SD33
Issue: 9
Date: 5/82

SERVICE INSTRUCTIONS
MODEL SERIES 33
NULLMATIC® TEMPERATURE TRANSMITTER

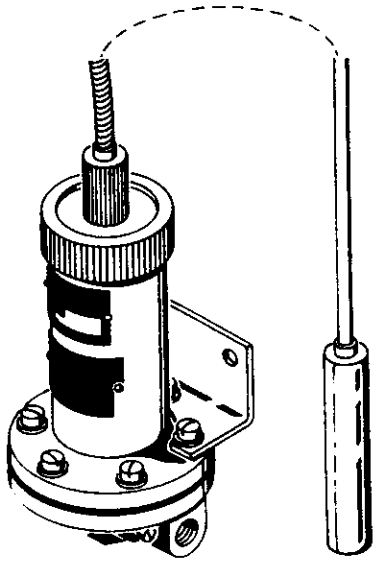


TABLE OF CONTENTS

MOORE PRODUCTS CO., Spring House, Pa. 19477

GENERAL DESCRIPTION

The Model Series 33 Nullmatic Temperature Transmitters are used to measure temperature in vessels, reactors, fractionating columns, heat exchangers, pipelines, air ducts, flues, etc., and transmit a pneumatic output proportional to the measured temperature range.

Each Model Series 33 Nullmatic Temperature Transmitter consists of two portions: a helium-filled Thermal System and a Nullmatic force-balance Transmitter. The Nullmatic force-balance Transmitter converts pressure changes in the Thermal System, caused by changes in temperature, to 3-15 psig output signals proportional to the measured temperature range.

Thermal Systems consist of a bulb, with a bendable extension (except Rigid Bulbs), a flexible armored capillary, and a bellows. Three kinds of Bulbs are available for use with a Thermal System: 3/8" O.D., 3/4" O.D. and Averaging. The 3/8" O.D. Bulbs are either Plain Bulbs or Rigid Bulbs. The 3/4" O.D. Bulbs are either Plain Bulbs, Non-Rigid Bulbs or Rigid Bulbs. The Averaging bulb has a 3/16" O.D. and is extendable. All thermal systems are made of either 316 Stainless Steel or Copper.

The Nullmatic force-balance Transmitter employs a pilot-operated null-balance principle of operation. This maintains the output pressure regardless of wide changes in flow or supply pressure.

GENERAL SPECIFICATIONS

Temperature Span ..... 3/4" O.D. and Averaging Bulbs -
Minimum: 50°F (30°C);
Maximum: 1000°F (540°C)
3/8" O.D. Bulbs -
Minimum: 70°F (40°C);
Maximum: 1000°F (540°C)

Operating Temp. Limits .... 3/4" O.D. and Averaging Bulbs -
Minimum: – 450°F (– 270°C);
Maximum: 1400°F (760°C).
Minimum: – 450°F
(– 270°C); Maximum:
1000°F (540°C)

Supply Pressure ..... Normal - 20 psig (3-15 psi output)
Maximum - 35 psig
Minimum - 4 psi above max. output

Output Range ..... 3-15 psig
3-27 psig and 0-30 psig output ranges are available.

Connections ..... 1/4" NPT for Supply and Output

Ambient Temp. Limits ..... – 40° to 180°F

MODEL DESIGNATION

33 C 5012 (C7C)

Basic Model Series Designation

Transmitter Model Number

Designator for Mating Transmitters and Thermal Systems

A — Spans of 250°F to 1000°F
C — Spans of 150°F to 800°F
D — Spans of 100°F to 475°F
E — Spans of 70°F to 250°F
SE — Spans of 50°F to 70°F

Thermal System Number

THERMAL SYSTEM NUMBER	THERMAL SYSTEM MATERIAL	BULB DIAMETER	BULB TYPE	BULB OVERALL LENGTH	BULB ACTIVE LENGTH	BENDABLE EXTENSION LENGTH	ARMORED CAPILLARY LENGTH
5012	Copper	3/4"	Plain	4"	4"	20"	36"
5048	Copper	3/4"	Rigid	6"	4"	None	36"
5072	316 S.S.	3/4"	Plain	4"	4"	20"	36"
5079	316 S.S.	3/4"	Rigid	6"	4"	None	36"
5081	316 S.S.	3/4"	Plain	4"	4"	20"	36" PVC*
5098	316 S.S.	3/4"	Non-Rigid	4"	4"	20"	36"
5142	316 S.S.	3/4"	Plain	4"	4"	20"	120"
5257	316 S.S.	3/4"	Rigid	6"	4"	None	120"
5287	Copper	3/4"	Non-Rigid	4"	4"	20"	36"
5341	316 S.S.	3/16"	Extendable	14'	14'	20"	36"
5475	316 S.S.	3/8"	Plain	4"	4"	24"	36"
5476	Copper	3/8"	Plain	4"	4"	24"	36"
5477	316 S.S.	3/8"	Rigid	11-1/4"	4"	None	36"
5478	Copper	3/8"	Rigid	11-1/4"	4"	None	36"
5479	316 S.S.	3/8"	Plain	4"	4"	24"	36" PVC*
5580	316 S.S.	3/8"	Plain	4"	4"	24"	120"

