HALLIKAINEN *Instruments*
INDUSTRIAL and SCIENTIFIC
750 NATIONAL COURT, RICHMOND, CALIFORNIA, 94804

CONSTANT TEMPERATURE BATHS

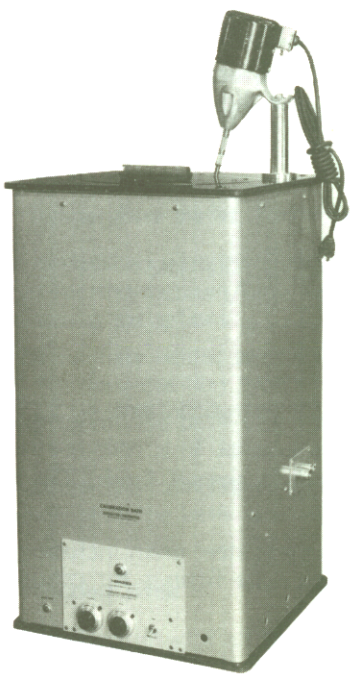
These baths have been designed for use in calibrating thermometers, filled system temperature instruments, or for other purposes when a temperature controlled bath is required.

To satisfy the many requirements in thermometer calibration, the baths have been separated into various operating ranges principally due to limitations of the available bath mediums. For example:

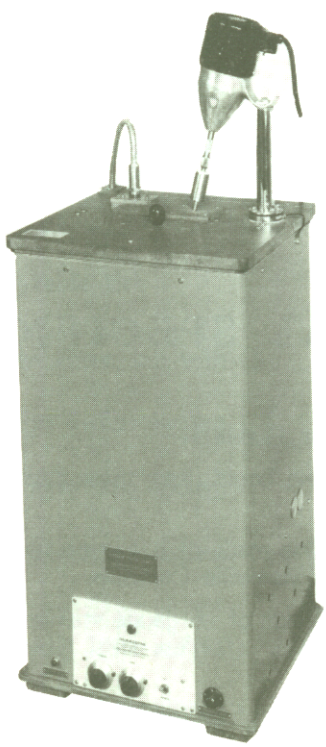
WORKING RANGE	MODEL
—150°F. to ambient	Cooling by liquid nitrogen, etc.
—100°F. to 500°F.	Medium/Low temperature baths
—40°F. to ambient	Cooling by automatic refrigeration
ambient to 500°F.	Medium temperature baths
400 to 1000°F.	Medium/High temperature baths
800 to 1300°F.	High temperature baths

Bath mediums, thermometer reference standards, etc., are not supplied as standard equipment. The following, however, are suggestions for bath mediums:

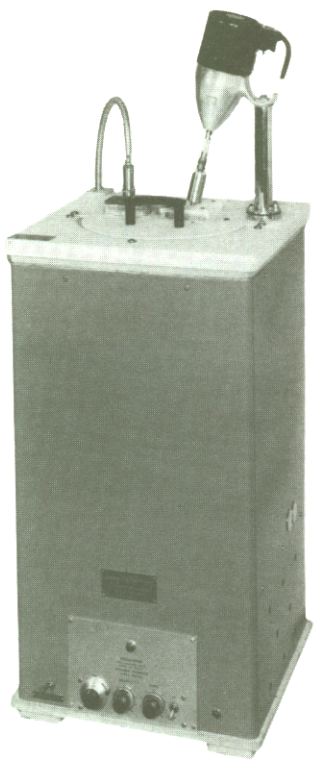
RANGE	BATH MEDIUM
—150°F. to ambient	"Freon E-3" or "Freon — 1114B2".
—100°F. to ambient	"Freon — 214"
—40°F. to ambient	A mixture of ethylene glycol and water, methanol
ambient to 200°F.	Water
ambient to 300°F.	Low viscosity medicinal oil with flash point above 300°F.
ambient to 500°F.	Silicone oil such as Dow Corning #F-1-0173, 100 centistoke.
400 to 1000°F.	Heat treating salt, such as E. F. Houghton & Co. Drawtemp 275
800 to 1300°F.	Heat treating salt, such as E. F. Houghton & Co. Liquid Heat 235.



