PACIFIC GAS AND ELECTRIC COMPANY

PG and E 245 MARKET STREET • SAN FRANCISCO, CALIFORNIA 94106 • (415) 781-4211 • TWX 910-372-6587

February 22, 1985

Local Union No. 1245
International Brotherhood of
Electrical Workers, AFL-CIO
P. O. Box 4790
Walnut Creek, California 94596

Attention: Mr. Jack McNally, Business Manager

Gentlemen:

The newly formed San Francisco Steam Heating System requires a classification which would combine the job duties of Steam Mainman and the ability to do certain arc-welding tasks.

Company proposes, pursuant to Section 204.4 of the Physical Agreement, to establish the following classification, job definition and line of progression, wage rate and training program:

MAINMAN-ARC

An employee with the qualifications of a Mainman-Arc who performs specialized work in connection with the installation, maintenance and operation of pipelines and other steam facilities without immediate supervision. Performs arc welding and other duties including complex layouts, hot tie-ins on larger diameter steam pipelines, operating main line valves. Works alone or as part of a crew, installs, maintains and repairs steam mains and appurtenances in the steam heat distribution system. May be required to drive a truck, operate compressors and mechanical equipment such as jackhammers, tampers, and impact tools and perform clerical work associated with those duties. May be assigned to perform pipe locations and leak surveys and investigations.

Such work may be performed alone, but, where necessary for protection, a Helper may accompany him. While the Helper's primary function will be to act as a flagman for the protection of both men; nevertheless, the Helper will be expected to provide assistance to the Mainman-Arc.

Next Lower Classification		Same or Higher Classifications	
0524	Fieldman	0640	Light Crew Foreman (Welder)
0930	Steam Helper	2626	Certified Welder
1150	Steam Mainman	2250	Steam Serviceman
0560	Fitter	1300	Gas Mechanic
0562	Fitter - Arc	2617	Welder - GC
		2625	Arc Welder - GC
		1300	Gas Mechanic

Proposed weekly wage rates:

Start	$579.40
End 6 Mo.	595.15
End 1 Yr.	607.50
End 18 Mo.	619.20
End 2 Yr.	636.15

The attached training program includes the existing Mainman Training Program, plus a welding training program consisting of the following:

- One-week Primary Shop Training
- Two weeks' Final Training - Arc Only
- Four weeks' High Pressure Arc Training
- Qualification Testing - successful completion of 12-inch position butt weld.

If you are in accord with the foregoing and attachments and agree thereto, please so indicate in the space provided below and return one executed copy of this letter to the Company.

Yours very truly,

PACIFIC GAS AND ELECTRIC COMPANY

By [signature]
Manager of Industrial Relations

The Union is in accord with the foregoing and attachments and it agrees thereto as of the date hereof.

LOCAL UNION NO. 1245, INTERNATIONAL BROTHERHOOD OF ELECTRICAL WORKERS, AFL-CIO

Apr. 26, 1985

By [signature]
Business Manager

PRIMARY SHOP TRAINING

The first two weeks of the Primary session will be devoted to welding training and instruction in related subjects. The welding training is programmed so that after successful completion the trainee is able to perform welding of 3/4", 1-1/4" and 2" pipe. This enables the trainee during subsequent on-the-job training to become proficient in what he has learned by actually welding on service and 2" main installations under the supervision of an experienced welder. This training also serves as a means of determining if the trainee has the ability to become proficient at welding. Trainees that successfully complete the primary welding training and the related subject training will begin the on-the-job training and will be awarded the Apprentice Fitter classification.

First Day

I. Introduction

  A. Scope of Training Course

    1. Qualify trainee for Fitter Classification

    2. Outline subjects to be covered

    3. How trainee will be rated

    4. Tests and results that must be obtained

II. Setting Up and Operation of Welding Equipment

  A. Precautions and safe practices

  B. Demonstration of welding equipment

III. The Weld

  A. Demonstration of fusion and penetration

IV. Basic Practice on Mild Steel Plate (10 Gauge - 141" thick)

A. Lesson 1 - making a penetration bead on a flat plate without having the bottom of the puddle drop out. Three welds, each about 4 inches in length, should be made with full penetration and without holes.

Second Day

I. Basic Practice

A. Lesson 2 - making an edge weld, without welding rod. Form 90^{0} angle between edges of two 3" x 6" plates and weld edges together.

Test weld by bending plates against weld until the plates flatten out.

B. Lesson 3 - making a weld bead in the flat position, using welding rod.

C. Lesson 4 - making a weld bead in the vertical position. The objective is to make weld beads that are parallel to plate edge and are uniform in ripple, width and height.

Third Day

I. Basic Practice

A. Lesson 5 - making a weld bead in the horizontal position. The objective is to make weld beads that are parallel to plate edge and are uniform in ripple, width and height.

B. Lesson 6 - making a flat lap weld.

C. Lesson 7 - making a vertical lap weld. The objective is to make a weld of uniform width without undercut or rolled edges. Fusion should penetrate to the root of angle formed by lap. The weld can be tested by bending the top plate against the weld. After bending, fusion point or weld metal should not be visible on bottom side of plate.

<u>Fourth Day</u>

I. Basic Practice

A. Lesson 8 - making a flat fillet weld. The objective is to make a weld that is evenly deposited on both plates without undercut or rolled edges. The weld can be tested by bending vertical plate against weld. Vertical plate should bend at edge of fillet and edge of plate should be fused to base plate.

<u>Fifth Day</u>

I. Basic Practice

A. Lesson 10 - making a flat butt weld

B. Lesson 11 - making a vertical butt weld

C. Lesson 12 - making an overhead butt weld

The objective is to make a weld that is uniform in ripple, width, height, and with complete penetration and fusion. Coupons cut from the weld should pass the root bend test.

<u>Sixth Day</u>

I. Practice Cutting and Beveling Pipe

The objective is to make straight cuts with minimum slag adhering. The pipe ends should be square with correct bevel.

II. Making a Rolling Butt Weld (2-inch Pipe)

III. Making a Position Butt Weld (2-inch Pipe)

The objective is to make a weld that is uniform in ripple, width, height and with complete penetration and fusion. Coupons cut from the weld should pass the root bend test.

Seventh Day

I. Making 3/4" Extra Heavy Pipe Nipple Fillet Weld to 2" Pipe (simulated service tee connection)

The objective is to make a fillet weld that is evenly deposited on both nipple and pipe, without undercut or rolled edges and without protrusion inside 3/4" nipple. The weld should stand test of attempting to knock nipple from pipe when enough force is applied so that distortion shown on both 3/4" and 2" pipes.

II. Make 45° Single-Angle Weld

The objective is to make a 45° miter weld with uniform reinforcement. Preparation for weld should include pipe ends cut with correct bevel and miter, and with minimum slag adhering.

Eighth Day

I. Use and Application of Offsets

II. Make 45° Offset

The objective is to make a 45° offset weld with uniform reinforcement. Preparation of weld should include pipe ends cut with correct bevel and miter, and with minimum slag adhering.

III. Make Full Size 2", 90° Saddle Weld

The objective is to make a 2" saddle weld with uniform reinforcement. Preparation for weld should include beveled cuts with minimum slag adhering.

Ninth Day

I. Welding Practice

A. On daily assignments that trainee has not successfully completed.

B. On 3/4" and 1-1/4" pipe (rolling and position welds).

II. Soldering Joints, Copper Service Pipe

Soldered joints should be made with the axis of the pipe stationary and in the horizontal position. The objective is to make soldered joints that are completely bonded. The joint should be sawed open longitudinally and spread apart for examination to determine if both bell and spigot end are completely bonded.

Tenth Day

I. Welding Practice

A. On daily assignments that trainee has not successfully completed.

II. Welding Qualification Test.

Trainees will be required to pass the following qualification test. This test will be given at the conclusion of the primary shop training. The same test, with reduced maximum time allowances will also be given when the trainee has been in the Apprentice Fitter classification for at least six months. The test will consist of the following:

A. Position butt weld on 3/4" pipe

Maximum time allowance - 8 minutes. Test: Bend the 3/4" pipe on weld. To be acceptable the weld must show no breaks or cracks after bending to 90° angle.

B. Position butt weld on 1-1/4" pipe

Maximum time allowance - 10 minutes. Test: Four coupons shall be cut from the weld, one from the top, one from the bottom, and one from each side. Each should be 1-1/4" in width. All four coupons shall be subjected to the root bend test. If, as a result of this test, a crack develops in the weld or between the weld and the base metal more than 1/8" long in any direction, this shall be cause for rejection. Cracks occurring on the corner of the speciman during testing shall not be considered. If no more than one coupon is rejected, the weld is to be considered acceptable.

C. Position butt weld on 2" pipe

Maximum time allowance - 15 minutes. Test: Same as specified under "B".

D. Service connection, 3/4" pipe nipple weld to 2" pipe

Maximum time allowance - 10 minutes. Test: The weld shall be rejected if it shows a serious undercutting or if it has rolled edges. The weld shall be tested by attempting to break the fitting off the run pipe by any available means (knocking off). A sample shall be rejected if the broken weld at the junction of the fitting and run pipe shows incomplete fusion, overlap, or poor penetration.