*Polyvinyl Chloride Coating

Factory Code

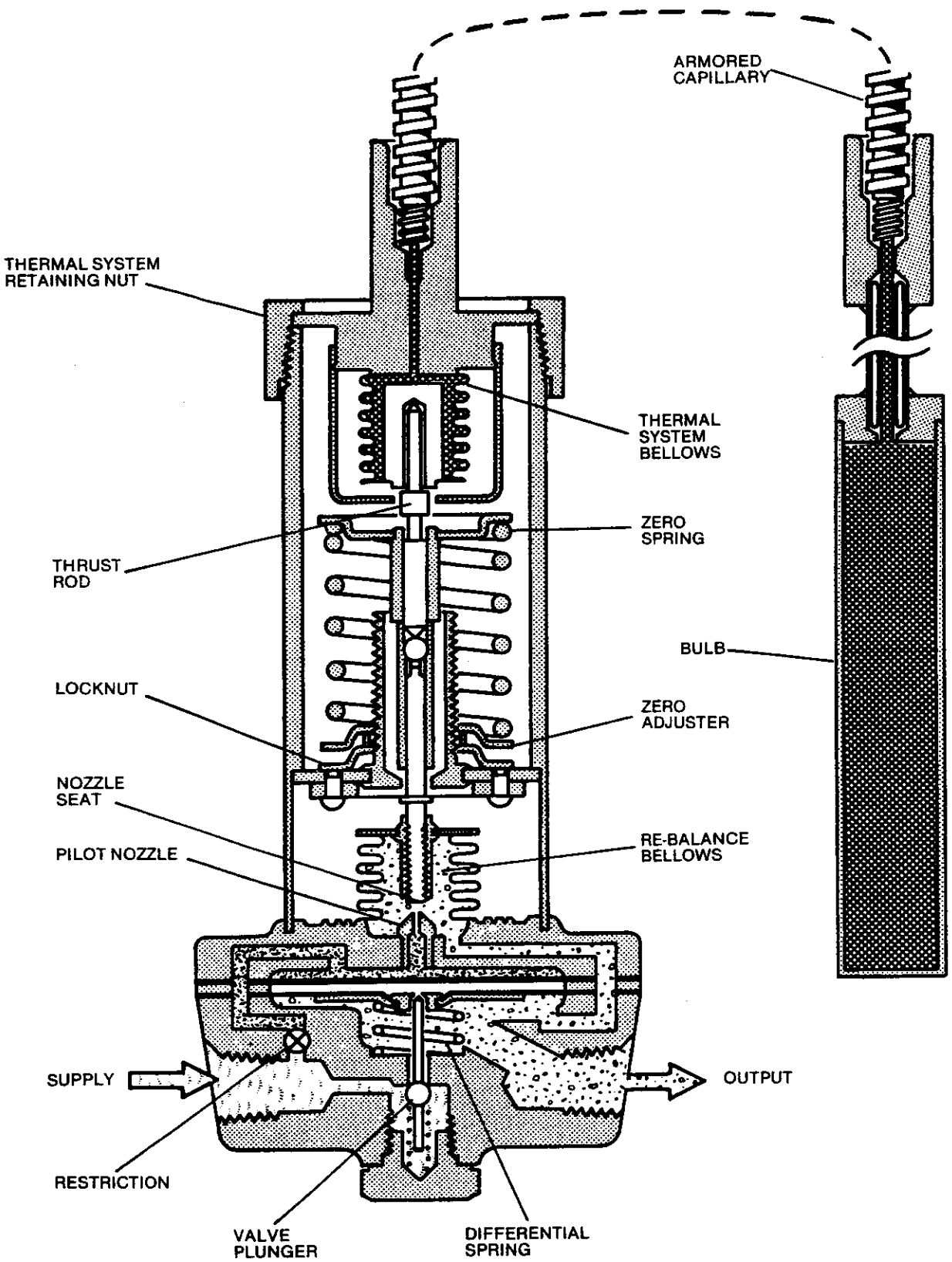


FIGURE 1 Schematic

PRINCIPLE OF OPERATION

Refer to Figure 1 and the following text.

As the measured temperature increases, the pressure of the gas in the Thermal System increases, increasing the force exerted by the Thermal System bellows. This increased force is applied to the rebalance bellows, via the thrust rod, decreasing the clearance between the pilot nozzle and nozzle seat. The decreased clearance restricts air flow from the pilot nozzle, increasing the pressure in the chamber above the booster diaphragm.

As the pressure above the booster diaphragm increases, the diaphragm is forced down. It contacts the valve plunger, closing the exhaust port, and moves the plunger down, opening the supply port. The output pressure increases, increasing the force exerted by the rebalance bellows. When the force exerted by the rebalance bellows equals the force exerted by the Thermal System bellows, the Transmitter output will have increased an amount proportional to the temperature increase. At this point, the exhaust diaphragm moves upward, allowing the valve plunger to move up and close the supply port, thus preventing any further increase of the Transmitter output.

The booster section consists of a booster diaphragm assembly, a valve plunger, a differential spring, a pilot nozzle, and a supply restriction. This 1:1 volume booster increases the output capacity of the Transmitter. A very small flow of supply air passes through the restriction and into the chamber on top of the booster diaphragm. It exits this chamber through the pilot nozzle and into the output. This small flow into the output is exhausted to atmosphere via the booster diaphragm. The differential spring acts on the bottom of the booster diaphragm and exerts a force equivalent to 3 psi. Therefore, the pressure in the chamber above the booster diaphragm will always be higher than the output (i.e., pressure on top = output + differential spring). The differential spring, therefore, maintains a constant pressure drop across the pilot nozzle. This constant drop minimizes movement of the rebalance bellows (i.e., extremely small clearance changes between the nozzle seat and pilot nozzle) to provide a high degree of accuracy.

TRANSMITTER INSTALLATION

MOUNTING

The Model 33 Nullmatic Temperature Transmitter includes a standard mounting bracket.

Two optional mounting brackets are available (see Fig. 2) and are bolted to the standard bracket for use. The P/N 3351-101 kit is used for pipe mounting, either horizontal or vertical. The P/N 859-89 mounting bracket is used for thermal well mounting.

Mounting dimensions are shown in Figure 2.

The Model 33 may be mounted in any reasonably vibration-free location. It is recommended to mount the Transmitter in a vertical position, although it may be mounted in any position. Mounting the Transmitter in positions other than vertical requires that the zero adjustment be reset.

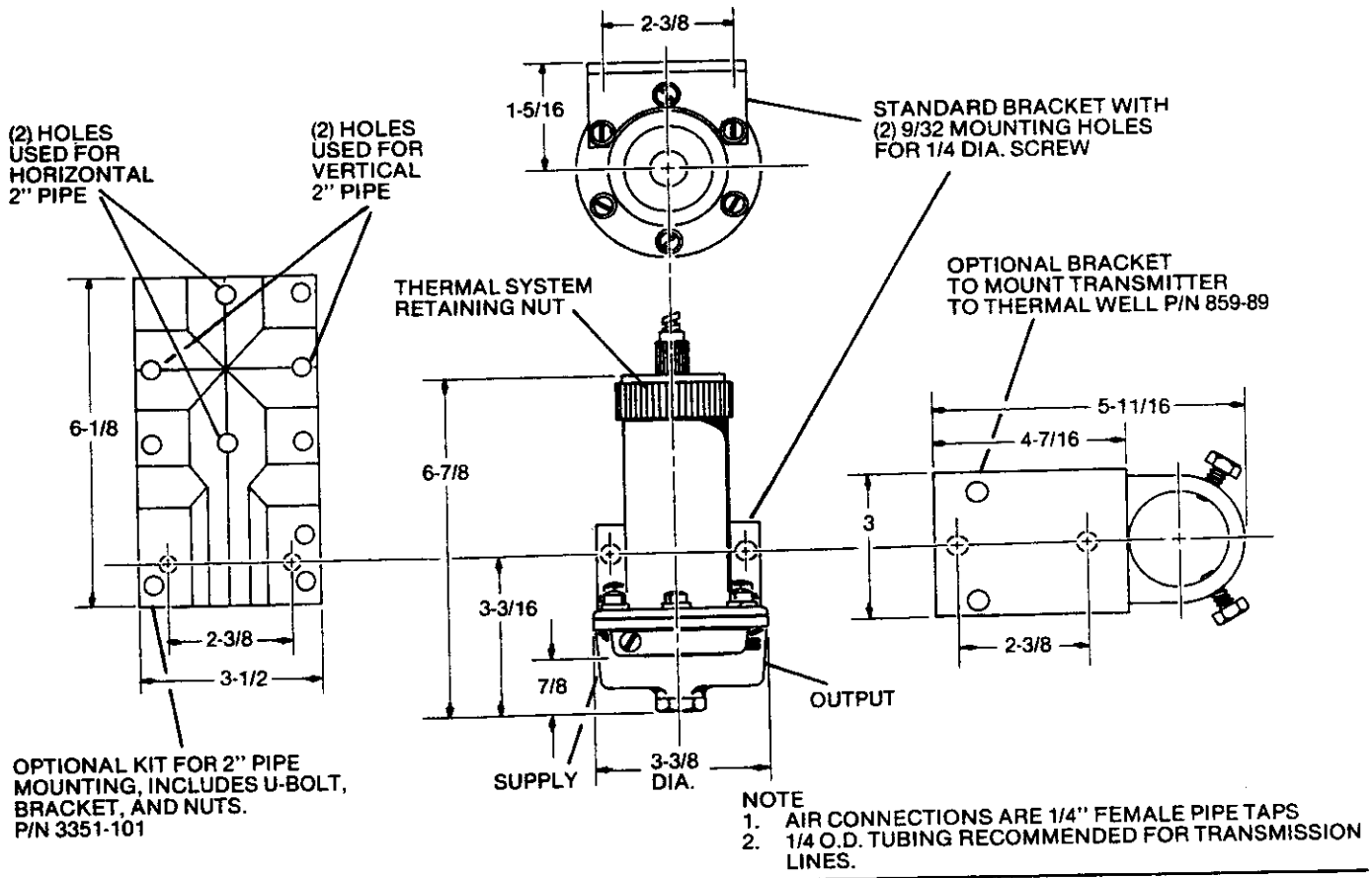


FIGURE 2 Transmitter Installation

Caution

Exceeding the specified ambient temperature limits can adversely affect performance and may cause damage.

