Wettability Test Apparatus, Model C1001

Instruction Manual

Manual No. 102034052, Revision B

Instrument No. 203936

fann®
Fann Instrument Company

Wettability Test Apparatus Instruction Manual

Houston, Texas, USA

Printed in USA.

The information contained in this document includes concepts, methods, and apparatus which may be covered by U.S. Patents. Fann Instrument Company reserves the right to make improvements in design, construction, and appearance of our products without prior notice.

Contact FANN

Phone

TELEPHONE: 281-871-4482
TOLL FREE: 800-347-0450
FAX: 281-871-4358

Mail

Fann Instrument Company
P.O. Box 4350
Houston, Texas, 77210 USA

Location

Fann Instrument Company
14851 Milner Road, Gate 5
Houston, Texas, 77032, USA

Online

www.fann.com
fannmail@fann.com

Table of Contents

List of Figures

List of Tables

1 Introduction

The Wettability Test Apparatus, Model C1001 is designed to evaluate the apparent wettability of spacer fluids, preflush fluids, and spacer and surfactant fluid combinations.

Achieving water wettability is important to the success of any cement operation. Because cement cannot adhere to the oil-wet surfaces left by a nonaqueous drilling fluid, a spacer fluid formulated with surfactants for converting the oil-wet surfaces into water-wet surfaces is required for displacing the drilling fluid. If the spacer fluid is correctly formulated, all surfaces are completely water-wetted ahead of the cement. This process helps reduce the risk for cement contamination and bonding problems, and helps ensure a strong annular seal.

Normally, oil-external fluids are not electrically conductive, while water-based spacers are. Actual conductivity depends on the solution chemistry of the fluid. The Fann Wettability Test Apparatus measures both the surface-acting and electrical properties. The circuitry measures the electrical activity in the fluid and on the electrode surfaces and provides a continuous reading that reflects the apparent wettability.

With this instrument, laboratory chemists can test drilling fluid and spacer mixtures at controlled shear rates and temperatures up to 180°F (82°C). They can use the results to custom design surfactant and spacer fluid combinations, resulting in optimal performance, efficiency and cost-savings.

The Fann Wettability Test Apparatus (WTA) conforms to American Petroleum Institute (API) Recommended Practice (RP) 10B-2, Recommended Practice for Testing Well Cements.

1.1 Document Conventions

The following icons are used as necessary in this instruction manual.

NOTE. Notes emphasize additional information that may be useful to the reader.

CAUTION. Describes a situation or practice that requires operator awareness or action in order to avoid undesirable consequences.

MANDATORY ACTION. Gives directions that, if not observed, could result in loss of data or in damage to equipment.

WARNING! Describes an unsafe condition or practice that if not corrected, could result in personal injury or threat to health.

ELECTRICITY WARNING! Alerts the operator that there is risk of electric shock.

HOT SURFACE! Alerts the operator that there is a hot surface and that there is risk of getting burned if the surface is touched.

EXPLOSION RISK! Alerts the operator that there is risk of explosion.

2 Safety

Observe all laboratory safety requirements pertaining to working with oil, synthetic, and solvent-based fluids. Know the flash points of all fluids prior to testing and ensure proper ventilation in the work area.

Follow these recommended safety practices:

1. The operator should always wear safety glasses in case the mixture splatters in his face when adding ingredients.
2. The operator should not drop any foreign objects in the container while mixing is occurring. These foreign objects could strike the operator or damage the mixing blades and container.
3. The Wettability Test Apparatus should be plugged in to a grounded outlet with the ground prong in place.
4. Always remove the plug from the receptacle before performing any work on the mixer base.
5. The instrument should be at a comfortable height for the operator. The operator should be able to add ingredients without straining to reach the instrument. Also, it should be close enough to shut it off quickly if necessary.
6. The mixing cup should be cleaned thoroughly after use to prevent the buildup or contamination. Leftover deposits can cause accelerated wear of components.
7. The mixing blades should be checked daily for damage. Damaged or worn blades should be replaced immediately.

3 Features and Specifications

The Wettability Test Apparatus consists of a double-walled stainless steel mixing container (sample cup assembly), mixer base and an electronic control unit. The instrument is shipped with a variable transformer. The maximum operating temperature is 180°F (82°C). See Figure 3-1.