FINAL SHOP TRAINING

FIRST DAY

I. Introduction

- A. Standards of Achievement Tests
- B. Outline exercises to be covered
- C. Lecture by representative of Lincoln Electric Company
- D. Welding procedures
- E. Safety
- F. Joint position and Electrodes
- G. AC and DC Machines
- H. Current settings

SECOND DAY

I. Methods of striking arc on ½" flat plate

- A. Welding flat stringer beads
- B. Run straight and parallel beads
- C. Use center for filler beads
- D. Run cover beads

THIRD DAY

I. Run stringer beads down hand 45° angle

II. Fillet welds flat position (no bevel)

III. Lecture by representative of Bayox, Inc.

- A. Wire Machine (MIG machine)
- B. Welding procedures
- C. Graphic demonstration
- D. Safety
- E. Current settings
- F. Demonstration of MIG followed by student participation

FINAL SHOP TRAINING (CONTINUED)

FOURTH DAY

A. Fillet welds vertical (no bevel)

B. Bevel plates fillet welds

FIFTH DAY

A. Bevel plates vertical welds

B. Stringer beads overhead

SIXTH DAY

A. Bevel plates, vertical and overhead stringer beads

B. 4" pipe with 5" sleeve over same simulating pressure control fitting

C. Position weld both ends

SEVENTH DAY

A. 4" position welds

B. Cut and bevel 6" and 8" pipe and butt weld in position

EIGHTH DAY

A. Cut and bevel 6" and 8" pipe and butt weld in position

B. Welding on live gas pipe

   1. Melt hole in live pipe and repair by welding.

   2. Weld service tees on live pipe.

NINTH DAY

(Same as eighth day)

TENTH DAY

A. Final test on 8" pipe

B. Practice arc welding 3/4" heavy nipples on 8" pipe simulating service tees

STEAM HEAT DISTRIBUTION
TRAINING PROGRAM
LESSON PLANS
MAINMAN

LESSON PLAN OF MAINMAN TRAINING

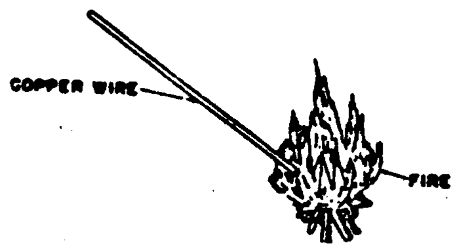
FIRST DAY

	Instructor
I. Classroom Training Of Steam Properties	
1.1 Heat Transfer (1 hour)	R. L. Waller
1.11 Conduction	(2 hours)
1.12 Convection	
1.13 Radiation	
1.14 Temperature Pressure Relationship	
1.2 Steam Flow In Pipes (½ hour)	
1.21 Tie-in Heat Transfer Methods	
1.22 Show Need For Good Construction Standards	
1.3 Definitions And Building Heat Loss (½ hour)	
II. Explanation Of Steam Energy Conservation Principles	P. H. Evens
2.1 Building Heating Systems And Parts (½ hour)	(2 hours)
2.2 Common Faults Of Heating Systems (½ hour)	
2.3 Steam Distribution (½ hour)	
2.31 Air Elimination	
2.32 Heating Unit Orifices	
2.4 Service Water Heating (½ hour)	

Heat Transfer

Heat travels, or is transferred, in three ways: conduction, convection and radiation.

Conduction. Fig. 1, illustrates the movement of heat through a substance. When one end of a piece of copper wire is heated some of the heat will travel through the wire and soon the other end will become hot. The heat energy flows from the region of higher to the region of lower temperature. Very seldom will conduction cause the part furthest from the source of heat to become as hot as that part which receives the heat directly. Different substances or materials vary in their ability to conduct heat. This ability or property of material to conduct heat is known as the coefficient of heat conductivity.

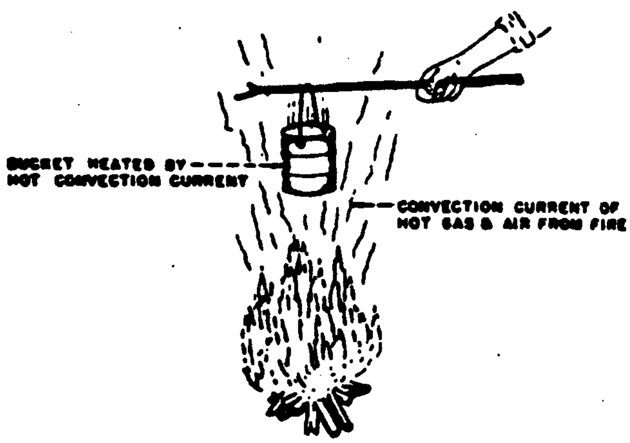


CONDUCTION

Fig. 1

A poor conductor is often referred to as an insulator. Wooden handles (a poor heat conductor) on metal cooking utensils make it possible to handle them when the metal (usually a good heat conductor) is heated. Any material which is composed largely of air spaces, or pockets of non-circulating air, such as felt and cork, are good heat insulators since air is a relatively poor heat conductor.

Convection. Fig. 2 illustrates the transfer of heat by the movement of the heated material itself. When any liquid or gas is heated, it expands and becomes less dense or lighter. The cooler and heavier gas or liquid flows toward the heated surface and takes the place of the light heated liquid as it moves upward. This colder portion in turn becomes heated, expands and is pushed upward. The result is a continuous flow of the cooler liquid or gas to the heated area and the heated liquid or gas to some cooler area where it gives up its heat to some material body placed in the convection current. A good example is the warming of buildings by hot air from a furnace; the warm air rises to the top of the rooms, gives up heat to the cold walls, and as the air is cooled it becomes heavier and settles again, displacing the warmer air.

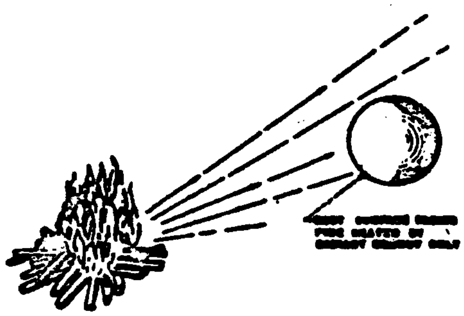


CONVECTION

Fig. 2

Radiation. Fig. 3, the third method of heat transfer, does not need any material to carry the heat. Radiated heat passes through a vacuum as well as through air or gas. An example of this kind of heat transfer is the heat we get from the sun. Radiated heat only heats that part of an object which is exposed to the radiating source.

In most cases of heat transfer, a combination of two or all three methods are involved.



RADIATION

Fig. 3

In boilers or steam generators, the chemical energy in fuel is ultimately converted into heat energy in steam. This energy is used to drive the turbine-generators to do mechanical work. The generators in turn convert the mechanical energy developed by the turbine into electrical energy.

Heat must be transferred in converting chemical energy to mechanical energy. Gases are useful for converting heat energy to mechanical energy because of their ability to store heat energy when compressed and to release energy when expanding. One of the most common gases used for this purpose is steam, derived by the evaporation of water. In the use of water to transfer heat energy, it is evaporated in the boiler at high pressure and is distributed through miles of pipe buried under city streets, to our customers. Evaporation is the changing of the physical property or state of a substance from a liquid to a vapor or gaseous state by the absorption of heat. Condensation is the reverse and is accompanied by release of heat. In order to understand fully the heat content when water changes its state by being evaporated or condensed, one needs to be familiar with pressure - temperature relationships. The temperature at which water or any liquid boils and becomes steam (gas or vapor) depends on the pressure exerted on the surface of the liquid. Water can be made to boil at any temperature between 32 and 705.2 degrees Fahrenheit. For every temperature below 705.2 degrees there is a corresponding pressure at which water boils. By referring to the Saturated Steam Pressure Table, the pressure temperature relationship of water from .0886 to 3206.2 pounds per square inch absolute (PSIA) can be found.

As mentioned, steam is water in a gaseous or vapor state and has a relatively high heat capacity. Its temperature and pressure range is such that it is one of the best and most economical mediums for transmitting heat energy. Steam may be wet or dry, depending on whether it contains some precentage of liquid. Steam at the same pressure and temperature of the liquid from which it was produced is called saturated steam. Saturated steam can also be defined as a vapor at a temperature corresponding to the boiling point of the liquid at the imposed pressure. Superheated steam is steam at a temperature greater than that of the boiling point corresponding to the pressure imposed on it. Steam is superheated by adding heat, increasing its temperature above that corresponding to the imposed pressure. The steam will remain superheated as long as its temperature remains above that temperature corresponding to the saturation temperature. Lowering the pressure will lower the temperature at which it will become saturated. The number of degrees of temperature that the steam is raised above the saturation temperature is known as degrees of superheat. For example, the saturation temperature of water under 1500 lbs. pressure is 596° and the steam produced will have a temperature of 596°. Therefore, the term saturated steam does not refer to the moisture content of the steam, but merely refers to the heat saturation point of water at a given pressure. Passing this steam through the superheater it can be heated to 1000° F.

Fig. 5 shows pressure from 1/4 pound to 3206 pounds absolute with corresponding saturated temperatures.