PNEUMATIC CONNECTIONS (Refer to Figure 2)

The supply and output connections are 1/4" N.P.T.

1/4" O.D. tubing is recommended for piping to the Transmitter, however, any scale-free piping may be used.

Blow out all piping before connections are made to prevent the possibility of dirt or chips entering the Transmitter.

Use pipe sealant sparingly, and then only on the male threads. A non-hardening sealant is strongly recommended.

Connect the Transmitter to a 20 psig (19 psig min.; 35 psig max.) source of clean, dry, oil-free instrument air. See SUPPLY AIR REQUIREMENTS.

Caution

Supply pressure in excess of 35 psig may cause damage.

SUPPLY AIR REQUIREMENTS

Connect the Transmitter to a source of clean, dry, oil-free supply air. Failure to do so will increase the possibility of a malfunction or a deviation from specified performance.

Caution

Synthetic compressor lubricants in the air stream at the instrument may cause the Transmitter to fail.

There are different types of synthetic compressor lubricants. Some may not be compatible with the neoprene diaphragm assembly or the Buna-N "O"-ring used in the Transmitter. Wetting of these parts by such an oil mist or oil vapor, etc., may cause them to deteriorate. This may ultimately result in failure of the Transmitter.

The requirements for a quality air supply can be found in the Instrument Society of America's "Quality Standard For Instrument Air" (ISA-S7.3). Basically this standard calls for the following:

Particle Size — The maximum particle size in the air stream at the instrument should be no larger than 3 microns.

Dew Point — The dew point - at line pressure - should be at least 10°C (18°F) below the minimum temperature to which any part of the instrument air system is exposed at any season of the year. Under no circumstances should the dew point - at line pressure - exceed 2°C (35.5°F).

Oil Content — The maximum total oil or hydrocarbon content, exclusive of noncondensibles, should not exceed 1 ppm under normal operating conditions.

THERMAL SYSTEM INSTALLATION

MOUNTING CONSIDERATIONS

Plain bulbs are generally used on open kettles, shallow pots, and tanks; where threaded support is not required. By adding a compression fitting to a 3/8" Plain Bulb, or a compression fitting and union screw to a 3/4" Plain Bulb, a fixed position can be obtained. The 3/4" Plain Bulbs with a compression fitting and union screw cannot be used for pressure-tight installations.

For vessels under pressure or whenever strong lateral forces are present, rigid bulbs or plain bulbs in thermal wells are used. Rigid bulbs are not used in thermal wells.

The speed of response depends primarily upon the degree of contact between the bulb and the measured process medium. Bare bulbs provide the fastest response. Response speed will also depend upon the circulation present in the processing vessel.

The Nullmatic Transmitter and Thermal System are calibrated together at the factory. On multiple unit installations, if the Thermal Systems are separated from their Transmitters, they must be remated with the original Transmitter - otherwise the calibration will be incorrect.

All bulbs, except averaging, have a 4 inch active portion. Consideration must be given to wall thickness, mounting hardware, etc., so that the 4 inch active portion is immersed in the medium to be measured.

To improve heat transfer between a thermal well and a bulb, copper contact strips may be employed. These .005" thick sheets are placed along side the bulb before it is inserted into the thermal well. The sheet must make positive contact against the thermal well walls.

Caution

Do not expose the Thermal System to process temperatures beyond the limits in Table 1 or Table 2. Exceeding the maximum operating temperatures may adversely affect performance. Exceeding the overrange limits can cause damage.

MOUNTING INSTRUCTIONS

3/8" O.D. Plain Bulbs

GENERAL

Figure 3 shows the 3/8" O.D. Plain Bulb dimensions, the compression fitting used and the thermal well dimensions.

Thermal wells are available in either 304 S.S. or 316 S.S. They have either a 2-1/8" lag or no lag. Three immersion lengths are available: 5-1/2", 8-1/4" and 12-1/4".

The compression fitting is used to mount the 3/8" O.D. Plain Bulb to the customer's connection or thermal well. It consists of a nut, a split packing follower with a retaining spring, (4) split asbestos packing rings, a split packing gland with a retaining spring, and a 1/2"

NPT male pipe fitting. This compression fitting can be used for pressure installations to 1000 psig. The P/N 12140-3 compression fitting is used on stainless steel Thermal Systems; the P/N 12141-15 compression fitting is used on copper Thermal Systems.

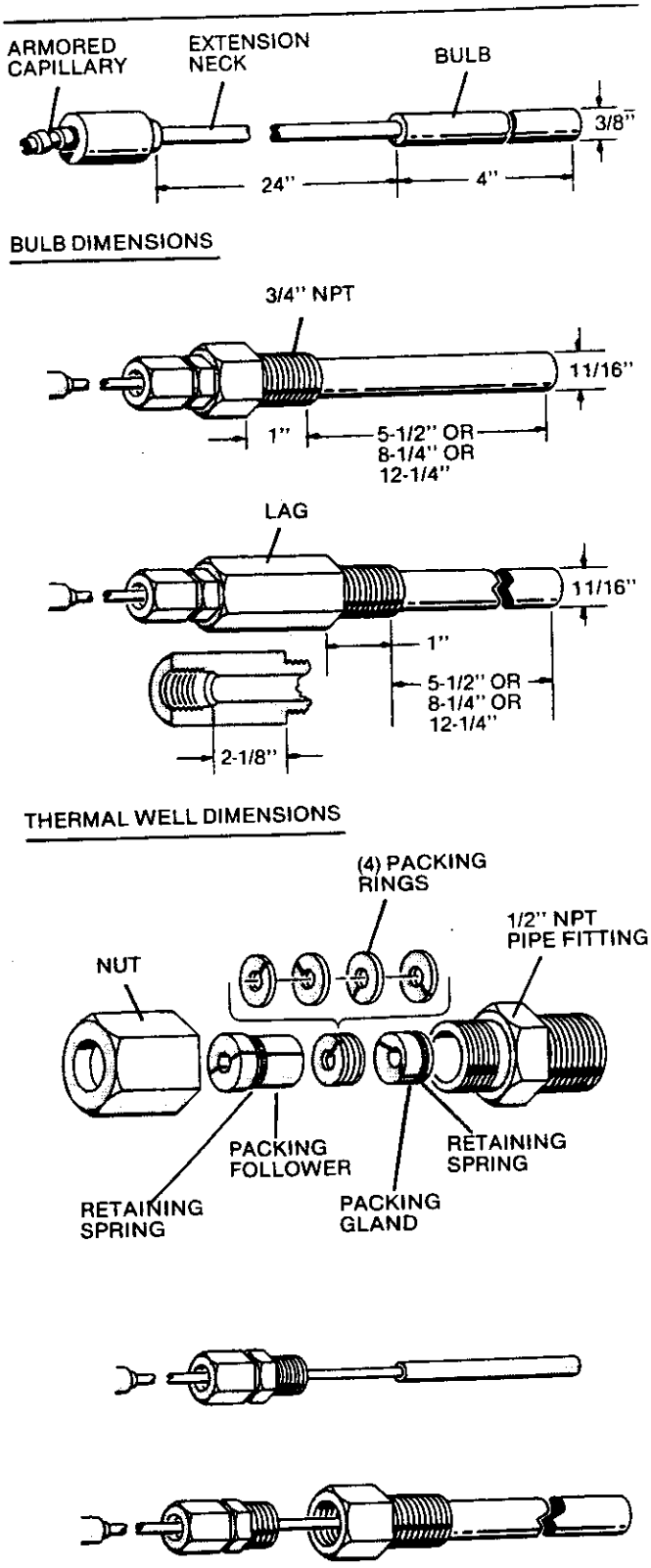


FIGURE 3 3/8" Plain Bulb Installation

PROCEDURE

Refer to Figure 3.