Table 3-1 lists the specifications for the instrument.

Table 3-1 Wettability Test Apparatus, Model C1001 Specifications

Category		Specification
Maximum Temperature		180°F (82°C)
Container Volume		750 ml
Blender Base		1 Speed, 120 V, 50/60 Hz
Electronic Control Unit	Length x Width x Height	8 x 8 x 8.5 in. 20.3 x 20.3 x 21.6 cm
	Weight	9 lb (4.1 kg)
Sample Cup Assembly	Width x Height	5.5 x 8.5 in. 13.97 x 21.6 cm
	Weight	2.5 lb (1.1 kg)
Variable Transformer		Input 120 V AC, Output 0-140 V AC, 10 AMP, KVA 1.4
Power Supply		115 V Frequency 60 Hz

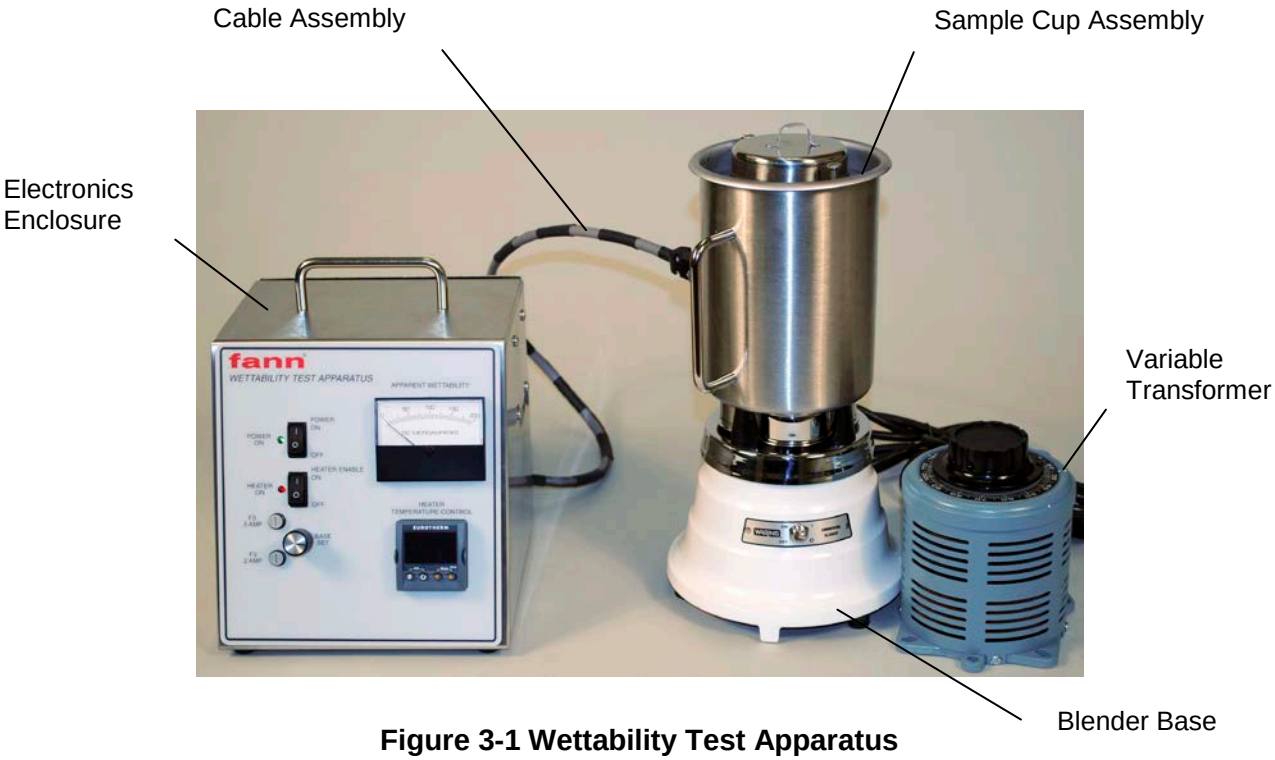

Figure 3-1 Wettability Test Apparatus

3.1 Wettability Test Apparatus Mechanical

This instrument consists of a double-walled stainless steel mixing container, mixer base, electronic control unit, and variable transformer. The mixing container can be used on any mixer base with continuous variable speed.