Press. Abs.	Temp. °F	Press. Abs.	Temp. °F	Press. Abs.	Temp. °F	Press. Abs.	Temp. °F	Press. Abs.	Temp. °F	Press. Abs.	Temp. °F
0.25	59.30	50	281.01	240	397.37	430	451.73	750	510.86	1900	628.58
0.50	79.58	60	292.71	250	400.95	440	454.02	775	514.59	2000	635.82
0.75	92.29	70	302.92	260	404.42	450	456.28	800	518.23	2100	642.77
1.0	101.74	80	312.03	270	407.78	460	458.50	825	521.79	2200	649.46
1.5	115.69	90	320.27	280	411.05	470	460.68	850	525.26	2300	655.91
2.0	126.08	100	327.81	290	414.23	480	462.82	875	528.66	2400	662.12
2.5	134.44	110	334.77	300	417.33	490	464.93	900	531.98	2500	668.13
3.0	141.48	120	341.25	310	420.35	500	467.01	925	535.24	2600	673.94
4.0	152.97	130	347.32	320	423.29	520	471.07	950	538.42	2700	679.55
5.0	162.24	140	353.02	330	426.16	540	473.01	975	541.55	2800	684.99
7.0	176.85	150	358.42	340	428.97	560	478.85	1000	544.61	2900	690.26
9.0	188.28	160	363.53	350	431.72	580	482.58	1100	556.31	3000	695.36
11.0	197.75	170	368.41	360	434.40	600	486.21	1200	567.22	3100	700.31
13.0	205.88	180	373.06	370	437.03	620	489.75	1300	577.46	3200	705.11
"0" Gage Press 14.6	212.00	190	377.51	380	439.60	640	493.21	1400	587.10	3206	705.40
15	213.03	200	381.79	390	442.12	660	496.58	1500	596.23	3300	705.40
20	227.96	210	385.90	400	444.59	680	499.88	1600	604.90	3500	705.40
30	250.33	220	389.86	410	447.01	700	503.10	1700	613.15	3000	705.40
40	267.25	230	393.68	420	449.39	720	506.25	1800	621.03	5000	705.40

Fig. 5

1.2 Steam Flow In Pipes

The instructor will discuss with the trainee the effects steam flowing in pipes have on pressure and temperature. He (trainee) will be able to use knowledge gained here in answering low-heat or no-heat complaints on customer's property. He will also see why it is necessary to inform customer to correct problems where heat is being transferred by one, two, or three of the heat transfer methods. He will also be able to see that temperature complaints can be traced to improper regulator settings.

1.3 Definitions And Building Heat Loss

The instructor will explain ways that heat is loss from buildings. He will also define the terms that are used to describe building heat loss. Some terms are, Transmission Loss, Air Changes, Infiltration, Ventilation, etc. Ways to eliminate or reduce these heat losses will be explained under energy conservation methods.

2.1 Building Heating Systems And Parts

Heating system types and parts will be discussed to give the mainman and appreciation of what type systems exist, ie., one pipe gravity system, two pipe gravity systems and vacuum return systems.

The advantages, disadvantages, and some construction practices will also be discussed with regards to each system type mentioned. System parts with their functions will be discussed.

2.2 Common Faults Of Heating System

Probably, every heating system has some faults. They may be the result of improper design or installation, or they may have been caused by the deterioration of the system, failure of heating equipment and accessories, or lack of adequate maintenance and repair.

In any case, when under heating is encountered, the fault should be found and corrected. Some of the more common faults will be discussed and ways of correcting them will be suggested.

2.3 Steam Distribution

Quick and even steam circulation is important for uniform heating of a building. Ways of achieving uniform steam distribution in building will be suggested.

2.4 Service Water Heating

Another means of conserving energy is to use steam condensate to heat building service water. It will be shown how water temperature should be controlled, what an efficient water system consists of and how the efficient system should be installed and serviced.

LESSON PLAN OF MAINMAN TRAINING

SECOND DAY

		Instructor
I.	Review Steam Utilization Equipment	
	1.1 Introduce Mainman To Construction And Maintenance of (½ hr.)	F. Hartsfield
	1.11 Heating Units	(1½ hour)
	1.12 Food Preparing Units	
	1.13 Laundry Equipment	
	1.14 Air Conditioning Equipment	
	1.15 Other Steam Using Equipment	
	1.2 Using Mark-Ups And Actual Equipment (1 hour)	
	1.21 Show How Regulators Work And Are Set	
	1.22 Show How Traps Work On Customers System	
	1.23 Explain Functions Of Temperature Control Equipment	
	1.3 Determining Load Demand (1 hour)	R. L. Waller
	1.31 Show How Load Demands Are Determined	(1 hour)
	1.32 Show How Building Loads Are Estimated Using Empirical - Data	
II.	Field Survey Of Steam Heat Customer Equipment And Piping	F. Hartsfield (4 hours)

1.1 Steam Utilization Equipment

Cast-iron radiators at one time constituted the majority of heating units, but today there are many kinds. Column-type, cast iron radiators are no longer manufactured. Large tube radiators have been discontinued and now only the small tube-type are available. Convectors with enclosing cabinets, finned-tube units with or without cabinets, and baseboard heat-distributing units are being used in many buildings. The instructor should have manufactor's catalogs to show how modern heating units work. He shall also, explain other steam equipment such as: Food preparing units, Laundry equipment, Air conditioning equipment, etc.

1.2 Using Mark-Ups And Actual Equipment

The instructor will use actual equipment and some mark-ups to explain safety and proper operation of steam traps and regulators.

He will also, explain how regulators are set and adjusted. Using actual equipment, he will allow the trainee to set and adjust regulators.

The instructor will obtain mark-ups of other equipment that a customer may use on his system. He will use the equipment and mark-ups for instructing the mainman. Temperature control equipment will be explained, where it is used, how it works, and its function. Further training will be obtained in the field.

1.3 Determining Load Demand

It is not intended at this point to make the trainee an expert in determining heating requirements for buildings. The information that will be presented will assist the trainee in understanding terminology used in the District Heating Industry and he will learn to estimate building load from empirical data. He will also, be given instruction in calculating customer open-jet demands. Following the classroom instructions above, the trainee will spend four hours with an instructor touring customer's premise.

BUILDING HEATING REQUIREMENTS

The quantity of heat required by a building will depend upon its use and the hours of occupancy, the heat loss of the structure, the indoor temperature to be maintained, and the average outdoor temperature. Inasmuch as heat loss calculations may not be available for buildings, it is sometimes difficult to calculate the total heating requirements by the heat loss method. A simple short-cut method for estimating the total heating requirement of any building is to use the formula on Page 45 and be cautious in choosing the values of its various component parts. These parts, discussed below, are degree-days, heating index, and building cubage.

Degree-Days

It has been determined that the daily requirements for heat vary directly as the difference between 65 F and the outdoor mean-daily temperature. The outdoor mean-daily temperature is the average of the maximum and minimum outdoor temperature during the 24 hours of a day. Therefore, on a day when the mean temperature is 45 F, or 20 degrees less than 65 F, twice as much heat is required as on a day when the mean temperature is 55 F, or ten degrees less than 65 F. This difference between 65 F and the outdoor mean-daily temperature is known as the degree-days.

The degree-day unit is used almost universally as a basis for estimating and comparing heating requirements for different outdoor temperatures. The number of degree-days for any one day is defined to be the difference between 65 F and the mean temperature for that day. It is applicable only when the mean-daily temperature is below 65 F. The sum of the degree-days for the individual days over a specified period, is the total degree-days for that period.

The normal monthly and seasonal degree-days for many United States and Canadian cities are tabulated in Table III. The United States data (1941-70) were compiled by the National Climatic Center, Asheville, North Carolina, National Oceanic and Atmospheric Administration, U. S. Department of Commerce. The Canadian data (1941-70) were compiled by the Climatology Division, Canadian Meteorological Service, Department of Transport, Toronto, Ontario.

Building Steam Consumption

Table IV is a compilation of data acquired from a survey made of 900 buildings in various locations of the United States. Twenty different classifications of buildings were included in the survey, and the information covers a sampling of all types of occupancy and heating systems (some may or may not have had temperature-control equipment). The data may be used as a guide in estimating heating requirements for almost any type of building occupancy.