The following procedure is recommended for assembling the compression fitting on the extension neck and mounting the bulb. All parts of the compression fitting, except the packing rings, will pass over the bulb.

1. Determine where, on the extension neck, the fitting is to be made-up.
2. Pass the nut, packing follower, packing gland and the pipe fitting over the bulb onto the extension neck.
3. Place one split packing ring on the extension neck, between the packing follower and packing gland.
4. Put the packing gland into the pipe fitting.
5. Note where the split is, on the packing ring, and using the packing follower, push the packing ring into the pipe fitting until it bottoms.
6. Repeat step 5 for each of the remaining (3) packing rings. Place each successive packing ring split 90° away from the last.
7. Put the packing follower into the pipe fitting.
8. Screw the nut onto the pipe fitting, but do not tighten.
9. Position the bulb into the vessel or installed thermal well, to the depth determined in step 1.

NOTE

If a P/N 4454-1105 contact strip is used, it must be placed along side the bulb before it is inserted into the thermal well.

10. Tighten the pipe fitting.
11. Tighten the nut.

To install a thermal well, simply tighten it into the vessel connection.

NOTE

The thermal well must be installed before installing the bulb into it.

3/8" O. D. Rigid Bulbs

GENERAL

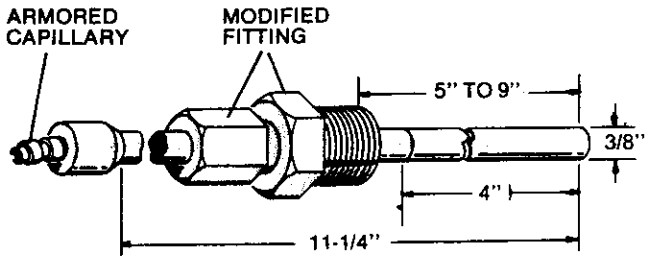
Figure 4 shows the 3/8" O.D. Rigid Bulb dimensions and the modified fitting used.

The 3/8" O.D. Rigid Bulbs have a 7-1/4" lag. This lag enables the bulb to have a 5" to 9" insertion length.

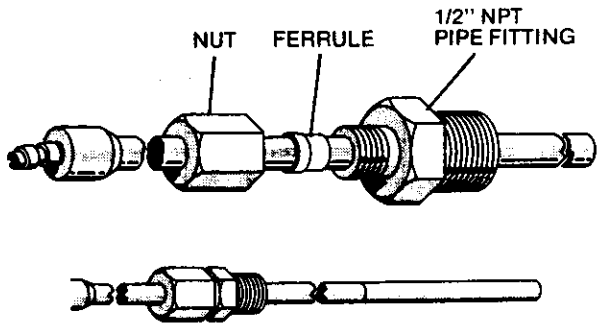
The modified fitting is used to mount the 3/8" Rigid Bulb to the customer's connection. It consists of a nut, a ferrule and a 1/2" NPT male pipe fitting. This fitting can be used for pressure installations to 1500 psig for stainless steel bulbs; 1000 psig for copper bulbs. The P/N 12142-3 fitting is used on stainless steel Thermal Systems; the P/N 12143-4 fitting is used on copper Thermal Systems.

IMPORTANT

Once the modified fitting is made-up and tightened, the ferrule becomes permanently fixed in place. This is a one-time setting and cannot be changed.



BULB DIMENSIONS



MODIFIED FITTING

FIGURE 4 3/8" Rigid Bulb Installation

PROCEDURE

Refer to Figure 4.

The following procedure is recommended for assembling the modified fitting on the bulb and mounting the bulb. All parts of the fitting will pass over the bulb.

1. Determine where, on the bulb, the fitting is to be made-up.
2. Pass the nut, ferrule and 1/2" NPT pipe fitting onto the bulb.
3. Position the bulb, into the vessel, to the depth determined in Step 1.
4. Tighten the 1/2" NPT male pipe fitting.
5. Place the nut over the ferrule and tighten it on the fitting.

3/4" O.D. Plain Bulbs

GENERAL

Figure 5 shows the 3/4" O.D. Plain Bulb dimensions, the compression fitting used and thermal well dimensions.

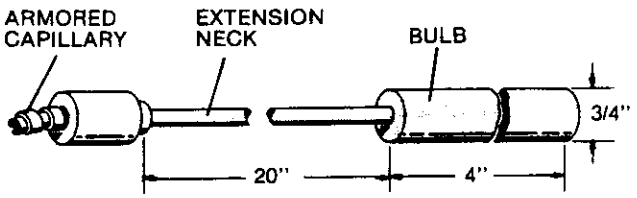
Thermal wells are available in either 304 S.S. or 316 S.S. They have either a 2-1/8" lag or no lag. Three immersion lengths are available: 5-1/2", 8-1/4" and 12-1/4".

The compression fitting is used to mount the 3/4" O.D. Plain Bulb to the customer's connection or thermal well.

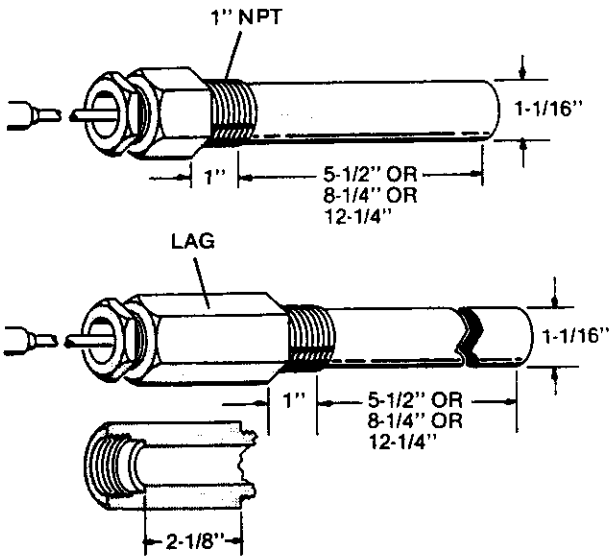
IMPORTANT

This compression fitting is used with a union screw or on a thermal well. It is not used alone.