3.2 Wettability Test Apparatus Controls and Indicators

A cable connection from the sample cup assembly to the electronic control unit provides the power to the heater, thermocouple, and electrodes that are all in the stainless steel mixing cup. The electronic control unit stores the individual heater and power controls, the temperature controller, a potentiometer, an indicator dial, a meter, and the electronics. See Figure 3-2.

The electronic control unit has two switches on the front that control the power and the heater element with the circuits fused separately. The top switch labeled **Power** controls the power to the electronics. The bottom switch labeled **Heater Enable** controls power to the heating element.

The Eurotherm temperature controller regulates the temperature. The operator can adjust the temperature controller to the desired temperature.

The knob labeled **Base Set** sets the range of the meter movement and reading for the spacer used during the calibration procedure. The meter reads the apparent wettability in Hogans (Hn), a dimensionless unit.

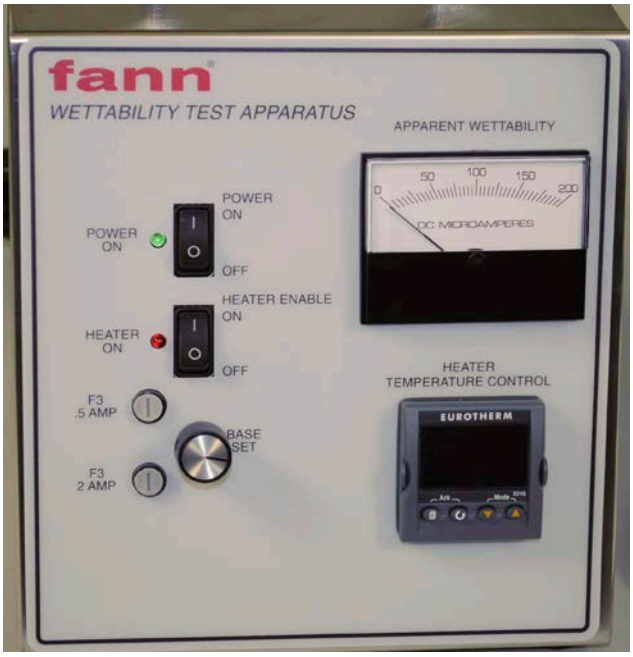

Figure 3-2 Electronic Control Unit

4 Installation

The WTA should be placed on a countertop at the proper height for the operator to add ingredients. The operator should be able to easily reach the control panel and view the display.

The functional components can generally be arranged to suit the available space and desires of the lab personnel, consistent with any established work processes. Some environments encourage a right-to-left flow, while others encourage a left-to-right flow. Consideration should be given to the location of the sample preparation area and cleaning the sample cup following test completion.

5 Operation

Testing should be conducted at bottomhole circulating temperature (BHCT). The heated mixer cup maintains the temperature of the preheated fluids.

Stirring rate should be enough to quickly homogenize added fluids and to prevent static non-mixing areas near the walls of the container.

Excessive shear will cause air-entrapment that may affect readings and surfactant performance.

5.1 Prepare the Sample

1. Shear the entire mud sample for at least 30 minutes to ensure the mud is a homogenous mixture; all solids are suspended.
2. If the mud is a field sample, proceed with heating and testing. If the sample is a laboratory-prepared mud, it should be hot-rolled for 16 to 24 hours before testing.
3. Mix the spacers and/or preflush fluids according to its standard procedures. Approximately 500 ml of fluid is enough volume to run a single test.
4. Precondition all spacer fluids at test temperature. Use an atmospheric consistometer to condition fluids whose properties could be significantly altered at temperatures greater than 180°F (82°C).

Spacers that show excessive sedimentation after conditioning may require redesign.