TABLE III
NORMAL MONTHLY AND SEASONAL DEGREE-DAYS (BASE 65 F) FOR UNITED STATES AND CANADIAN CITIES

(See notes at end of Table)

City	July	Aug.	Sept	Oct.	Nov.	Dec.	Jan	Feb.	Mar.	Apr.	May	June	Total
NEW ENGLAND STATES													
Maine													
Portland	[illegible]	55	[illegible]	483	792	1218	1349	1179	1028	669	341	108	7468
New Hampshire													
Concord	16	45	192	447	813	246	1346	1187	1014	624	316	58	7360
Massachusetts													
Boston	0	3	16	331	664	992	1110	969	834	492	218	27	5621
Amherst	8	21	122	387	728	1159	1283	1100	927	540	251	42	6576
Worcester	10	34	164	418	753	1172	1283	1117	963	591	286	81	6846
Rhode Island													
Providence	0	13	93	350	651	1039	1135	987	871	531	269	36	5972
Connecticut													
Bridgeport	0	0	47	261	570	967	1079	955	840	496	226	24	5461
Hartford	0	12	108	384	711	1141	1246	1070	911	519	226	24	6350
New Haven	0	0	72	319	630	1017	1119	974	856	516	252	38	5793
NORTH ATLANTIC STATES													
New York													
Albany	9	22	136	422	782	1212	1349	1162	980	543	253	39	6888
Binghamton	21	40	172	456	804	1228	1333	1182	1045	609	320	75	7286
Buffalo	12	43	138	419	756	1150	1280	1137	1020	603	321	58	6927
New York	0	0	29	209	528	915	1017	885	741	387	137	10	4848
Rochester	3	26	126	398	735	1138	1271	1126	992	567	286	46	6719
Syracuse	11	18	120	392	720	1144	1283	1131	986	555	272	46	6676
New Jersey													
Atlantic City	0	0	36	262	570	927	1001	871	741	309	131	9	4846
Newark	0	0	34	243	584	946	1042	907	768	386	143	0	5034
Pennsylvania													
Allentown	0	6	86	344	681	1063	1153	907	834	453	190	21	5827
Erie	24	43	141	415	747	1113	1237	1114	986	606	336	80	6851
Harrisburg	0	0	51	283	636	1004	1082	916	744	370	128	0	5274
Philadelphia	0	0	36	249	664	924	1014	871	716	387	122	0	4865
Pittsburgh	0	6	65	298	627	983	1086	924	763	382	161	10	5278
Reading	0	0	36	253	579	946	1036	896	722	382	122	0	4831
Scranton	19	18	116	391	726	1113	1208	1056	899	496	219	28	6277
Williamsport	0	14	96	367	716	1079	1172	1019	963	456	196	23	5881
Maryland													
Baltimore	0	0	27	290	567	871	980	846	688	340	110	0	4729
Delaware													
Wilmington	[illegible]	0	32	254	579	939	1023	879	725	381	128	0	4043
District of Columbia													
Washington	0	0	14	190	510	859	911	776	617	268	72	0	4211
Virginia													
Lynchburg	0	0	33	234	540	843	880	753	606	260	86	0	4233
Norfolk	0	0	9	141	402	704	760	661	532	226	53	0	3486
Richmond	0	0	21	203	480	806	853	717	569	226	64	0	3939
West Virginia													
Huntington	0	0	46	295	585	899	962	880	648	283	116	11	4626
SOUTH ATLANTIC STATES													
North Carolina													
Asheville	0	0	50	289	561	815	840	717	592	279	100	14	4237
Charlotte	0	0	10	192	420	698	710	588	481	145	34	0	3218
Greensboro	0	0	24	209	507	787	815	683	544	203	50	0	3825
Raleigh	0	0	12	186	480	732	780	630	502	180	48	0	3514
High Point	0	0	15	189	441	729	747	672	486	156	39	0	3465
South Carolina													
Greenville-Spartanburg	0	0	6	146	420	685	704	577	480	144	28	0	3163
Georgia													
Atlanta	0	0	8	137	408	667	701	560	443	144	27	0	3086
Alabama													
Birmingham	0	0	6	137	381	614	684	517	389	116	20	0	2844
Tennessee													
Chattanooga	0	0	18	182	483	738	769	625	483	186	51	0	3606
Memphis	0	0	7	142	423	691	760	594	467	131	22	0	3227
Nashville	0	0	10	120	486	763	828	672	524	178	45	0	3696

TABLE III (Continued)

City	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
NORTH CENTRAL STATES, E.											
Ohio											
Akron-Canton	9	16	101	369	729	1104	1206	1044	393	495	231
*Cincinnati	0	0	37	246	612	949	1020	[illegible]	[illegible]	[illegible]	118
Cleveland	9	17	96	384	702	1076	1181	1039	[illegible]	501	244
Columbus	0	8	76	342	[illegible]	1083	1135	[illegible]	[illegible]	419	[illegible]
Dayton	0	7	63	307	[illegible]	1067	1144	[illegible]	546	413	164
Toledo	0	18	89	379	782	1147	1246	[illegible]	[illegible]	496	[illegible]
Youngstown	9	22	118	384	741	1122	[illegible]	[illegible]	[illegible]	419	[illegible]
Indiana											
Evansville	0	0	34	236	603	921	[illegible]	[illegible]	[illegible]	264	[illegible]
Fort Wayne	0	12	90	363	744	1128	[illegible]	[illegible]	[illegible]	471	[illegible]
Indianapolis	0	0	63	302	[illegible]	1097	1150	[illegible]	[illegible]	[illegible]	159
South Bend	6	24	90	388	782	1141	[illegible]	[illegible]	[illegible]	507	[illegible]
Illinois											
Chicago	0	8	57	316	738	1132	[illegible]	1053	[illegible]	[illegible]	208
Peoria	0	8	70	327	753	1147	[illegible]	1044	[illegible]	416	[illegible]
Rockford	6	16	99	392	[illegible]	1243	1339	[illegible]	[illegible]	[illegible]	[illegible]
Springfield	0	8	48	262	[illegible]	1070	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Michigan											
Detroit	0	11	80	342	[illegible]	[illegible]	1225	[illegible]	[illegible]	[illegible]	[illegible]
Grand Rapids	8	27	114	409	799	1168	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lansing	9	27	133	422	[illegible]	1175	1314	[illegible]	[illegible]	545	[illegible]
Wisconsin											
La Crosse	10	17	130	421	[illegible]	1339	1516	[illegible]	[illegible]	[illegible]	[illegible]
Madison	14	38	173	474	[illegible]	1338	[illegible]	[illegible]	[illegible]	591	[illegible]
Milwaukee	15	38	140	440	956	[illegible]	1414	[illegible]	[illegible]	[illegible]	348
Kentucky											
Louisville	0	0	35	241	[illegible]	911	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NORTH CENTRAL STATES, W.											
North Dakota											
Bismarck	18	36	252	564	1083	[illegible]	[illegible]	[illegible]	[illegible]	660	339
Fargo	13	33	234	554	1092	1612	[illegible]	[illegible]	1265	[illegible]	[illegible]
South Dakota											
Huron	9	13	169	482	978	1420	[illegible]	1319	[illegible]	675	[illegible]
Sioux Falls	10	18	168	486	967	1395	1575	[illegible]	[illegible]	587	[illegible]
Nebraska											
Grand Island	6	0	107	382	804	1178	1374	1044	[illegible]	461	194
Lincoln	0	0	83	329	780	1169	[illegible]	1039	[illegible]	[illegible]	166
Omaha	0	6	71	301	750	1147	1314	1036	[illegible]	[illegible]	148
Kansas											
Topeka	0	0	55	258	663	1029	1147	[illegible]	[illegible]	329	118
Wichita	0	0	32	211	606	946	1046	[illegible]	[illegible]	275	90
Minnesota											
Duluth	67	104	318	611	1098	1569	1751	1481	[illegible]	792	484
Minneapolis	14	28	195	498	993	1451	[illegible]	1366	[illegible]	612	266
Rochester	21	35	186	486	972	1429	[illegible]	1347	1153	615	[illegible]
Iowa											
Des Moines	0	13	94	350	816	1240	1414	[illegible]	[illegible]	465	186
Sioux City	0	10	113	378	861	1287	[illegible]	[illegible]	[illegible]	474	[illegible]
Missouri											
Kansas City	0	0	42	235	542	1014	1153	[illegible]	735	[illegible]	[illegible]
Saint Joseph	0	0	49	265	681	1063	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Saint Louis	0	0	35	224	800	942	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Springfield	0	6	35	227	585	898	[illegible]	[illegible]	[illegible]	[illegible]	94
SOUTH CENTRAL STATES											
Oklahoma											
Oklahoma City	0	0	12	148	[illegible]	[illegible]	874	[illegible]	[illegible]	[illegible]	[illegible]
Tulsa	0	0	10	143	[illegible]	781	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Texas											
Dallas	0	0	0	56	[illegible]	521	[illegible]	[illegible]	314	[illegible]	0
Wichita Falls	0	0	0	92	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Arkansas											
Fort Smith	0	0	0	135	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Little Rock	0	0	0	143	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Louisiana											
New Orleans	0	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE III (Continued)