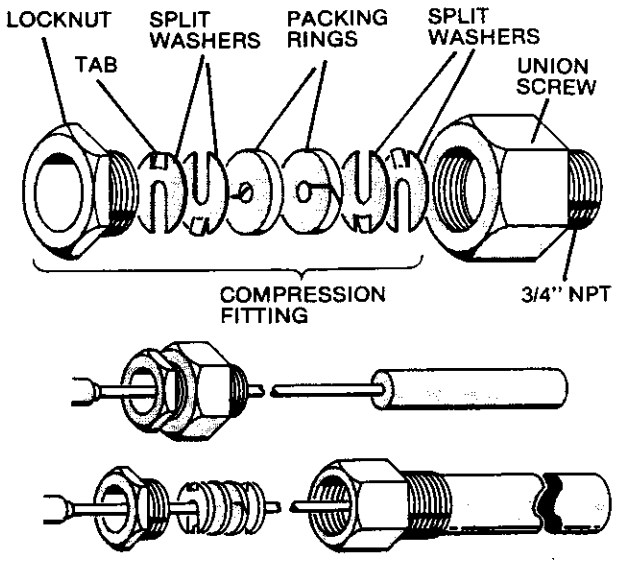
The compression fitting consists of a union locknut, (4) 316 S.S. split washers, and (2) split asbestos packing rings. This compression fitting when used with a union screw, is used on non-pressure installations only. The P/N 1551-31 compression fitting is used on stainless steel Thermal Systems; the P/N 1551-30 compression fitting is used on copper Thermal Systems. The P/N 1551-31 compression fitting and the P/N 859-112 union screw are available together under P/N 1551-22 for stainless steel Thermal Systems. The P/N 1551-30 compression fitting and the 1551-5 union screw are available together under P/N 1551-9 for copper Thermal Systems.



BULB DIMENSIONS



THERMAL WELL DIMENSIONS



COMPRESSION FITTING AND UNION SCREW

FIGURE 5 3/4" Plain Bulb Installation

PROCEDURE

Refer to Figure 5.

The following procedure is recommended for assembling the compression fitting on the extension neck and mounting the bulb.

1. Determine where, on the extension neck, the fitting is to be made-up.
2. Pass the union locknut (and union screw - if not to be installed in a thermal well) over the bulb onto the extension neck.
3. Position the bulb into the vessel or installed thermal well, to the depth determined in step 1.

NOTE

If a P/N 4454-0105 contact strip is used, it must be placed along side the bulb before it is inserted into the thermal well.

4. Tighten the union screw into the vessel connection, if a thermal well is not being used.
5. Place one split washer on the extension neck with the tab facing inward. Slide this washer into the installed thermal well or union screw until it bottoms.
6. Place the second split washer on the extension neck, rotated 180°, with the tab facing outward. Slide this washer into the installed thermal well or union screw to mate with the first split washer.
7. Place one split packing ring on the extension neck.
8. Note where the split is, on the packing ring, and push the packing ring in until it bottoms.
9. Place the other packing ring on the extension neck. Push this packing ring in, with the split 90° away from the other, until it bottoms.
10. Place the last two split washers on the extension neck as shown in Figure 5, and slide them in against the last packing ring.
11. Position and tighten the union locknut.

To install a thermal well, simply tighten it into the vessel connection.

NOTE

The thermal well must be installed before installing the bulb into it.

3/4" O.D. Rigid Bulbs

GENERAL

Figure 6 shows the 3/4" O.D. Rigid Bulb dimensions and the union locknut and union screw used.

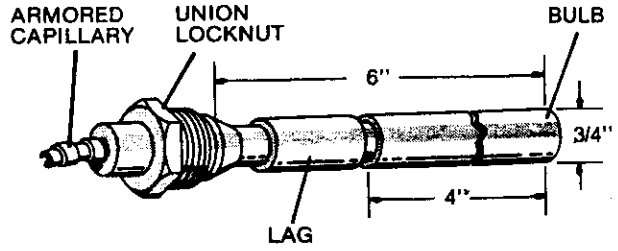
The union locknut and union screw are used to mount the 3/4" Rigid Bulb to the customer's connection. The tapered metal seat of the bulb seats in the union screw. This fitting, union locknut and union screw, can be used for pressure installations to 1500 psig for stainless steel bulbs; 1000 psig for copper bulbs.

The union locknut is included on the Thermal System and is a permanent part of it.

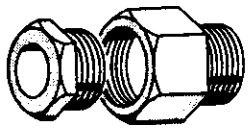
The P/N 859-112 union screw is used on stainless steel bulbs, the P/N 1551-5 union screw is used on copper bulbs.

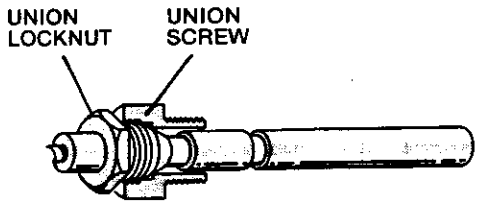
PROCEDURE

1. Tighten the union screw into the vessel connection.
2. Position the bulb into the vessel.
3. Tighten the union locknut.



BULB DIMENSIONS





FITTING

FIGURE 6 3/4" Rigid Bulb Installation

3/4" O.D. Non-Rigid Bulbs

GENERAL

Figure 7 shows the 3/4" O.D. Non-Rigid Bulb dimensions and the union locknut and union screw used.

The union screw and union locknut are used to mount the 3/4" Non-Rigid Bulb to the customer's connection. A tapered metal seat is permanently welded (316 S.S. units) or silver soldered (copper units) to the extension neck. The purpose of the seat is to obtain pressure vessel connections for bare bulbs, by eliminating the asbestos packing used in compression fittings. The seat may be located anywhere on the neck, but must be specified on the order.

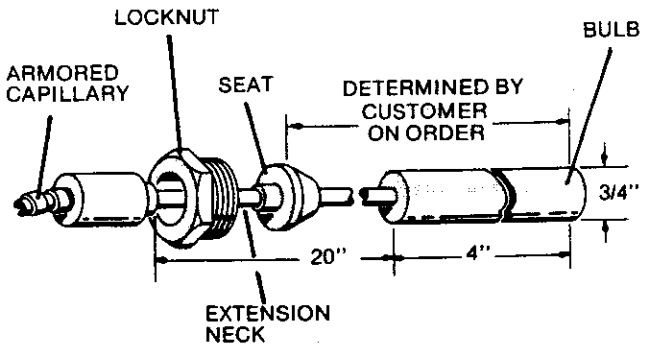
The union locknut and union screw, as a fitting, can be used for pressure ratings to 1500 psig for stainless steel bulbs; 1000 psig for copper bulbs.

The union locknut is included on the Thermal System and is a permanent part of it.

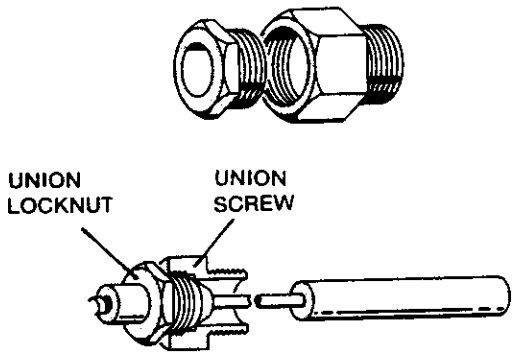
The P/N 859-112 union screw is used on stainless steel bulbs; the P/N 1551-5 union screw is used on copper bulbs.

PROCEDURE

1. Tighten the union screw into the vessel connection.
2. Position the bulb into the vessel.
3. Tighten the union locknut.



BULB DIMENSIONS



FITTING

FIGURE 7 3/4" Non-Rigid Bulb Installation

Averaging Bulbs

GENERAL

Figure 8 shows the Averaging Bulb dimensions.

Averaging Bulbs have a 3/16" diameter bulb, 14' long, coiled into a 5-1/2" diameter for shipment. The end of the bulb includes a ring for anchoring the bulb after it has been stretched to its installation length.