DO NOT use high-pressure, high-temperature (HPHT) consistometers or other equipment that may contaminate the fluids with mineral oil during preconditioning**.**

5.2 Set up the Equipment

1. Clean and dry the mixing container before running a test.
2. Inspect the bottom for leaking fluids. If leaking exists, replace the seals and/or the complete blade assembly if necessary.
3. Connect the wiring harness to the container. Refer to Figure 5-1.
4. Turn on the **Power**. The thermocouple should read room temperature. The meter should read zero (0) and remain constant. If it does not read zero, then a conductive path is present because there is an electrical short or the sample cup assembly is wet.

Figure 5-1 Cable Assembly Connected to Mixing Container

DO NOT TURN ON THE HEAT TO THE BLENDER WITH THE CUP DRY. EXCESSIVE TEMPERATURES COULD DAMAGE THE SEALS IN THE BLADE ASSEMBLY.

5.3 Calibrate the Wettability Test Apparatus

Perform these steps as quickly as possible in order to maintain test temperature. Steps 2-5 should take no more than 2 minutes to complete.

1. Fill the blender cup to within 1 inch of the top with tap water and set the temperature controller to the desired test temperature [180°F (82°C) maximum]. Turn on **Heater Enable,** the power to the heater and allow the cup to heat approximately 20 minutes.
2. After test temperature has been reached, pour the water out and pour the hot preconditioned spacer into the blender cup. Turn on the mixer at 300 rpm. The apparent wettability reading should stabilize as the temperature stabilizes.
3. The meter can now be calibrated by adjusting the **Base Set** control. This will set the maximum reading that will be targeted during the test. The greater this span set value, the greater the sensitivity reading of the meter.

The recommended maximum set point value is 175 Hn, not the full-scale value of 200Hn. When a mud has fully inverted, electrolytes (usually from calcium chloride) in the mud's internal phase may cause the final apparent wettability value of the system to be greater than that of the pure spacer. If this occurs, do not alter the set point for the remainder of the test with that spacer.

4. Turn off the heater, **Heater Enable,** and pour the spacer into a beaker. Quickly rinse the cup with hot water, dry it, and return it to the mixer base. Verify that the meter has returned to zero. If the meter does not read zero, a conductive path exists via either a short or moisture in the blender cup.
5. Pour preconditioned mud into the mixer cup sufficient to reach the electrodes (approximately 200 mL). Start shearing at the lowest possible speed. Observe the meter reading of the oil-based mud. It should read zero. If it reads some value above zero, then either the instrument is malfunctioning, as discussed previously or the oil-based mud is severely contaminated with water in the external phase.

5.4 Run the Test

With this procedure, you can observe viscosity spikes that often occur at specific mud-to-spacer and mud-to-surfactant ratios and perform compatibility testing later.

You may follow some or all of the following steps based upon prior knowledge of the mud system, spacer, and surfactant behavior.

If you do not know how the spacer and surfactants will perform, begin your test at step 1. Otherwise, you can begin your test at step 5, omitting steps 1-4.

1. Pour 175 mL each of preheated mud and spacer into the cup. Turn on the mixer and set it to stir at 200-600 rpm. A vortex is a good indicator that the speed is adequate. Mix thoroughly until homogenous.
2. While the mixer is stirring, titrate with surfactants and observe the apparent wettability behavior. When the maximum reading is obtained, the mixture is fully water-external, and the mud has been inverted. The reading should remain stable for 10 minutes at all shear rates. If the reading falls, increase surfactants, and monitor until a stable reading is obtained.
3. If the stable reading is less than the expected value for this system to indicate apparent wettability, continue titrating with surfactant. However, if the reading does not increase or begins to degrade, the spacer volume should be increased to improve the solubility of the surfactants in the aqueous phase.
4. Once a satisfactory system has been made, turn off instrument, properly dispose of the fluids and clean all equipment. Proceed to Step 5 to confirm the final mixture.
5. Titrate the preheated mud with the preconditioned, surfactant-laden spacer system. This titration will determine the spacer volume required to cause inversion of the total system and provide a fully water-external, water-wetting system.
6. After a maximum reading is obtained, monitor it for 10 minutes. If the reading falls, add more spacer and continue observing.

Inversion to a water-wet state is acceptable between 30% - 70% spacer addition by volume.

5.5 Adjust the Phase Change (Inversion)

Depending on the viscosity profile of the mud, spacer, and mixtures of both, it may be desirable to adjust the surfactant package such that the inversion from oil-external to water-external occurs at a mud-to-spacer ratio other than 50:50. Synthetic muds typically have a low yield point, and when the phase change occurs, the now water-wet solids often will settle severely.