Model 1124



Model 1162



Model 1178

HEATING SPECIFICATIONS

All baths are electrically heated. Some use a combination of a special, fast acting, stainless steel, tubular immersion heater, and several low watt density strip heaters clamped to the outside of the bath tank wall. (The very low temperature baths cooled by liquid nitrogen use immersion heater only, see Table I.) The size, type, shape, and location of the heaters have been considered in order to minimize the bath temperature gradient. The quick heat heaters provided are automatically de-energized a few degrees below the bath set temperature, and may be reset manually. The medium/high temperature baths use only low watt density strip heaters clamped to the outside of the bath tank wall (see Table V) providing for quick heat, for control heat, and for auxiliary heat. The high temperature baths use helical chromel heaters mounted in insulating blocks and heat the bath tank by thermal radiation (see Table VI).

COOLING SPECIFICATIONS

Depending upon the actual low temperature bath, cooling may be either by some liquefied gas (nitrogen, carbon dioxide, etc.), or by automatic refrigeration. In operation, cooling is continuous with temperature set point controlled by the temperature controller actuating electric heaters.

TEMPERATURE CONTROL

The optimum performance of a controlled system depends upon many other factors than the controller itself. For example, the bath liquid must be thoroughly agitated to minimize the bath temperature gradients and facilitate rapid heat transfer. It is advisable to supply heat where heat losses would normally occur to further diminish temperature gradients. Time lag should be minimized in heaters as well as in the temperature sensing elements.

TEMPERATURE CONTROLLERS

THERMOTROL

The THERMOTROL temperature controller is considered standard equipment on all but the medium/high and high temperature baths. It is designed to function as an "on-off," proportional, or proportional with reset controller. A resistance thermometer is used as a sensing element. Because of its unique design and custom assembly, the THERMOTROL is not affected by variations in ambient temperature. The THERMOTROL is capable of controlling the bath temperature of a medium temperature bath at a point to better than ± .004°F. when using water as the bath medium. The reset action of the controller will restore the bath temperature to the exact same set point temperature after an upset or load change, thus avoiding droop or overshoot common with proportional or on-off controllers. Normally, the THERMOTROL is mounted in the bath housing; however, it can also be supplied in a separate cabinet for external mounting. A detailed description of the THERMOTROL is given in a separate brochure which is available upon request.

DECADE THERMOTROL

Similar to the standard THERMOTROL, with the exception that the coarse temperature setting is made by fixed increments through precision resistors selected by means of multi-position switches, whereas the standard THERMOTROL employs multiturn potentiometers. This controller can also be supplied in a separate cabinet for external mounting.

THERMODYNE

The medium/high and the high temperature baths are supplied with THERMODYNE or decade THERMODYNE temperature controllers only. The THERMODYNE is similar to the THERMOTROL, except that the reset action is eliminated. In this application, it is used as a proportional controller with salt as a bath medium. A detailed description of the THERMODYNE is given in a separate brochure which is available upon request.

GENERAL SPECIFICATIONS

LOW TEMPERATURE BATHS

Cooling by Liquefied Gas, —150°F. to ambient (Table I)

Depending on the bath medium and cooling liquid used, these baths are suitable for operation from —150°F. up to ambient.

The exterior of the bath is a square housing made of heavy gauge steel with a baked enamel finish. The top and bottom are fabricated of charcoal gray Johns-Mansville Colorlith.

The bath tanks are 12" in diameter and made of 16 gauge stainless steel with stainless steel drain including a valve and an overflow. The cooling coil is a helix of ½" stainless steel tubing with Swagelok tube fittings for connection to liquefied gas cylinders, etc.

Insulation used in these baths consists of Lockfoam B-302 and Styrafoam.

Heating is through a 1000 watt tubular immersion heater with stainless steel sheath located in the lower portion of the bath tank.

A special stirrer (model 1117 Hallikainen — Shell JET-STIR Impeller) is used to agitate the bath medium, minimizing the over-all time constant and temperature gradients of the bath. The hollow stirrer blades cause the bath liquid to flow radially out through the blades with a high velocity, as well as in directions normal and tangential to the blade surfaces. The stirrer is driven by a totally enclosed fan-cooled electric mixer motor with its own power cord and on-off switch.