City	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
MOUNTAIN STATES, N.													
Montana													
Helena	33	5[illegible]	304	611	909	1293	1494	1118	1066	690	401	194	8190
Missoula	39	71	301	648	981	1242	1370	1058	983	633	397	201	7931
Idaho													
Boise	0	12	127	406	756	1020	1116	826	741	480	352	97	5833
Wyoming													
Casper	13	17	229	536	933	1203	1298	1070	1064	690	389	147	7858
Cheyenne	22	31	225	530	886	1110	1190	1006	1035	669	394	156	7256
MOUNTAIN STATES, S.													
Nevada													
Reno	17	30	168	456	747	992	1026	781	766	546	328	146	6022
Utah													
Salt Lake City	0	0	105	402	777	1076	1147	885	787	474	237	88	5978
Colorado													
*Denver	0	0	132	381	702	915	995	837	822	491	221	59	5605
New Mexico													
Albuquerque	0	0	7	218	615	893	924	700	595	282	68	0	4292
PACIFIC STATES													
Washington													
Olympia	89	103	198	446	651	791	982	672	676	504	341	197	5630
*Seattle	56	97	123	332	534	670	738	574	502	429	258	124	4487
Seattle Tacoma	80	82	170	397	612	760	831	636	648	489	313	167	5186
Spokane	21	47	196	533	885	1116	1228	918	853	567	327	144	6835
Yakima	20	37	147	462	798	1045	1163	820	719	486	239	94	6009
Oregon													
Eugene	41	51	119	386	582	729	794	602	592	441	280	133	4739
Portland	48	56	119	347	591	763	834	627	598	432	264	128	4792
California													
Fresno	0	0	0	90	345	596	611	423	344	182	51	9	2668
*Los Angeles	0	0	0	35	113	218	268	207	190	124	60	25	1240
Oakland	80	74	58	135	291	468	508	367	350	270	193	114	2909
Sacramento	0	0	0	101	380	586	617	428	372	227	120	20	2838
San Diego	6	0	16	43	140	257	314	237	219	144	79	52	1507
*San Francisco	202	177	102	127	233	403	437	325	332	291	257	194	3080
Alaska													
Anchorage	220	282	507	936	1317	1613	1640	1322	1260	891	583	312	10911
Fairbanks	148	334	618	1224	1868	2337	2384	1890	1720	1083	649	211	14344
Juneau	288	332	474	719	975	1160	1287	1036	1026	783	584	354	9007
Nome	462	496	687	1132	1482	1879	1829	1674	1788	1383	936	585	14325
CANADA													
[illegible]undland													
[illegible]	190	176	346	62[illegible]	797	1089	1225	1143	1152	926	727	465	8840
[illegible]unswick													
[illegible]	108	122	295	588	842	1279	1430	1276	1147	808	514	284	8641
Quebec													
Montreal	14	40	198	406	859	1367	1589	1376	1156	675	314	74	8157
Quebec	44	87	280	610	970	1402	1629	1469	1256	806	428	145	9225
Ontario													
Hamilton	10	20	142	403	734	1125	1261	1131	996	588	320	73	6819
London	24	43	187	468	816	1215	1350	1210	1060	631	343	94	7442
Ottawa	20	54	232	536	911	1442	1628	1408	1187	691	336	85	8521
Toronto	8	17	141	405	730	1118	1261	1119	988	588	304	68	6744
Manitoba													
Winnipeg	42	74	328	686	1224	1784	2044	1730	1480	808	437	144	10740
Saskatchewan													
Regina	57	97	378	738	1272	1745	1979	1681	1482	800	428	180	10827
Saskatoon	58	137	386	744	1300	1801	2096	1698	1505	816	428	179	11087
Alberta													
Calgary	176	189	416	717	1130	1446	1636	1304	1250	805	494	282	9799
Edmonton	96	182	411	729	1221	1624	1843	1469	1327	775	413	209	10278
British Columbia													
Vancouver	73	86	227	480	653	863	908	707	698	605	329	188	5644
Victoria	174	179	236	424	602	733	793	641	649	468	358	247	5541

*Asterisk [illegible] stations, others are Airport stations.
[illegible] are shown as zero.

The third column "Space Heating Steam Lb Per Deg-Day Per M Cu Ft" must be corrected if it is to be used for estimating steam consumption for a building of a volume different from that shown in Table IV.

TABLE IV
HEATING INDEX OF BUILDINGS WITH VARIOUS TYPES OF OCCUPANCY[1]

Type	Number	Average Volume M Cu Ft[2]	Space Heating Steam Lb/Deg-Day/ M Cu Ft	Heating Index[3]	Average Daily Occupancy Hours
Office	334	2160	0.686	1.457	12.1
Office and Bank	49	3000	0.577	1.374	13.1
Office and Printing	8	1895	1.230	2.510	17.7
Office and Theatre	7	4950	0.412	1.056	12.9
Office and Stores or Shops	26	1615	0.617	1.187	13.2
Bank	16	806	0.796	1.228	11.7
Department Stores	63	3400	0.385	0.939	11.1
Stores	73	310	0.624	0.760	10.4
Loft	63	865	0.586	0.941	10.0
Warehouse	24	2230	0.459	0.969	9.4
Hotel and Club	73	1795	0.990	1.960	22.3
Apartment or Residence	51	1425	0.962	1.781	21.8
Theatre	22	1240	0.482	0.853	12.9
Garage	13	1540	0.202	0.383	21.4
Manufacturing	19	1350	0.808	1.469	9.5
Church	9	656	0.532	0.788	7.9
Hospital	4	3306	1.194	2.912	22.0
School	8	1115	0.592	1.015	11.5
Municipal or Federal	15	3216	0.587	1.425	15.6
Lodge, Gym, Hall, or Auditorium	12	880	0.390	0.626	12.4
Miscellaneous	7	1387	0.479	0.677	21.4
Total or Average	896	1890	0.651		13.4

[1] From a study sponsored by the Building Owners and Managers Association International, and the International District Heating Association

[2] Computed from outside dimensions.

[3] Lb per degree-day per M cu ft divided by exposure factors shown in Table V.

Exposure Factor

In general, unit steam usage of a given class of building decreases as the size of the building increases, mainly because a large building has less exposed surface per cu ft of volume than a smaller building. The average exposure factors for buildings of various volumes are shown in Table V.

Heating Index

The fourth column in Table IV shows the lb of steam per degree day per M cu ft of building volume corrected to a building size of 50 M cu ft having an exposure factor of 1.00. This is the *Heating Index* unit to be used in the formula hereafter under "Method of Estimating Consumption."

Building Volume

The third component in comparing or estimating heating requirements is building volume. Great care must be taken when making the calculations, that the building volumes of all buildings are computed alike, or the results might be as much as 25 to 30 per cent in error.

A building with a volume of 450,000 cu ft. as computed from outside dimensions, has a volume of only 360,000 cu ft if net heated space dimensions are used. The net heated space volume is usually considered to be 80 per cent of the volume computed from outside dimensions.

Measurement Factor

The data in Table IV have a measurement factor of one. When the inside net heated space is the known volume, the corresponding volume, using outside dimensions, should be considered as approximately 25 per cent greater. Therefore, the known heated volume should be multiplied by a measurement factor of 1.25, in order to compare this building with those whose volumes are given in Table IV.

Method of Estimating Consumption

The total steam consumption for a heating season, for any type of building, may be estimated if proper analysis is made of the information presented previously in this publication; and the correct values are substituted in the following formula:

$$\text{Lb of Steam} = \text{degree-days} \times \text{heating index} \times \text{exposure factor} \times \text{volume in M cu ft} \times \text{measurement factor}$$

As an example of how to use this formula, assume an office building in New York City with 2,000 M cu ft of volume, where the volume is measured from outside dimensions:

Total estimated steam for one heating season:

$$\text{Steam} = 5050 \times 1.457 \times 0.48 \times 2000 \times 1 = 7{,}063{,}500 \text{ lb}$$

Or for the month of January:

$$\text{Steam} = 995 \times 1.457 \times 0.48 \times 2000 \times 1 = 1{,}391{,}700 \text{ lb}$$

Calculated Heat Loss Method

A more detailed and exact method for calculating the steam consumption of a building can be found in the American Society of Heating, Refrigerating, and Air Conditioning Engineers' *Handbook of Fundamentals.*

Effect of Abnormal Heat Gains and Losses

In estimating the steam consumption of a building, or when comparing one building with another, consideration must be given to abnormal heat sources and/or losses. Better than average lighting, electrical office equipment, solar radiation, etc., will reduce the amount of heat required from the heating system. On the other hand, ventilation will require more heat f the heating system; this is true whether an exhaust fan is being use outside air is being introduced.

TABLE V

EXPOSURE FACTORS

For Correction of Variation in Ratio of Building Volume to Exposed Area[1]

Building Volume M Cu Ft[2]	Average Exposure Factor
50	1.00
100	0.94
250	0.83
500	0.72
750	0.65
1,000	0.60
2,000	0.48
3,000	0.42
4,000	0.40
5,000	0.39
6,000	0.38
7,000	0.38
8,000	0.37
10,000	0.35

[1]Based on a study of 60 office buildings in Detroit, Mich. Ref January 1943 *Bul* International District Heating Association.

[2]Computed from outside dimensions of the portion of the building above grade

The average building of 4,000 M cu ft content has an exposure fa of 0.40. The average building of 2,000 M cu ft has an exposure facto 0.48. For comparison, the larger building has 0.40 ÷ 0.48 = 0.833 as m exposed surface per cu ft of volume as the smaller building.

For purposes of estimating steam requirements, the comparison of bu ings whose ratio of volumes is greater than two to one is not recommen

(For more information about Building Heating Requirements, refer to Proceedings of the International District Heating Association: 1951, page 136; 1965, page 96. Also the IDHA HANDBOOK, latest edition.)

LESSON PLAN OF MAINMAN TRAINING

THIRD DAY

I. Review Design And Construction Of Condensate And Steam Metering Equipment — Instructor TBA (2 hours)

- 1.1 Meter Reading (½ hour)
- 1.2 Meter Setting And Related Equipment Review (¼ hour)
- 1.3 Introduction To Steam Flow Meters (¼ hour)
- 1.4 Test And Repair Of Steam Meters (1 hour)

II. Shop Disassembly Of Metering Equipment — Instructor TBA (6 hours)

- 2.1 In And Out Test Of Meters
- 2.2 Meter Repairs

1.1 Meter Reading

The trainee at this point will be introduced to meter reading. The training that follows require such knowledge. The instructor will give the trainee a printed set of meter reading instructions. The trainee can on his own become proficient at reading meters by further study of the instructions. Field training will also be provided.