A properly designed spacer should have adequate rheological properties to support solids released from the mud system.

Some mud systems will viscosify severely when inverted in the presence of an aqueous spacer. The titration procedure shown in steps 1-4 above (Section 5.4) is best suited to pinpointing the critical surfactant concentration. Once that surfactant concentration is known, steps 5-6 can be repeated with the alternate surfactant concentrations to find a mud-to-spacer ratio where inversion occurs, but with a lower viscosity spike.

6 Test Analysis

6.1 References

- API Recommended Practice for Testing Well Cements API RP 10B-2
- API Specification 10A, Cements and Materials for Well Cementing
- Society of Petroleum Engineers (SPE), SPE59135, *Removing Subjective Judgment from Wettability Analysis Aids Displacement*

6.2 Results

When the mixing container is empty, no electrical activity is present and the meter reading should be 0 Hogans (Hn). Likewise, when the container is full of a stable, oil-external drilling fluid, the meter reading is 0 Hn.

Once the external phase of the fluid exhibits electrical activity, the instrument will measure the level of apparent wettability. The meter reading will provide a quantitative measure of the fluid's apparent wettability and will allow direct comparisons between different spacer and surfactant systems. The operator can examine the effects of individual surfactants on the system.

The graph in Figure 6-1 shows the wettability transition that is occurring as the phase changes in four synthetic muds being mixed with an aqueous spacer containing a popular surfactant package. The synthetic muds used in that test were composed of an isomerized olefin (IO), a linear alpha olefin (LAO), an ester, or a linear paraffin (LP).

As the spacer volume increases, the apparent wettability also increases, thus indicating a phase change. Although some electrical conductivity occurs, the surfaces may not become totally water-wet; it depends on the affinity of surfaces for oil or water.

As the spacer volume is further increased, the affinity of the system to become more favorably water-external will increase as each new equilibrium level is obtained. Eventually, the meter reading will reach a maximum value equal to or greater than the value measured for 100% spacer, thus indicating that the electrodes are water-wet and the mixture is water-external.

If the final reading is greater than the calibrated value for 100% spacer, then the meter is measuring the electrolytes released from the internal phase of the mud.