Cooling by Automatic Refrigeration, —40°F. to ambient (Table II)

The exteriors of these baths are similar to the above, except that the housing is rectangular in shape rather than square. The automatic refrigeration compressor, etc., is located in its own section to the rear of the actual bath itself. The 12" deep baths utilize a ½ HP air-cooled refrigerator compressor, whereas the 18" deep baths use a 1 HP water-cooled compressor.

Insulation used is 3" —thick Styrafoam.

Heating load on 12" baths is a maximum of 1650 watts and on the 18" baths is 3000 watts. In the 12" bath, 250 watts of heating load is a tubular immersion heater with the balance of the load consisting of strip heaters clamped to the outside of bath tank wall. In the 18" bath a 1000 watts immersion heater is used.

Low/Medium Temperature Baths, —100°F. to +500°F. (Table III)

In these baths, it may be desirable to replace bath liquid when changing from low to high temperature or vice versa. In order to secure good mixing and reduce gradients, the bath medium should have as low a viscosity as compatible with the operating temperature for which it is intended. Presently, there does not appear to be any one bath medium suitable for the entire range of —100 to +500°F.

Cooling is by liquefied gas, a cold eutectic, or some similar low temperature liquid. Heating is by means of a 250 watt tubular immersion heater and strip heaters clamped to the outside of the bath tank wall. An auxiliary heater switch is provided that permits selection of different constant heats.

The general construction of these baths is similar to the above, except that the insulation used is SILASTIC RTV.

Medium Temperature Baths, ambient to 500°F., (Table IV)

In general, these baths are identical to the low/medium baths mentioned above, except for insulation and cooling coil.

The cooling coil is shorter and of a smaller diameter tube. The adjustable auxiliary heater switch is not used.

Medium/High Temperature Bath, 400°F. to 1000°F. (Table V)

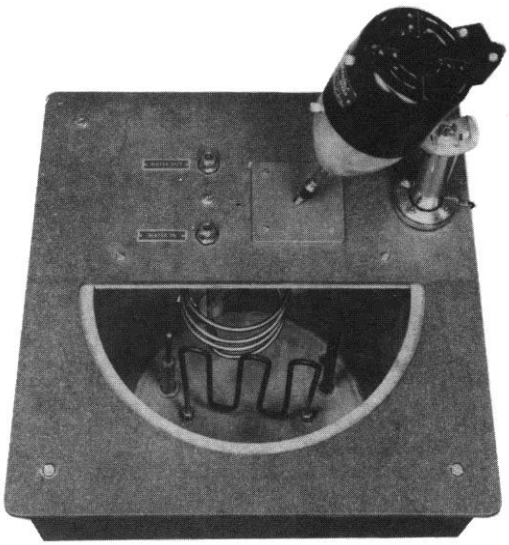
The general appearance of these baths is the same as that of the medium temperature baths, but with the following exceptions:

1. The inner tank is made of extra heavy, 8" inside diameter, ductile cast iron, similar to ASTM A339-56, Grade 60-45-10, but formulated with a higher silicon content to withstand the corrosive action of the molten salts normally used as a bath medium and for resistance against scaling.
2. An additional auxiliary heater switch is provided that permits the selection of four different constant auxiliary heats to supplement the modulated controlled heat input.
3. These baths are not supplied with cooling coil, drain, or overflow.
4. For the mixer impeller blades, a standard type impeller is used rather than the JET-STIR Impeller.
5. Insulation is Johns-Mansville Superex.

High Temperature Baths, 800°F. to 1300°F. (Table VI)

The general appearance and construction of these baths is the same as for the medium/high temperature baths above, but with the following exceptions:

1. The auxiliary heater switch is an on-off toggle switch and not of the four-position type.
2. The top of the bath is Johns-Manville Maranite. The bottom of the bath is of Johns-Manville Transite.
3. Heating is accomplished by helical chromel electrical heaters which heat the bath tank by radiation.



Bath Working Area

The working area of all the above baths is reached through a removable lid in the top cover. The removable lid is in the shape of a half circle and normally one-half the diameter of the bath tank.

