURE

dP_{eh}	Pressure drop of external heat source piping, ft w.c.
dP_h	Heat source friction loss, ft w.c.
L_{in}	Length of external heat source piping between pressure gauge port and the inlet to the indirect-fired water heater, ft (minimum 6 inches)
L_{out}	Length of external heat source piping between the indirect-fired water outlet and the gauge port, ft (minimum 25 pipe diameters)
P_{iht}	Pressure at heat source inlet with flow, ft w.c.
P_{ihs}	Pressure at the heat source inlet with no flow, ft w.c.
P_{oht}	Pressure at the heat source outlet with flow, ft w.c.
P_{ohs}	Pressure at the heat source outlet with no flow, ft w.c.
W_{hf}	Heat source water flow during friction loss test, gallons per minute

4.3 PRESSURE

4.3.1 Pressure gauges used to perform the Heat Source Friction Loss test shall have an error no greater than $\pm 2\%$. These gauges shall have minimum graduations of 0.5 ft w.c.

4.3.2 Pressure gauges used in the other tests shall be calibrated so that the error is not greater than ± 1 pound per square inch.

5.0 APPARATUS

The apparatus described below is used in conjunction with Indirect-Fired Water Heaters during the testing.

5.1 PIPING

See Figure 1 for a conceptual piping arrangement. Provisions shall be made to assure constant supply water temperature and pressure to the unit. Figure 2 contains a conceptual piping arrangement for an Indirect-Fired Water Heater that uses a mixing valve as determined by 5.5. Figure 3 shows a piping arrangement for measuring the heat source friction loss.

6.0 TEST CONDITIONS

6.1 INSTALLATION

6.1.2 HEAT SOURCE PIPING

During conduct of the continuous draw test, the connecting pipe between the thermocouple and the Indirect-Fired Water Heater shall be metal pipe up to the thermocouple and the balance of the piping may be as specified by the testing laboratory (see Figure 1).

6.1.2.2 For the heat source friction loss test, install pressure gauges on the heat source inlet and outlet connections as shown in Figure 3a. Each gauge shall be located in a tee in straight section of piping having the same nominal size as the indirect water connection and a minimum length of 25 diameters plus 6 inches. Maintain at least 25 diameters of straight pipe upstream of each gauge and at least 6 inches downstream of each gauge. As an alternate to installing two pressure gauges as requested above, a single pressure gauge may be installed the common port of a three way valve with the other two ports connected to the inlet and outlet of the heat source piping at the locations called out above. See alternate piping in Figure 3b.

6.2 AIR AND WATER

6.2.1 WATER SUPPLY

6.2.1.2 HEAT SOURCE WATER SUPPLY

During all of the draw tests, the water supplied to the water heater's heat exchanger inlet, T, shall be $180^{\circ}\text{F} \pm 2.5^{\circ}\text{F}$. During the heat source friction loss test, the water supplied to the heat source inlet connection shall be between 58°F and 80°F .

7.0 TEST PROCEDURE

7.5 HEAT SOURCE FRICTION LOSS TEST

7.5.1 INDIRECT-FIRED STORAGE AND INSTANTANEOUS WATER HEATERS

Set up the indirect water heater as shown in Figure 3 and with the pressure gauge connections described in 6.1.2.2. Fill the test set-up with water and purge the system of air. Pressurize the system so that a readable amount of pressure is present on both gauges with no water flowing through the indirect water heater. Start the pump and adjust the throttling valve so that the heat source flow rate W_{hf} , is within ± 0.25 GPM of the nominal value established in 7.3.1. Record the pressure on the inlet pressure gauge, P_{int} , and outlet pressure gauge, P_{oht} . Shut down the pump and record the pressure gauge reading at the inlet and outlet with no heat source flow through the indirect water heater (P_{ihs} and P_{ohs} , respectively). If a single pressure gauge and three way valve is used then the pressure at the inlet and outlet with no flow does not need to be recorded.

7.5.2 DATA

Record the following measurements:

- Length of the external heat source piping between the pressure gauge port and the inlet to the indirect-fired water heater in feet, L_{in}
- Length of the external heat source piping between the indirect-fired water heater outlet and the pressure gauge port in feet, L_{out}

The Following readings shall be recorded during the test:

- Measured heat source water flow rate during friction loss test, W_{hf}
- Pressure at heat source inlet with flow, P_{iht}
- Pressure at heat source outlet with flow, P_{oht}
- Pressure at heat source inlet with no flow, P_{ihs} if two pressure gauges are used
- Pressure at heat source outlet with no flow, P_{ohs} if two pressure gauges are used

8.0 DATA TO BE RECORDED

- Water volume determination values are to be recorded on form **IWH-V-1**
- Standby heat loss data is to be recorded on form **IWH-ST-1**. Data logger output may be substituted if the required data and times as shown on form **IWH-ST-1** are included in the printout.
- Continuous draw data is to be recorded on form **IWH-CD-1**.
- First draw data is to be recorded on form **IWH-FD-1**.
- The calculated values are to be recorded on the report form **IWH-R-1**.
- The summary information is to be included on form **IWH-S-1**
- Heat source friction loss test data is to be recorded on form **IWH-FL-1**