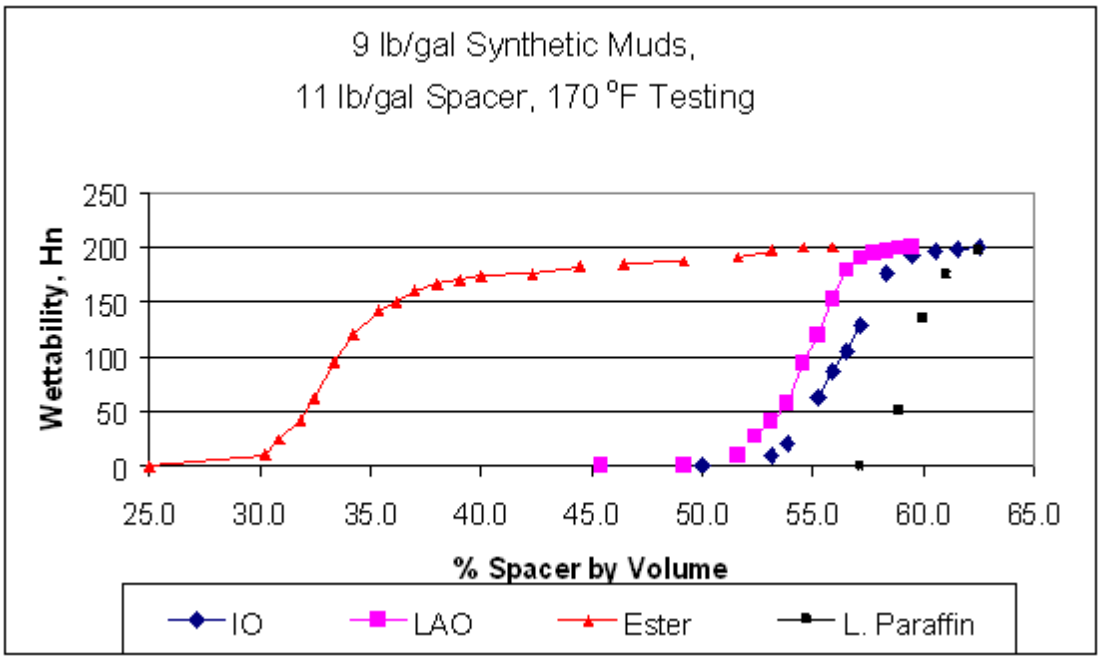

Figure 6-1 Wettability Test Results

7 Troubleshooting and Maintenance

- The mixing container should be washed thoroughly after each batch to remove deposits that can cause wear.
- Check the blades in the mixing container daily for wear.
- Replace blades that have worn noticeably; worn blades can cause vibration in the mixer.
- Ensure that the blades turn freely in the container. If the blades drag, inspect the area around them for deposits or other material. If this problem cannot be readily fixed, replace the container.
- If the controller does not respond to changes from the control pad, unplug the mixer from the power source to reset it.
- The mixer base and variable transformer do not have any user-repairable items. If the mixer base does not start or does not maintain speed properly, return the mixer base to Fann for repair.
- If the display or programming buttons stop working properly, return the unit to Fann for repair.

.

8 Parts List

Review the following table for any replacement parts and their respective part numbers.

Table 8-1 Wettability Test Apparatus, P/N 203936, Revision F

Part No.	Description
203538	CABLE ASSEMBLY
203937	SAMPLE CUP ASSEMBLY
203938	ENCLOSURE ASSEMBLY
205633	BLENDER BASE, 1 SPEED 120 VOLT , 50/60Hz SINGLE SPEED BASE UNIT ONLY WITHOUT CONTAINER
206536	TRANSFORMER VARIABLE 120 VOLTS INPUT, 120 VOLTS AC OUTPUT, 0-140 Volts AC MAXIMUM, AMPS 10

Figure 8-1 Wettability Test Apparatus

Table 8-2 Sample Cup Assembly, P/N 203937, Revision G

Item No.	Part No.	Quantity	Description
0001	204424	1	CUP OUTER
0002	204425	1	CUP INNER
0003	370534	2	TERMINAL RING 1/4 SOLDER LUG
0006	205188	1	WIRE THERMOCOUPLE, RING TERMINAL, TYPE J, PFA, GROUNDED, 12 in. LONG
0007	205394	1	HEATER STRIP 90 WATT 115 VOLT, 1 in X 9 in
0008	204427	1	CUP COLLAR
0009	203827	1	CONNECTOR BODY D TYPE MALE 9 PIN
0010	203820	1	CONNECTOR CONSTANTAN MALE PIN
0011	203822	1	CONNECTOR IRON MALE PIN
0012	203824	5	CONNECTOR STD GOLD PL BRASS
0013	204428	1	BASE BLENDER CONTAINER
0015	204651	1	BLADE ASSEMBLY
0017	207607	2	10-32 X 3/8 BHMS SS
0018	205357	1	HANDLE
0019	203759	1	SCREWLOCK D SHELL CONN 4-40 SC
0021	204633	1	ORING 4.35 in. X 0.210 in., NITRILE 70 DUROMETER
0023	205366	1	INSULATOR KIT FOR DO5/TO5 STUD
0024	205370	4	SPACER ANGLED 18 DEG
0029	203404	2	10-32 X 1-1/2 BHMS SS
0030	100029866	2	WASHER, FLAT, #10, SS
0031	207783	2	GROMMET RUBBER 1/4 in. ID X 3/8in.
0032	100024762	1	FERRULE, 1/4 in. OD TUBE, FRONT, BRASS
0033	100028427	3	SCREW, HEX CAP, 1/4-20 NC X 3/4, SS, 316
0034	100001867	6	NUT, HEX, 1/4-20 NC, SS
0036	372723	5	FLAT WASHER 1/4 x 1/2 x 1/16 in., SS, I.D. 0.26 in., O.D 0.5 in.
0037	204638	1	ORING 3.60 in. X 0.205 in. X 3.19 in., 50 DUROMETER
0038	208476	2 IN.	TUBE HEAT SHRINK 1/4 in. DIA BLA
0039	205393	2 FT	INSULATION HEATER 1/32 in. THK J50
0042	208547	14 IN.	WIRE 22AWG TEFLON STRANDED, BLACK
0044	206242	16 IN.	WIRE 22 AWG TEFLON STRANDED, BLUE
0046	206229	14 IN.	WIRE 22 AWG PVC STRANDED, GREEN
0048	204290	24 IN.	SLEEVING FIBERGLASS SIZE 6 CLASS R GRADE A 1200F, 0.166 IN. ID
0050	204350	1 IN.	TUBE HEAT SHRINK, 1/8 in. DIA