LOW TEMPERATURE BATHS
TABLE I—150°F. to AMBIENT
COOLING BY LIQUEFIED GAS

	220 volts AC Tank—12" deep	115 volts AC Tank—12" deep	220 volts AC Tank—18" deep	115 volts AC Tank—18" deep	CONTROLLER
Model No. Immersion Heat	**1414** 1000 Watts	**1415** 1000 Watts	**1416** 1000 Watts	**1417** 1000 Watts	THERMOTROL Integral
Model No. Immersion Heat	**1418** 1000 Watts	**1419** 1000 Watts	**1420** 1000 Watts	**1421** 1000 Watts	THERMOTROL External
Model No. Immersion Heat	**1422** 1000 Watts	**1423** 1000 Watts	**1424** 1000 Watts	**1425** 1000 Watts	Decade THERMOTROL Integral
Model No. Immersion Heat	**1426** 1000 Watts	**1427** 1000 Watts	**1428** 1000 Watts	**1429** 1000 Watts	Decade THERMOTROL External
Housing — 20" x 20" x 27⅜" Overall height to top of mixer — 38¾" Weight (shipping) — Approximately 160 lbs. Tank Capacity — 5½ gallons			Housing — 20" x 20" x 33⅜" Overall height to top of mixer — 44¾" Weight (shipping) — Approximately 175 lbs. Tank Capacity — 8½ gallons		

TABLE II— —40°F. TO AMBIENT
COOLING BY AUTOMATIC REFRIGERATION

	115 volts AC Tank—12" deep Air Cooled	220 volts AC Tank—18" deep Water Cooled	CONTROLLER
Model No. Immersion Heat Auxiliary Heat High Medium Medium/Low Low	**1282** 250 Watts 1400 " 1050 " 350 " 262 "	**1283** 1000 Watts 2000 " 1500 " 500 " 375 "	THERMOTROL Integral
Model No. Immersion Heat Auxiliary Heat High Medium Medium/Low Low	**1399** 250 Watts 1400 " 1050 " 350 " 262 "	**1402** 1000 Watts 2000 " 1500 " 500 " 375 "	THERMOTROL External
Model No. Immersion Heat Auxiliary Heat High Medium Medium/Low Low	**1400** 250 Watts 1400 " 1050 " 350 " 262 "	**1403** 1000 Watts 2000 " 1500 " 500 " 375 "	Decade THERMOTROL Integral
Model No. Immersion Heat Auxiliary Heat High Medium Medium/Low Low	**1401** 250 Watts 1400 " 1050 " 350 " 262 "	**1404** 1000 Watts 2000 " 1500 " 500 " 375 "	Decade THERMOTROL External
Housing — 20" x 39" x 27½" Overall height to top of mixer — 37⅞" Weight (shipping) — Approximately 500 lbs. Tank Capacity — 5½ gallons		Housing — 20" x 40" x 33½" Overall height to top of mixer — 44⅞" Weight (shipping) — Approximately 600 lbs. Tank Capacity — 8½ gallons	

LOW/MEDIUM TEMPERATURE BATHS
TABLE III— —100°F. TO 500 F.

	220 volts AC Tank—12" deep	115 volts AC Tank—12" deep	220 volts AC Tank—18" deep	115 volts AC Tank—18" deep	CONTROLLER
Model No.	**1388**	**1385**	**1395**	**1392**	THERMOTROL Integral
Quick Heat	1400 Watts	1050 Watts	2000 Watts	1050 Watts	
Control Heat					
High	950 "	950 "	950 "	950 "	
Medium	600 "	600 "	600 "	600 "	
Medium/Low	350 "	350 "	350 "	350 "	
Low	221 "	221 "	221 "	221 "	
Model No.	**1389**	**1386**	**1396**	**1393**	THERMOTROL External
Quick Heat	1400 Watts	1050 Watts	2000 Watts	1050 Watts	
Control Heat					
High	950 "	950 "	950 "	950 "	
Medium	600 "	600 "	600 "	600 "	
Medium/Low	350 "	350 "	350 "	350 "	
Low	221 "	221 "	221 "	221 "	
Model No.	**1390**	**1375**	**1397**	**1381**	Decade THERMOTROL Integral
Quick Heat	1400 Watts	1050 Watts	2000 Watts	1050 Watts	
Control Heat					
High	950 "	950 "	950 "	950 "	
Medium	600 "	600 "	600 "	600 "	
Medium/Low	350 "	350 "	350 "	350 "	
Low	221 "	221 "	221 "	221 "	
Model No.	**1391**	**1387**	**1398**	**1394**	Decade THERMOTROL External
Quick Heat	1400 Watts	1050 Watts	2000 Watts	1050 Watts	
Control Heat					
High	950 "	950 "	950 "	950 "	
Medium	600 "	600 "	600 "	600 "	
Medium/Low	350 "	350 "	350 "	350 "	
Low	221 "	221 "	221 "	221 "	
Housing — 17" x 17" x 24⅛"			Housing — 17" x 17" x 30⅛"		
Overall height to top of mixer — 35½"			Overall height to top of mixer — 41½"		
Weight (shipping) — 150 pounds			Weight (shipping) — 165 pounds		
Tank Capacity — 5½ gallons			Tank Capacity — 8½ gallons		