1.2 Meter Setting And Related Equipment Review

A typical meter installation will be discussed in detail. Visual aids such as, company standard drawings will be used. Field training will also be provided.

1.3 Introduction To Steam Flow Meters

The instructor shall explain alternate ways of measuring steam and explain in a general nature the equipment that is used. He shall also explain what problems exist using these alternate methods. The instructor will also show some applications best suited to the use of steam flow meters.

1.4 Test And Repair Of Steam Meters

An instructor will discuss the procedure of meter intest and meter outtest. The material to be covered follows.

DUTIES FOR CONDESATE METER TESTER WHEN TESTING METERS

1. Check scale for accuracy as follows:

   a. Check scale for binds and/or obstructions that may be leaning against scale tank.

   b. Check scale for accuracy by using a weight of known value.

2. Check counter for accuracy as follows:

   a. Check counter by activating the controls and observing the rotation.

3. Check temperature gauge.

   a. Replace chart, and wind clock each day test equipment is used.

4. Outside window behind scale will be kept closed at all times.

5. Scale shall be kept covered when not in use.

CONDENSATE METER INTEST PROCEDURE

A. Check company number and statement against field service tag, if in error circle meter number or statement, enter correct meter number or statement on the tag and initial.

B. Remove and inspect index to verify that meter index and meter type correspond.

C. Remove index, install test index and proper orifice, set counter for two revolutions.

D. Purge meter for two revolutions to allow the meter to temperaturise and to set the starting point.

E. Remove water from tank, and balance scale to zero pounds.

F. Set counter for 30 revolutions and push reset button on the counter to activate test procedure.

G. Compute test result as in chart A.

H. Note in column #24 of intest record, Form #62-4915 reason why meter was removed from service as in chart B.

I. Record test result on field service tag and on intest record, Form #62-4915.

J. Remove test index, reinstall original meter index and secure index box with two screws to avoid separating index and meter.

CONDENSATE METER OUTTEST PROCEDURE

A. Remove and inspect index to verify that meter index and meter type correspond.

B. Remove index, install test index and proper orifice, set counter for two revolutions.

C. Purge meter for two revolutions to allow the meter to temperaturise and to set the starting point.

D. Remove water from tank, and balance scale to zero pounds.

E. Set counter for 30 revolutions and push reset button on the counter to activate test procedure.

F. Compute test result as in chart A.

G. Record test result on test record, Form #62-4916.

H. Remove test index and reinstall original index. Before meter index is installed it will be verified by both the tester and Shop Foreman that the meter index and meter type correspond. Certification of the index information is to be logged in steam meter book, and must be initialled by both the tester and shop foreman.

REPAIR PROCEDURE

A. Clean and repair all worn parts.

B. Replace all bearing bushings and bearing pins.

C. Use a .500" expansion reamer whenever a new bushing is pressed into a bearing roller, on E, F, and G steam meters. No reamer is to be used on A, B, C, or D steam meters. Replace all bearings and bushings on these meters.

D. Drums that have large build up of dirt or deposits are to be sent out for cleaning. Original drums are to be replaced with new or good used ones as necessary.

E. Lubricate, use WD 40.

F. Inspect all spouts, clean with rat tail steel brush.

G. Counter drive shaft must be free turning. Replace if worn.

CLASSIFICATION OF TYPES OF REPAIR

A1 - Meter in service one year or less and test result does not exceed -1.0% to +1.6%.

B - Repaired meter using same or cleaned drum.

D - Repaired meter using new drum. All outgoing test results not to exceed -1.0% to +1.6%.

CHART A

FORMULA FOR DETERMINING METER ACCURACY

$$\frac{\text{WEIGHT OF WATER X TEMP. CORRECTION}}{\text{CORRECTED WEIGHT}}$$

EXAMPLE: B METER.

150 lb. Index
154.25 lb. weight of water

75° water temp. (Use Chart C)

.9854 X 154.25 = 152.06 corrected weight.
-150.00 index
2.06 difference.

$$\frac{2.06}{152.06} = .0135 \times 100 = 1.35\%$$

If corrected weight is more than index, meter is —.

If corrected weight is less than index, meter is ≠ .

CHART B

Terminology to be used when meters are removed from service.

1. Inactive
2. Noisy
3. Damaged
4. Over load
5. High Bill
6. Scheduled
7. Scheduled miscellaneous tag
8. Unknown

CHART C

WATER TEMPERATURE CORRECTION FACTORS

WATER TEMPERATURE	CORRECTION FACTOR
33° - 47°	.9832
48° - 51°	.98334
52° - 54°	.9835
55° - 57°	.98365
58° - 59°	.9838
60° - 61°	.98396
62° - 63°	.9841
64° -	.9843
65° - 66°	.9844
67° - 68°	.9846
69°	.98476
70° - 71°	.9849
72°	.98507
73°	.98523
74° - 75°	.9854
75°	.9858
76°	.9859
77°	.9861
78°	.9862
79°	.9864
80°	.9865
81°	.9867
82°	.9868
83°	.9870
84°	.9871
85°	.9873

CHART D

CONVERSION FACTORS - OUNCES TO POUNDS - DECIMAL EQUIVALENTS

OUNCES		
1	.063	.06
2	.125	.13
3	.188	.19
4	.250	.25
5	.312	.31
6	.375	.38
7	.437	.44
8	.500	.50
9	.561	.56
10.	.625	.63
11	.688	.69
12	.750	.75
13	.813	.81
14	.878	.88
15	.938	.94
16	1.000	1.00

CHART E

CONDENSATE METER SIZES AND CAPACITIES

SIZE	TEST CAPACITY POUNDS	POUND PER REV. OF DRUM	MAX. CAPACITY OF METER
A	75	2.5	250
B	150	5	500
C	225	7.5	750
D	450	15	1500
E	900	30	3000
F	1950	65	6500
G	3600	120	12000

Pounds per revolution of drum x 30 revolutions = test capacity in pounds.

2.1 <u>In And Out-Test Of Meters</u>

Shop Training

2.2 <u>Meter Repairs</u>

Shop Training

LESSON PLAN OF MAINMAN TRAINING

FOURTH DAY

I. Review Theory Of Steam Flow Through Nozzles And Orifices — Instructor R. Waller (2 hours)

1.1 Discuss Installation Of Nozzles, Orifices And Other Measuring Equipment (1 hour)

1.11 Show Advantages Of Each Type Installation

1.12 Show Disadvantages Of Each Type Installation

1.2 Explain Nozzle And Orifice Flow As It Relates To Customer Appliances, Open Jet Flow

1.21 Calculating Customer Open Jet Demand

1.22 Estimating Open Jet Independently Of Manufactors Catalog

II. Instruction On Customer Contact And Service Policies And Procedures — Instructor I. Hauser (1 hour)

III. Indoctrination On The Customer Services Department Processing of Steam Heat Accounts — Instructor C. Makar (4 hours)

1.1 Discuss Installation Of Nozzles, Orifices And Other Measuring Equipment

The trainee will be shown what is required in flow meter installations. He will be shown typical flow meter installations of orifice meters, flow nozzles, and Venturi Tubes. Visual aids such as Fig's. 1 and 2 will be used. The advantage and disadvantage of each installation will be detailed.

Advantages And Disadvantages Of Various Types Of Primary Elements

Advantages	Disadvantages
Orifice	
(1) Lowest Cost	(1) High nonrecoverable head loss
(2) Easily installed and/or replaced	(2) Suspended matter may build up at the inlet side of horizontally installed pipe unless eccentric or segmental types of orifices are used with the hole flush with the bottom of the pipe.
(3) Well established coefficient of discharge	(3) Low capacity
(4) Will not wiredraw or wear in service during test period	(4) Requires pipe line flanges, unless of special construction
(5) Sharp edge will not foul up with scale or other suspended matter	
Flow Nozzle	
(1) Can be used where no pipe line flanges exist	(1) Higher cost than orifice
(2) Cost less than venturi tubes and capable of handling same capacities	(2) Same head loss as orifice for same capacity
	(3) Inlet pressure connections and throat taps when used must be made very carefully
Venturi Tube	
(1) Lowest head loss	(1) Highest cost
(2) Has integral pressure connections	(2) Greatest weight and largest size for a given size line
(3) Requires shortest length of straight pipe on inlet side	
(4) Will not obstruct flow of suspended matter	
(5) Can be usedwhere no pipe line flanges exist	
(6) Coefficient of discharge well established	

1.2 Explain Nozzle and Orifice Flow as it Relates to Customer Appliances, Open Jet Flow

The instructor will highlight effective use of orifices to make building distribution systems more efficient. He will also assist the trainee in making calculations to determine customer open jet demand. Fig. 3 will be used to aid in the calculations.

Instructions will also be given to enable the trainee to estimate, without manufacture's specifications, open jet demand for different appliances. It is not intended to have the trainee become an expert at estimating open jet demands, this job shall be left to the proper authorities, ie. manufactures, engineers, etc.