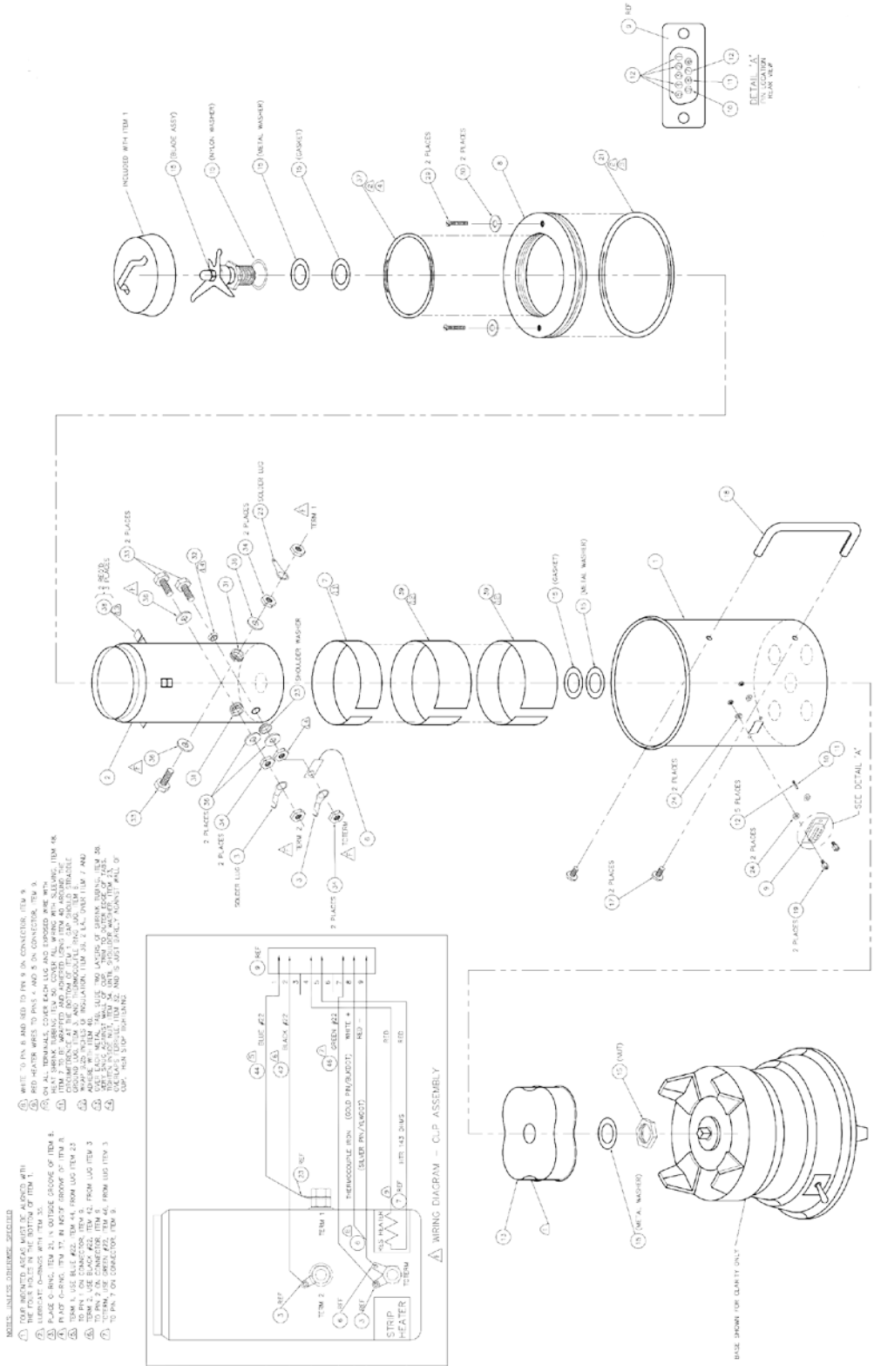

Figure 8-2 Sample Cup Assembly

Table 8-3 Enclosure Assembly, P/N 203938, Revision H

Item No.	Part No.	Quantity	Description
0001	203635	1	ENCLOSURE
0002	203636	1	ENCLOSURE BACK
0003	208452	1	CABLE POWER 115V 18 AWG M&F PLUG
0004	100123131	1	CONNECTOR, 9 PIN, PLUG
0005	379844	1	CONNECTOR CARD EDGE-44 POS- 0.1 CTR
0006	205361	1	KNOB EHC MODEL EH-71-1E2S
0007	204264	1	METER PANEL 200UA MODUTEC 25
0008	101485666	1	TEMP CONT 3216 PROG
0009	208438	1	PLUG INTL ELECT CODE TYPE
0010	101476559	3	TERMINAL
0011	205357	1	HANDLE
0012	205360	1	STANDOFF THRD 6-32 0.25 HEX X 2in.
0013	205358	4	FEET RECESSED BUMPERS KEYS
0014	205359	1	BRACKET MOUNTING
0015	203939	1	PCB ASSEMBLY
0016	203759	1	SCREWLOCK D SHELL CONN 4-40 SC
0017	206086	1	TRANSFORMER MAGNATEK N-6U
0018	203821	1	CONNECTOR CONSTANTAN FEMALE SOCKET
0019	203823	1	CONNECTOR IRON FEMALE SOCKET
0020	203825	5	CONNECTOR STD GLD PL PHOS BRONZE
0021	203445	4	SPACER 1/4 OD X 6 CLEAR ID
0022	206720	1	ORING 1/4 X 1/2 NITRILE
0023	207607	2	10-32 X 3/8 BHMS STAINLESS STEEL
0024	207488	5	6-32 X 3/8 BHMS STAINLESS STEEL