MEDIUM TEMPERATURE BATHS
TABLE IV—AMBIENT TO 500°F. BATHS

	220 volts AC Tank—12" deep	115 volts AC Tank—12" deep	220 volts AC Tank—18" deep	115 volts AC Tank—18" deep	CONTROLLER
Model No.	**1120**	**1124**	**1128**	**1132**	THERMOTROL Integral
Quick Heat	1400 Watts	1050 Watts	2000 Watts	1050 Watts	
Control Heat	{700 " ext. {250 " imm.	{700 " ext. {250 " imm.	{700 " ext. {250 " imm.	{700 " ext. {250 " imm.	
Model No.	**1123**	**1127**	**1131**	**1135**	THERMOTROL External
Quick Heat	1400 Watts	1050 Watts	2000 Watts	1050 Watts	
Control Heat	{700 " ext. {250 " imm.	{700 " ext. {250 " imm.	{700 " ext. {250 " imm.	{700 " ext. {250 " imm.	
Model No.	**1136**	**1138**	**1137**	**1139**	Decade THERMOTROL Integral
Quick Heat	1400 Watts	1050 Watts	2000 Watts	1050 Watts	
Control Heat	{700 " ext. {250 " imm.	{700 " ext. {250 " imm.	{700 " ext. {250 " imm.	{700 " ext. {250 " imm.	
Model No.	**1406**	**1407**	**1408**	**1409**	Decade THERMOTROL External
Quick Heat	1400 Watts	1050 Watts	2000 Watts	1050 Watts	
Control Heat	{700 " ext. {250 " imm.	{700 " ext. {250 " imm.	{700 " ext. {250 " imm.	{700 " ext. {250 " imm.	
Housing — 17" x 17" x 24⅛"			Housing — 17" x 17" x 30⅛"		
Overall height to top of mixer — 35½"			Overall height to top of mixer — 41½"		
Weight (shipping) — 140 pounds			Weight (shipping) — 165 pounds		
Tank Capacity — 5½ gallons			Tank Capacity — 8½ gallons		

MEDIUM/HIGH TEMPERATURE BATHS
TABLE V—400°F. TO 1000°F.

	220 volts AC Tank—12" deep	220 volts AC Tank—18" deep	CONTROLLER
Model No.	**1162**	**1164**	
Quick Heat	2000 Watts	2000 Watts	THERMODYNE
Control Heat	1000 "	1000 "	Integral
Auxiliary Heat			
High	850 "	1500 "	
Medium	500 "	1000 "	
Medium/Low	350 "	500 "	
Low	206 "	333 "	
Model No.	**1174**	**1176**	
Quick Heat	2000 Watts	2000 Watts	THERMODYNE
Control Heat	1000 "	1000 "	External
Auxiliary Heat			
High	850 "	1500 "	
Medium	500 "	1000 "	
Medium/Low	350 "	500 "	
Low	206 "	333 "	
Model No.	**1166**	**1168**	
Quick Heat	2000 Watts	2000 Watts	Decade THERMODYNE
Control Heat	1000 "	1000 "	Integral
Auxiliary Heat			
High	850 "	1500 "	
Medium	500 "	1000 "	
Medium/Low	350 "	500 "	
Low	206 "	333 "	
Model No.	**1410**	**1411**	
Quick Heat	2000 Watts	2000 Watts	Decade THERMODYNE
Control Heat	1000 "	1000 "	External
Auxiliary Heat			
High	850 "	1500 "	
Medium	500 "	1000 "	
Medium/Low	350 "	500 "	
Low	206 "	333 "	
Housing — 17" x 17" x 24¾"		Housing — 17" x 17" x 30¾"	
Overall height to top of mixer — 38⅝"		Overall height to top of mixer — 44⅝"	
Weight (shipping) — 170 pounds		Weight (shipping) — 180 lbs.	
Tank Capacity — 2½ gallons		Tank Capacity — 3¾ gallons	
Salt Required (one filling) 40 pounds		Salt Required (one filling) 60 pounds	