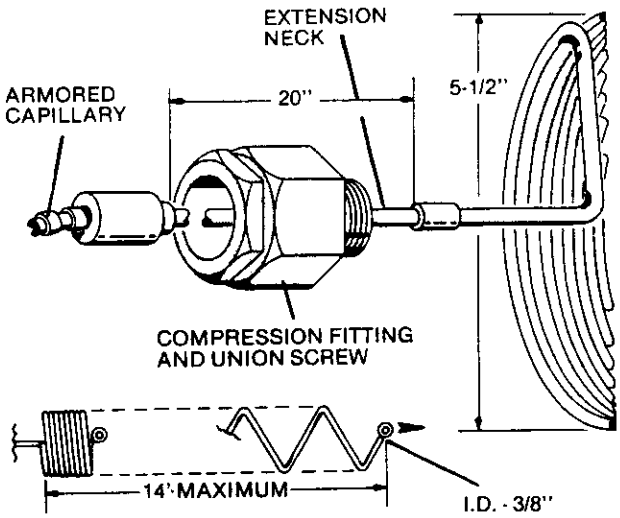
The compression fitting is used to mount the Averaging Bulb to the duct or vessel. It is the same one that is used to mount 3/4" O.D. Plain Bulbs. See Figure 5.

The Averaging Bulb is available in 316 S.S. only. It uses the P/N 1551-31 stainless steel compression fitting and the P/N 1551-22 union screw. These are available under P/N 1551-22.

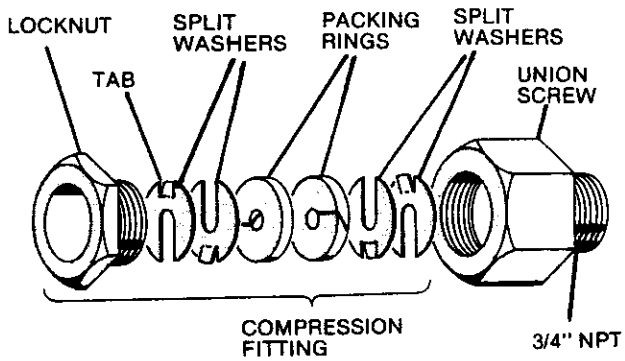
The compression fitting and union screw (P/N 1551-22) are assembled on the extension neck before shipment.

PROCEDURE

1. Install the bulb into the duct or vessel and anchor it.
2. Tighten the union screw into the duct or vessel connection.
3. Tighten the union locknut.



BULB DIMENSIONS



COMPRESSION FITTING AND UNION SCREW

FIGURE 8 Averaging Bulb Installation

MAINTENANCE

GENERAL

The Model 33 Nullmatic Temperature Transmitter has no recommended routine maintenance. The only item to check on a periodic basis is the Transmitter's zero adjustment.

In installations where the process medium is dirty or coats the bulb (or thermal well), the bulb (or thermal well) should be removed periodically for cleaning.

CLEANING (See Figure 9)

The restriction screw, screen and valve plunger are the only items that require maintenance under ordinary conditions.

Restriction Screw

The small orifice and/or the filter screen may become clogged if the air supply is not clean.

1. Turn off supply air.
2. Remove the restriction screw.
3. Remove the filter screen from the restriction screw.

4. Using the knurled cleaning wire, located in the base of the transmitter, clear the small orifice in the end of the restriction screw.
5. If the orifice is blocked and the cleaning wire cannot clear, soak the restriction screw in solvent to dissolve the blockage.
6. The filter screen can be cleaned by soaking it in solvent, and then blowing it through with air.
7. Make certain that the "O" ring is not cut or gouged.

Valve Plunger

In cases of dirty supply air, a deposit may build up on the supply and/or exhaust seats.

1. Turn off supply air.
2. Remove the retaining nut in the base of the transmitter. The valve plunger and spring will drop out.
3. Clean the supply and exhaust seats in the transmitter. The supply seat is readily accessible; the exhaust seat can be reached with a tobacco pipe cleaner.
4. Replace the valve plunger and spring.
5. Replace and tighten the retaining nut.

TROUBLE ANALYSIS

The following table lists symptoms, probable causes and remedies. The symptoms and probable causes listed in order from most to least likely.

SYMPTOM	PROBABLE CAUSE	REMEDY
High Indication	Valve Plunger	Clean valve plunger
	Restriction screw loose	Tighten retaining screw
	Zero setting shifted	Reset zero setting
	Exhaust holes clogged	Clear exhaust holes
Low or No Indication	Restriction clogged	Clean restriction
	Valve plunger retaining nut loose	Tighten retaining nut
	Zero setting shifted	Reset zero setting
	Low or No air supply	Adjust to recommended supply pressure
	Partial or complete loss of thermal system fill	Replace thermal system
	Thermal system retaining nut not tight	Tighten retaining nut

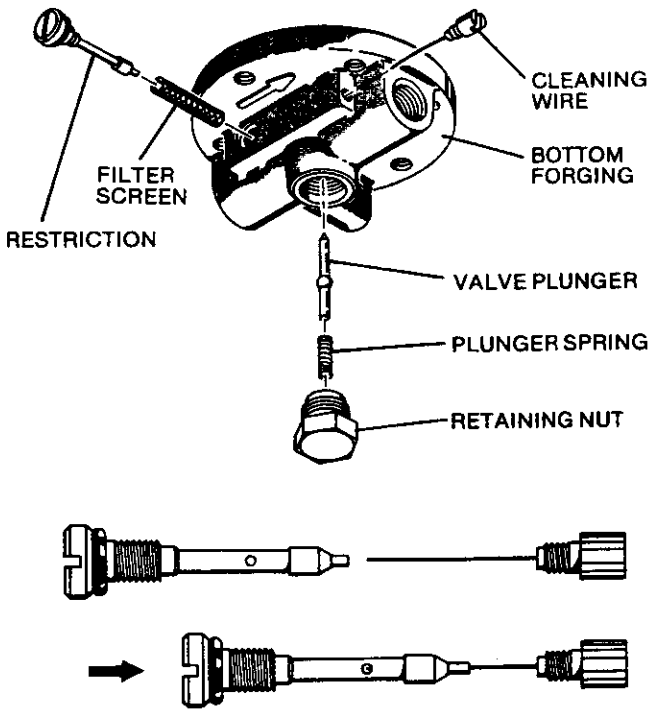


FIGURE 9 Cleaning

CALIBRATION

GENERAL

The only calibration adjustment is the zero adjustment. The span of the Instrument is determined by the Thermal System fill pressure. The System is inherently linear.

TEST EQUIPMENT

The following equipment is necessary to affect proper calibration of the Nullmatic Temperature Transmitter.

1. A controlled temperature bath.
2. A temperature measuring device accurate to 1/4%.
3. A 0-30 psig output test gauge accurate to 1/4%.
4. A supply air source set at 20 psig.

PROCEDURE

1. Immerse the bulb in a bath of known temperature within the range of the Instrument. The bath should be agitated and the temperature measured.
2. Allow a few minutes for the Thermal System to come to the bath temperature.
3. The output may be calculated for any temperature within the range of the Instrument. Calculate the output for the temperature of the bath.
4. Remove the zero adjuster cover plate.

5. Loosen the (lower) locknut and adjust the adjusting nut (next to the spring) until the output test gauge reads the calculated output.
6. Tighten the locknut against the adjusting nut to avoid a shift due to vibration.
7. Replace the zero adjuster cover.

TRANSMITTER AND THERMAL SYSTEM SELECTION

GENERAL

Tables 1 and 2 indicate the spans and maximum operating temperatures against which the proper Model 33 should be selected. Table 1 is used for Fahrenheit selection; Table 2 is used for Celsius selection.