The intent of this training is to give a basic understanding of steam flow through various measuring devices and restrictions.

2. Instructions on Customer Contact and Service Policies and Procedures

The instructor shall use company Standard Practices to instruct the trainee on how to meet the public, to extend good service, to extend uniform service to all customers, and to answer complaints.

3. Indoctrination on the Customer Services Department Processing of Steam Heat Accounts

The trainee will spend four (4) hours with a representative of the Customer Services Department. The training received there should better equip the trainee to answer billing complaints in the future.

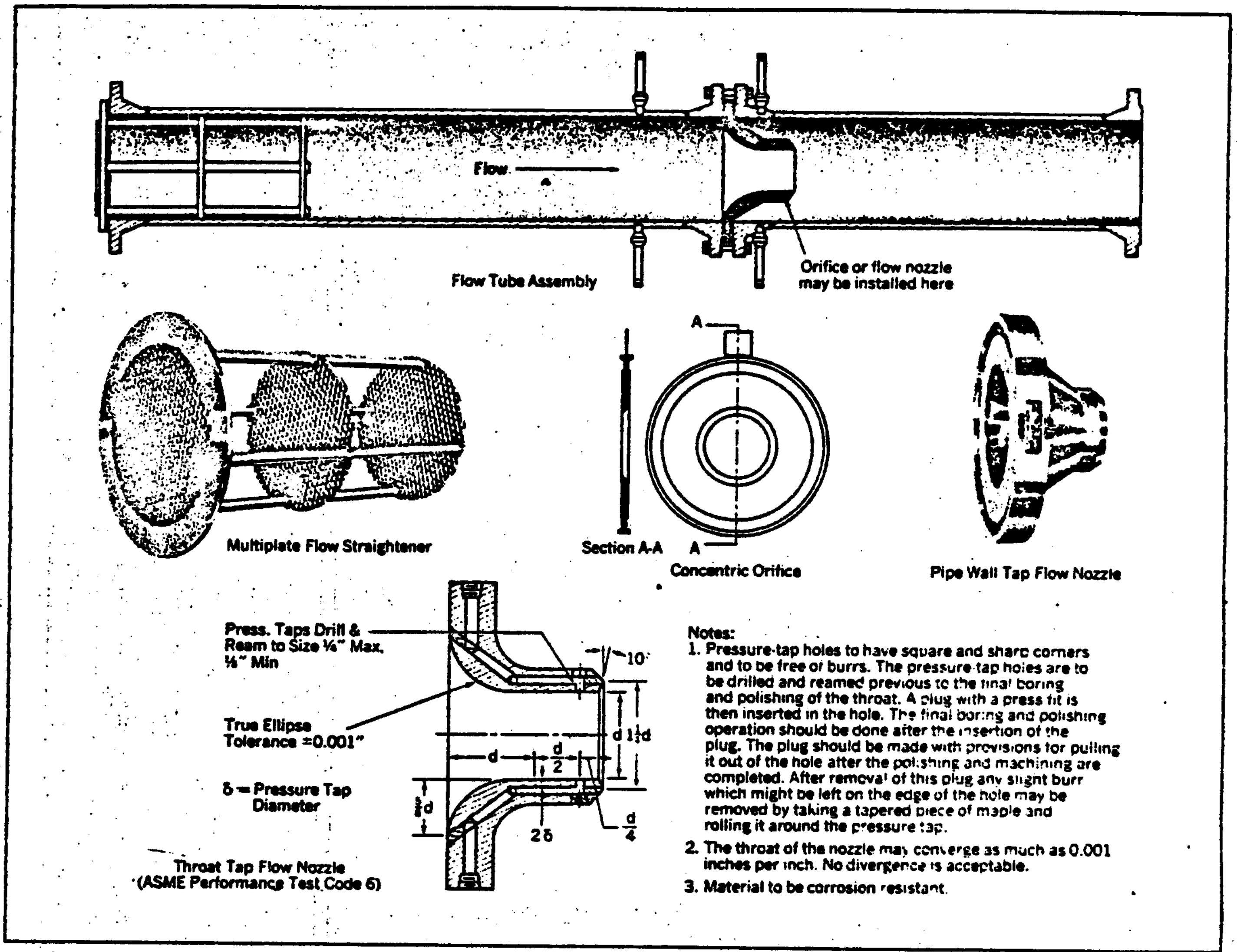


Fig. 1 Orifice and flow nozzles.

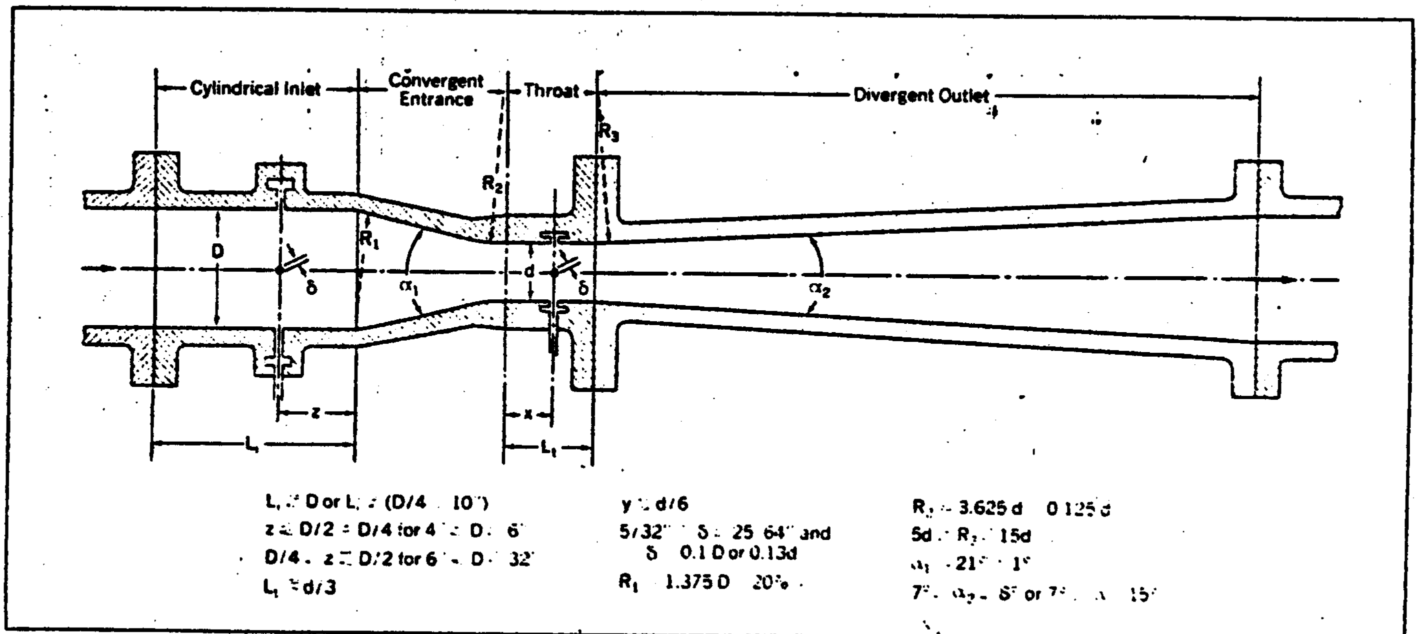


Fig. 2 Dimensional proportions of classical (Herschel) venturi tubes with a rough-cast, convergent inlet cone. (Source, ASME, *Fluid Meters, Their Theory and Application*, Sixth Edition, 1971).

FIG. 3 CALCULATING OPEN JET DEMAND

NAME WING SING CHEW (Robert Woo) STEAM SURVEY
ADDRESS 692 Sutter Street SUPPLY
ACCOUNT NO. SRG 19 12402 OPEN JETS 21,090 lbs./mo.

NUMBER	DIAMETER	ABSOLUTE PRESSURE	LBS. PER HOUR	HOURS USED PER MONTH	MONTHLY CONSUMPTION
3	1/8"	90 psia	37/each	442	16,300
1	1/16"	90 psia	9	4	36
1	3/16"	90 psia	82	52	4,260
2	>1/16"	90 psia	4	65	260
1	1/16"	90 psia	9	26	234

METER NO.