HIGH TEMPERATURE BATHS
TABLE VI—800°F. TO 1300°F.

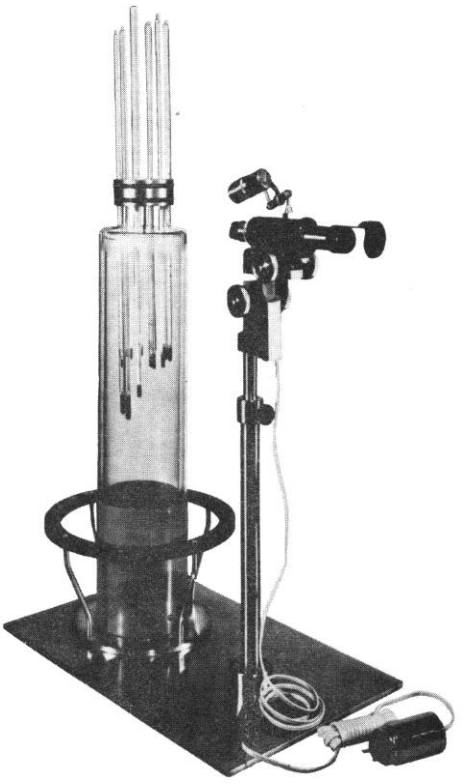
	220 volts AC Tank—12" Deep	220 volts AC Tank—18" deep	CONTROLLERS
Model No.	**1177**	**1173**	
Control Heat	2200 Watts	2200 Watts	THERMODYNE
Auxiliary Heat	2200 "	2200 "	Integral
Model No.	**1302**	**1303**	
Control Heat	2200 Watts	2200 Watts	THERMODYNE
Auxiliary Heat	2200 "	2200 "	External
Model No.	**1178**	**1175**	
Control Heat	2200 Watts	2200 Watts	Decade THERMODYNE
Auxiliary Heat	2200 "	2200 "	Integral
Model No.	**1412**	**1413**	
Control Heat	2200 Watts	2200 Watts	Decade THERMODYNE
Auxiliary Heat	2200 "	2200 "	External
Housing — 17" x 17" x 35⅜"		Housing — 17" x 17" x 31⅜"	
Overall height to top of mixer — 39¼"		Overall height to top of mixer — 45¼"	
Weight (shipping) — 180 pounds		Weight (shipping) — 190 pounds	
Tank Capacity — 2½ gallons		Tank Capacity — 3¾ gallons	
Salt Required (one filling) 40 pounds		Salt Required (one filling) 60 pounds	

MODEL 1010—ICE POINT BATH

This bath consists of an unsilvered Dewar vessel, 5" I.D. x 16¾" inside depth. It is fitted with an aluminum alloy thermometer holder with a capacity for 12 thermometers. To read the thermometers, the vessel and the thermometer holder are rotated by a handwheel. This bath is normally used to check thermometer ice points to insure their continued adherence to previous standards. The required bench space for this equipment is 10" wide x 18-5/16" deep x 20½" high.