NEW TRANSMITTER AND THERMAL SYSTEM

1. From the column marked common SPANS, select the desired span value. If the desired span is between the listed values, base the span selection on the next higher span shown.
2. Read from left to right along the selected span value to the first column listing a MAXIMUM OPERATING TEMPERATURE equal to or greater than the high end of the desired range. The MAXIMUM OPERATING TEMPERATURES for 3/8" bulbs and the 3/4" and averaging bulbs are listed separately. Use the Transmitter shown at the top of that column (e.g., 33D).
3. If the Thermal System may be subjected to a significant overrange in temperature, check the columns under MAXIMUM OVERRANGE to insure that the excess temperature is within limits.
4. Consult the factory to determine the type of Thermal System desired (according to location, mounting, etc.).

DIRECT REPLACEMENT

Direct replacement for either the Thermal System or the entire Transmitter — Thermal System can be made from the information stamped on the neck of the Thermal System bellows or on the Transmitter. For example:

TRANSMITTER	THERMAL SYSTEM
MODEL - 33C5072	PART - 5072-C8F
SERIAL - 14033-5072C8F	RANGE - 0-150°F
RANGE - 0-150°F	TRANS. - 33C

NEW THERMAL SYSTEM FOR EXISTING TRANSMITTER

An existing Transmitter may be used only if the new selection data for a new Thermal System dictates that the same Transmitter can be used. The factory must be consulted to make this determination.

TABLE 1 FAHRENHEIT SELECTION

	MAXIMUM OPERATING TEMPERATURE °F (1. 2. 3.)										MAXIMUM OVERRANGE °F*			
MODEL	33A		33C		33D		33E		33SE		3/8" BULBS (COPPER BULB LIMIT — 800°F)			
BULB DIA. / COM. SPANS °F	3/8"	3/4" AVER	3/8"	3/4" AVER	3/8"	3/4" AVER	3/8"	3/4" AVER		3/4" AVER	33A	33C	33D	33E
50	—	—	—	—	—	—	—	—	—	100	—	—	—	—
60	—	—	—	—	—	—	—	—	—	250	—	—	—	—
70	—	—	—	—	—	—	150	—	—	370	—	—	—	650
80	—	—	—	—	—	—	200	200	—	—	—	—	—	825
90	—	—	—	—	—	—	230	286	—	—	—	—	—	975
100	—	—	—	—	100	100	270	370	—	—	—	—	625	1000
110	—	—	—	—	150	165	290	465	—	—	—	—	900	1000
120	—	—	—	—	200	220	320	550	—	—	—	—	1000	1000
125	—	—	—	—	225	250	330	590	—	—	—	—	1000	1000
130	—	—	—	—	250	280	360	635	—	—	—	—	1000	1000
140	—	—	—	—	300	335	390	720	—	—	—	—	1000	1000
150	—	—	150	150	350	395	430	805	—	—	—	650	1000	1000
160	—	—	190	190	400	450	450	890	—	—	—	710	1000	1000
170	—	—	230	230	440	510	480	975	—	—	—	770	1000	1000
175	—	—	250	250	460	540	500	1000	—	—	—	800	1000	1000
180	—	—	270	270	470	565	520	1000	—	—	—	830	1000	1000
190	—	—	305	310	500	620	540	1000	—	—	—	890	1000	1000
200	—	—	340	350	520	680	570	1000	—	—	—	950	1000	1000
225	—	—	440	450	580	825	640	1000	—	—	—	1000	1000	1000
250	260	255	500	550	640	970	700	1000	—	—	650	1000	1000	1000
275	330	325	550	650	700	1000	—	—	—	—	750	1000	1000	—
300	400	400	610	750	750	1000	—	—	—	—	850	1000	1000	—
325	480	470	665	850	810	1000	—	—	—	—	1000	1000	1000	—
350	550	540	715	950	870	1000	—	—	—	—	1000	1000	1000	—
375	620	610	765	1000	920	1000	—	—	—	—	1000	1000	1000	—
400	700	680	820	1125	980	1400	—	—	—	—	1000	1000	1000	—
425	770	750	870	1215	—	1400	—	—	—	—	1000	1000	—	—
450	840	820	920	1285	—	1400	—	—	—	—	1000	1000	—	—
475	890	890	970	1380	—	1400	—	—	—	—	1000	1000	—	—
500	940	960	1000	1400	—	—	—	—	—	—	1000	1000	—	—
600	1000	1230	—	1400	—	—	—	—	—	—	1000			
700	1000	1300	—	1400	—	—	—	—	—	—	1000	*ALL 316 S.S. 3/4", AVER — 1400°F ALL CU. 3/4" — 800°F		
800	1000	1400	—	1400	—	—	—	—	—	—	1000			
900	1000	1400	—	—	—	—	—	—	—	—	1000			
1000	1000	—	—	—	—	—	—	—	—	—	1000			

1. Max. operating temperature for Copper Bulbs is 800°F.
2. Transmitter must be selected from first column (read left to right) of max. oper. temps. which satisfy range req.
3. Thermal systems are not interchangeable between different lettered transmitters.

TABLE 2 CELSIUS SELECTION

MODEL	MAXIMUM OPERATING TEMPERATURE °C (1. 2. 3)										MAXIMUM OVERRANGE °C*			
	33A		33C		33D		33E		33SE		3/8" BULBS· (COPPER BULB LIMIT - 425°C)			
BULB DIA. / COM. SPANS °C	3/8"	3/4" AVER	3/8"	3/4" AVER	3/8"	3/4" AVER	3/8"	3/4" AVER	3/8"	3/4" AVER	33A	33C	33D	33E
28	—	—	—	—	—	—	—	—	—	35	—	—	—	—
30	—	—	—	—	—	—	—	—	—	40	—	—	—	—
35	—	—	—	—	—	—	—	—	—	120	—	—	—	—
40	—	—	—	—	—	—	70	—	—	190	—	—	—	380
45	—	—	—	—	—	—	90	90	—	—	—	—	—	450
50	—	—	—	—	—	—	110	140	—	—	—	—	—	525
60	—	—	—	—	60	65	140	225	—	—	—	—	380	540
70	—	—	—	—	105	125	170	310	—	—	—	—	480	540
80	—	—	—	—	155	185	205	395	—	—	—	—	540	540
90	—	—	95	95	200	240	240	480	—	—	—	385	540	540
100	—	—	130	135	245	300	270	540	—	—	—	445	540	540
110	—	—	165	175	265	355	—	540	—	—	—	510	540	—
120	—	—	205	215	295	415	—	540	—	—	—	540	540	—
130	—	—	240	255	315	470	—	540	—	—	—	540	540	—
140	—	125	265	295	335	530	—	540	—	—	—	540	540	—
150	155	155	285	335	360	540	—	—	—	—	390	540	540	—
160	185	185	305	375	385	540	—	—	—	—	455	540	540	—
170	210	210	325	415	405	540	—	—	—	—	540	540	540	—
180	240	240	345	455	430	540	—	—	—	—	540	540	540	—
190	265	265	365	495	455	540	—	—	—	—	540	540	540	—
200	320	295	400	535	475	540	—	—	—	—	540	540	540	—
225	390	365	450	600	—	760	—	—	—	—	540	540	—	—
250	450	435	495	700	—	760	—	—	—	—	540	540	—	—
275	500	505	535	750	—	760	—	—	—	—	540	540	—	—
300	540	535	—	760	—	—	—	—	—	—	540	—	—	—
350	540	680	—	760	—	—	—	—	—	—	540	—	—	—
400	540	700	—	760	—	—	—	—	—	—	540	—	—	—
500	540	760	—	—	—	—	—	—	—	—	540	—	—	—
556	540	—	—	—	—	—	—	—	—	—	540	*ALL 316 S.S. 3/4", AVER - 760°C ALL CU. 3/4" - 425°C		