REMARKS

1 Clothes Press	(1)1/8"Jet	Mtrd.except head & buck valve	8hrs/day, 6days/wk
1 Clothes Press	(1)1/8"Jet	Mtrd.except head & buck valve	6hrs/day, 6days/wk
1 Clothes Press	(1)1/8"Jet	Mtrd.except head & buck valve	3hrs/day, 6days/wk
1 Set Puff Irons	(1)1/16"Jet		1hr/wk
1 Dress Steamer	(1)3/16"Jet		2hrs/day, 6days/wk
1 Spotting Gun	(1)>1/16"Jet		½hr/day
1 Sleeve Steamer	(1)1/16"Jet		1hr/day
1 Stm.Elec.Iron	(1)>1/16"Jet		2hrs/day

SURVEYED BY DATE

NAME Dallas Moore DBA STEAM SURVEY
ADDRESS 607 Geary Street SUPPLY
ACCOUNT NO. TRG 22 26753 OPEN JETS 5300

NUMBER	DIAMETER	ABSOLUTE PRESSURE	LBS. PER HOUR	HOURS USED PER MONTH	MONTHLY CONSUMPTION
2 Washing Machines		90 psia	40#/each	87 x 2 x .75	5,220
2	1/16"	90 psia	4#/each	10 x 2	80
		(Measured)	(Per Mfg.Spec.)	(Per Customer)	

METER NO. #1440

REMARKS

2 Washing Mahcines (1)1/2"Jet/ea. Each Machine used 4 hours a day - 1 hour for each load

2 Spotting Guns (1)1/8"Jet/ea. Each used 1/2 hour per day

ALL USED 5 DAYS/WEEK

LESSON PLAN OF MAINMAN TRAINING

FIFTH DAY

I. Accounting	Instructor
1.1 Why Accounting	I. O. Hauser
1.2 Steam Accounting	(2 hours)
1.3 Requesting And Closing Out Jobs	
II. Tour Of Office	
2.1 Engineering Section (1 hour)	Instructor
2.2 Maps And Records (1 hour)	T.B.A.
III. Job Planning	Instructor
3.1 Equipment Selection	I. O. Hauser
3.2 Site Layout	(2 hours)
IV. Evaluation Of Training	Instructor
4.1 How Can Training Program Be Improved	R. L. Waller
4.2 Explain Additional Training To Be Received	(1 hour)

ACCOUNTING

Today's subject, "Accounting", may be defined as the recording and compilation of the effects of all financial transactions; that is a historical record of a completed job. I am sure the financial transaction you like best is cashing your paycheck. However, there is much more to accounting than the payment of wages.

Accounting provides our management the information it needs for the adequate evaluation of past performances (historical data for comparison purposes) and the determination of future actions to be taken by the company. In order to accomplish these objectives, our accounting system is so organized to assure the proper and adequate collection, classification, recording, accumulation and dissemination of financial and statistical data.

Our accounting practices are dictated by regulatory bodies, necessary for tax purposes, and required for efficient operation of the company.

A. Why Accounting

To those of you with little or no accounting background, it will appear that the requirements of our accounting system are burdensome and extremely heavy. It looks like a needless waste of effort, anyone can see the work you have just completed. Why itemize your time and the material you have used to many different accounts. Well the breakdown item by item to the various accounts is required by the Public Utilities Commission and for the efficient operation of the company.

Poor accounting by people in the field, doing the construction work, causes misunderstanding with the office personnel. To repeat, operating people in the field cannot see why it is necessary for them to prepare and submit all those records required by the office. The office people cannot see why the operating people cannot or will not take the time to provide the records the office needs to do its work. This misunderstanding is due to the lack of information on the part of operating people on what is accounting and why we keep accounts.

1. Company Accounting Practices

The accounting practice followed by our company is prescribed by the regulatory commissions that have legal jurisdiction over public utilities. In our case the regulatory commissions are the California Public Utilities Commission (C.P.U.C.) and the Federal Power Commission (F.P.C.). The accounting system prescribed formally codifies a uniform system of accounts which is designed to provide the same accounting practice among all public utilities. You may have heard, "We use a uniform system of accounts." This is where the expression comes from. Now the prescribed system gives the C.P.U.C. and the F.P.C. an opportunity to find out in advance the kind of accounting data which shall be available to assist them in their regulatory duty. It has been said of the Public Utilities Commission, that they say, "Do your accounting our way so we can understand it." The uniform system of accounts prescribes the following:

a. A title, number and definition of each primary balance sheet, plant, income and expense account.
b. The items to be recorded in each account.
c. General and specific instructions relating to accounting practices.
d. Definition of certain terminology as applied to accounting activities.

All prescribed accounts are accompanied by detailed instructions as to type of transactions to be recorded in each account. Representative lists of items and functions includable in different accounts are provided for further classification.

You should understand that we are not prohibited from keeping other accounts and records in addition to those prescribed by the regulatory bodies. We have established our own internal accounting procedure, interpret the results and make our own form of our periodic financial and operating reports. The regulatory commissions require that our reports to them can be traced directly to the accounting records.

In other words we have to be able to prove to the commission that we actually did the work that our records sent to the commission show. This means any [illegible] job that you have worked on can be traced in our accounting records. The original requisitions for material can be found along with the time cards showing the labor charged to the job.

2. Source Data

The source data that begins the accounting cycle originates in our case, where you work, the Gas Operating Department. Your foreman will write or have his clerk write a requisition for material. He will submit a time report for each employee working for him. The equipment used, such as truck mileage, trenchers and backfillers will be reported. As these reports are received by the accounting department from throughout the company, they are summarized by type and become the underlying support for one or more accounting entries that allocate the dollar cost of that particular report. For example, your time sheet will only contain your name, the hours you worked, a brief description of the job you worked on, the job number and the accounts your time should be charged to. This time report becomes the basis of two accounting entries:

a. It supports the amount of wages you receive.

b. It supports the distribution of your wages to the appropriate financial accounts.

Controls are maintained to assure completeness of the collection of this source data by the use of check-off lists that cover all employees and all departments who are required to submit source data.

3. Rate Base

The detailed accounting records which show a continuing inventory by type of property unit and its installed cost are of great importance to the company. Examples of units of property are 100 feet of 4" distribution main, 50 feet of 6" distribution main, a steam service, a steam meter, etc. These records represent the principal portion of our gas rate base--the basis for our gas earnings. As you may know, the earnings of a public utility are limited by the Public Utilities Commission. The earnings allowed (called rate of return) are generally arrived at by determining the interest cost of the company's debt plus an allowance for return on the investment made by our stockholders. From the earnings so allowed we must pay interest on money borrowed to install mains, dividends to stockholders and put aside dollars which can be used for expansion of our business.

The necessity of accurate field reporting cannot be overemphasized.

Accurate records may save considerable embarrassment years later. For instance, if in a rate case (we are asking for more earnings) the cost of construction of similar installations constructed about the same time are compared, differences between the cost of similar jobs may show up. These differences can discredit all of the construction records, and it can be made to appear that the employees of the gas company were deliberately trying to get away with something. Actually all that happened was careless reporting of construction costs.

4. Taxes

Your company is one of the largest property taxpayers in the state. In some counties it is the largest taxpayer. Our property records form the basis for the calculation of our property taxes, depreciation accruals and insurance valuation. We wish to pay our fair share of the taxes, but at the same time we do not want to overpay them.

5. Operating Statistics

Up to this point we have been talking about the accumulation of financial data. Now let's see how these same statistics can be used by our management. They will compare the costs of your division's operations with those of the other divisions. They will compare our company-wide costs of operation with those of other gas companies. If anything gets too far out of line, it will be found and corrected by an audit.

a. Auditing

The objectives of company employees engaged in auditing our accounts follow·

(1) Prevention and detection of fraud.

(2) Analysis and improvement of internal controls.

(3) Control and reduction of costs.

(4) Survey of personnel and office methods to see that they are in conformity with management policies.

The internal audit report provides management with an assurance that its policies are being followed. The report normally contains recommendations for changes either in current management policies or steps required to prevent future nonconformance with such policies. In other words, Big Brother is watching how we work.

6. Financial Statements

The accounting records are used to prepare financial statements for the owners of our company, the stockholders. Comparison is made with years past to show how well our company is doing now.

STEAM ACCOUNTING

Capital Accounts

4501 - Main Installation including all accessory items (valves, expansion joints, manholes, traps, etc.)

4502 - Service Installation

4505 - Steam Meters

Maintenance Accounts

4801 - Repair of Mains including all accessory items

4802 - Repair Services (partial replacement)

4805 - Repair Steam Meters

Units of Property
Capital vs. Maintenance

To determine whether Capital or Maintenance accounts are to be used for the replacement of main, valves, expansion joints, etc., it will be necessary to know whether the length and/or size of replacement represents a unit of property or less than a unit of property.

Units of Property

4" Main and Under	-	100 feet of continuous pipe including accessory items
6" Main and Over	-	50 feet of continuous pipe including accessory items

Replacement of valves, expansion joints, etc., 4" and under shall be charged to the Maintenance Account.

Replacement of valves, expansion joints, etc., 6" and over shall be charged to the Capital Account.

2.1 Engineering Section

The trainee will spend time in the Engineering Section. There, he will be introduced to job Preparation Procedures and rules that relate to steam facilities.

2.2 Maps And Records

This training will show the trainee how records that he may generate are kept on file. Ways that these records are used will be highlighted. The importance of these records will be stressed. It is intended to impress on the trainee's mind the importance of making accurate records of his work.

3.1 Equipment Selection

The instructor will present a proposed job. Proper tool and equipment selection will be requested of the trainee. This is planned to teach the trainee to work with very little supervision. He will at times (emergency conditions) be required to perform without supervision.

3.2 Site Layout

The trainee shall be required to plan a proposed work area layout. Instruction on the layout of a work area will be given before hand.

4.1 How Can Training Program Be Improved

The opinion of the trainee will be seeked at this point. This will be an open discussion with his supervisor. During the discussion, ways to improve the Program will be sought.

4.2 Explain Additional Training To Be Received

The future training to be received will be brought out. If the trainee has questions or should think of areas where training will be needed and is not provided, his questions will be answered, and if possible, arrangements will be made to provide the training.

The Steam Serviceman Monthly Assignment Chart outlines work training to be recieved.