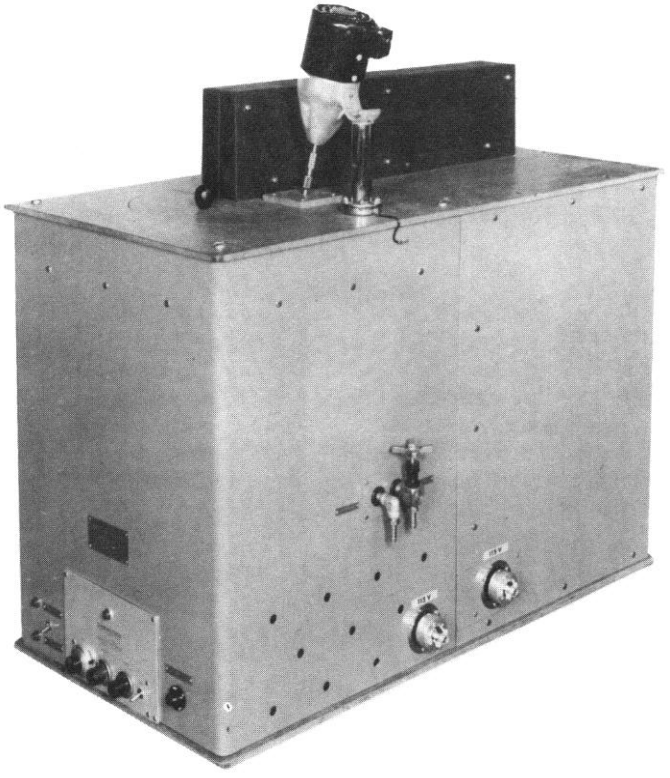
MODEL 1011—LOW TEMPERATURE BATH (—60°C. to +80°C.)

This bath is identical to Model 1010, except for the addition of a stirrer for agitating the liquid. It is normally used with a solvent and cooled by dry ice. The required space for this bath is 10" wide x 18-15/16" deep x 24½" high.

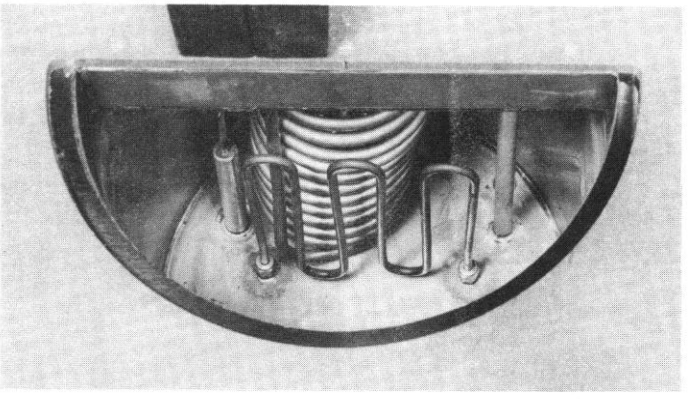


Model 1010 with Model 1009 Comparator Telescope

(Telescope not included as standard)



Model 1400



Interior of Low Temperature Baths

BATH PERFORMANCE

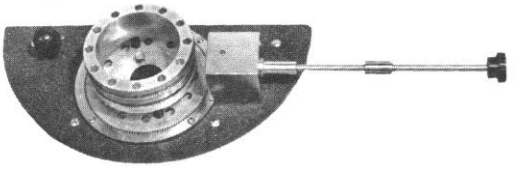
The following table lists conservative performance data obtained from the baths listed in this brochure.

Temperature Set Point	Bath Medium	Accuracy	Remarks
—70°F	Methanol	±.03°F	Liquid N^2 Cooling
—40°F	Ethylene Glycol & Water	±.04°F	Automatic Refrigeration
—40°F	Silicone Oil (#200)	±.25°F	Automatic Refrigeration
0°F	Ethylene Glycol & Water	±.04°F	Automatic Refrigeration
32°F	Silicone Oil (#200)	±.15°F	Automatic Refrigeration
50°F	Water	±.2°F	Automatic Refrigeration
100°F	Water	±.01°F	Cooling Water Required
180°F	Water	±.004°F	
200°F	Silicone Oil (F-1-0173)	±.25°F	Cooling Water Required
250°F	Medicinal or Light Viscosity Oil	±.01°F	
500°F	Silicone Oil (F-1-0173)	±.03°F	
500°F	Salt (#275)	±.2°F	
950°F	Salt (#275)	±.1°F	
1300°F	Salt (#235)	±.3°F	

ACCESSORIES

ROTATING THERMOMETER HOLDERS FOR ETCHED STEM THERMOMETERS

Rotating Thermometer Holders have been devised to hold a quantity of Etched Stem Thermometers so that a number may be checked at one time.