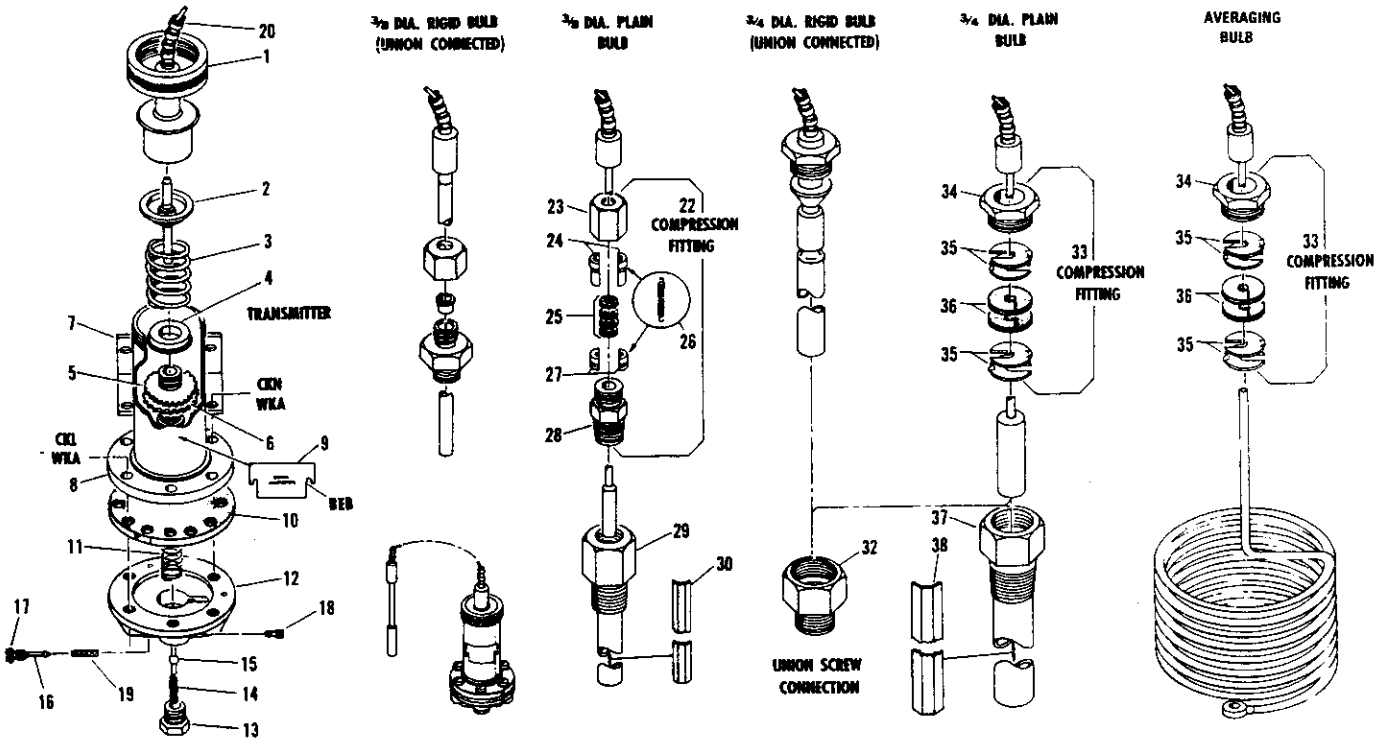
1. Max. Operating Temperature for Copper Bulbs Limited to 425°C.
2. Transmitter must be selected from first column (read left to right) of max. oper. temps. which satisfies range req.
3. Thermal systems are not interchangeable between different lettered transmitters.

MOORE PRODUCTS CO.
SPRING HOUSE, PA. 19477

PARTS LIST

MODEL 33 NULLMATIC TEMPERATURE TRANSMITTER

Drawing
No. 3351PL



Item No.	Part No.	Description	Req'd.
		TRANSMITTER	
1	859-5	Cover Nut	1
2	3351-28	Spring Seat	1
3a	3351-41	Zero Spring (Mod. 33SE only)	1
3b	3351-40	Zero Spring (All Other Models)	1
4	10430-155	Spring Seat	1
5	10430-154	Zero Adjusting Nut	1
6	3351-43	Zero Locknut	1
7	1145-19	Mounting Bracket	1
8		Not Available For Field Use	-
9	859-37	Cover Plate	1
*10	14033-5	Diaphragm Assy.	1
11	4771-55	Differential Spring	1
12	14033-20	Bottom Housing (Incl. (2) 2155-255 Filter Screens)	1
*13	2155-6	Retaining Nut	1
*14	2155-7	Valve Spring	1
*15	2155-3	Valve Plunger	1
*16	10792-12	Restriction Screw (Incl. Item 17 & 19)	1
*17	2938-154	"O" Ring	1
*18	1518-4	Cleaning Wire	1
19	111-20	Filter Screen	1
20		Thermal System - Specify Range & B/M Number	1
		3/8 DIA. PLAIN BULB	
22a	12140-3	Compression Fitting - Stain. Stl. (Incl. Items 23a, 24a, 25, 26 27a & 28a)	1
22b	12141-15	Compression Fitting - Brass (Incl. Items 23b, 24b, 25, 26 27b, 28b)	
23a	12140-7	Packing Nut - Stain. Stl.	1
23b	12141-13	Packing Nut - Brass	1
24a	12140-9	Packing Follower - Stain. Stl.	2
24b	12141-17	Packing Follower - Brass	2
25	12141-10	Packing Ring	4
26	12141-18	Spring	2

Item No.	Part No.	Description	Req'd.
27a	12140-10	Split Gland - Stain. Stl.	2
27b	12141-16	Split Gland - Brass	2
28a	12140-4	Tube Fitting Stain. Stl.	1
28b	12141-6	Tube Fitting - Brass	1
29		Socket - Specify As Required	1
30	4454-1105	Contact Strip	1
		3/4 DIA. RIGID BULB (UNION CONNECTED)	
32a	859-112	Bushing - Stain. Stl.	1
32b	1551-5	Bushing - Brass	1
		3/4 DIA. PLAIN BULB	
33a	1551-31	Compression Fitting - Stain. Stl. (For use with Socket - Incl. Items 34a, 35a, 36)	1
33b	1551-30	Compression Fitting - Brass (For use with Socket - Incl. Items 34b, 35b, 36)	1
33c	1551-22	Compression Fitting - Stain. Stl. (For Bare Bulb - Incl. Items 34a, 35a, 36 & 32a)	1
33d	1551-9	Compression Fitting - Brass (For Bare Bulb - Incl. Items 34b, 35b, 36 & 32b)	1
34a	1551-24	Packing Nut - Stain. Stl.	1
34b	859-105	Packing Nut - Brass	1
35a	1551-23	Split Washer - Stain. Stl.	4
35b	1551-8	Split Washer - Brass	4
36	1551-7	Packing Ring	2
37		Socket-Specify As Required	1
38	4454-0105	Contact Strip	1

Code	Hardware	Req'd.
BEB	#3-48 x 3/16 Lg. Rd. Hd. Screw	2
CKL	1/4-20 x 7/8" Lg. Fil. Hd. Screw	3
CKN	1/4-20 x 1" Lg. Fil. Hd. Screw	3
WKA	1/4 Lockwasher	6

* Recommended On-Hand Spare Parts. Always Specify Range, Serial No., or Other Nameplate Information When Ordering Spare Parts.

Printed in U.S.A. 5/82 Supersedes 1/80