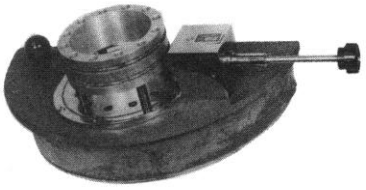


Model 1143

Model 1143—This holder is designed principally for use with the medium temperature baths. The holder is mounted on a Colorlith lid of the configuration and size to fit the top opening of the bath. The actual holder itself is made of aluminum alloy and is designed to hold 12 etched stem thermometers.

Model 1405

This holder is the same as Model 1143, except that it is fitted with additional Maranite insulation below the Colorlith lid. It is for use on low/medium baths only.



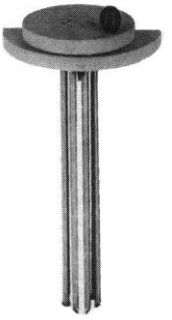
Model 1227

Model 1227

This holder is similar to Model 1143, except that it is fitted with 3" urethane insulation below the Colorlith lid. It is for use on Model 1283, 1402, 1403, and 1404 baths. For liquefied gas cooled baths, use Model 1438, which is similar in construction. This is for Models 1282, 1399, 1400, 1401, 1414 through 1429.

Model 1186

This holder is for use with the medium/high temperature baths. It consists of eight stainless steel tubes mounted on a Transite block which rotates on a Transite lid of the proper size and configuration to fit the top opening of the bath. Model for 12" deep baths is 1186B12, and for 18" deep baths the model number is 1186B18.

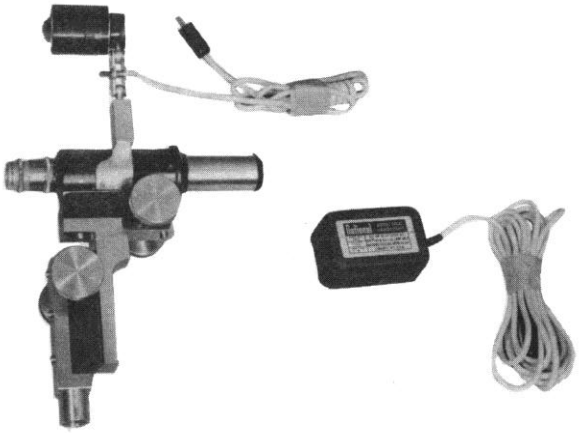


Model 1186

Model 1287

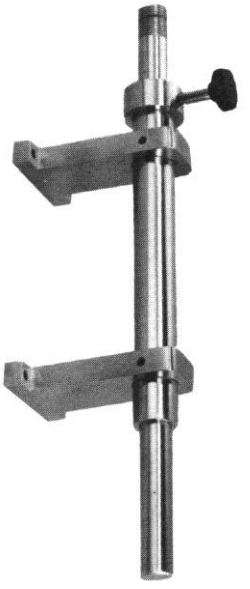
Same as Model 1186 holder except with special insulating material. Used on high temperature baths only. Model 1287A12 is for 12" deep baths and Model 1287A18 for 18" deep baths.

COMPARATOR TELESCOPE—Model 1009



This Comparator Telescope is used primarily on baths when testing etched stem thermometers. The Comparator Telescope can be moved from bath to bath providing each bath is equipped with a telescope stand.

The Comparator Telescope is fitted with a 10X Hygenian eye-piece with cross hairs, 80mm. focal length objective and a focus adjusting rack and pinion. A direct headlamp with a six-volt transformer is standard equipment.



Model 1161

TELESCOPE STAND—Model 1161

This stand is available for mounting on all the baths described in this brochure, except Models 1010 and 1011. It is used to hold the Comparator Telescope and should be permanently mounted on each bath to which the Comparator Telescope will be applied. When ordered with a bath, it will be fastened to the bath at the factory before shipment.