0025	207489	4	6-32 X 1/2 BHMS STAINLESS STEEL
0026	207632	3	NUT 6-32 HEX REGULAR STAINLESS STEEL
0027	207819	2	WASHER SPLIT 6 STAINLESS STEEL
0028	207948	2	4-40 X 3/8 BHMS STAINLESS STEEL
0029	207487	1	6-32 X 1/4 BHMS STAINLESS STEEL
0030	207336	4	8-32 X 3/8 BHMS STAINLESS STEEL
0031	207947	4	WASHER SPLIT 8 STAINLESS STEEL
0032	207631	4	NUT 8-32 HEX REGULAR STAINLESS STEEL
0033	204589	1	OVERLAY
0036	208529	36 IN.	WIRE 18 AWG PVC STRANDED WHITE
0038	208522	36 IN.	WIRE 18 AWG PVC STRANDED BLACK
0040	208523	18 IN.	WIRE 18 AWG PVC STRANDED RED
0042	208526	18 IN.	WIRE 18 AWG PVC STRANDED GREEN
0044	206219	18 IN.	WIRE 20 AWG PVC STRANDED BLACK
0046	206217	18 IN.	WIRE 20 AWG PVC STRANDED RED
0048	206218	18 IN.	WIRE 20 AWG PVC STRANDED WHITE
0050	204287	1	TERMINAL RING 6 18-14 AWG BLUE
0052	206250	18 IN.	WIRE 22AWG PVC STRANDED BLACK PVC INSULATION BLACK STRANDED 22 AWG 7/30 300 V 80 DEG C
0054	206242	18 IN.	WIRE 22 AWG TEFLON STRANDED BLUE
0056	206229	18 IN.	WIRE 22 AWG PVC STRANDED GREEN
0058	207901	1	WASHER EXTERNAL TOOTH 4 STAINLESS STEEL
0060	204350	10 IN.	TUBE HEAT SHRINK 1/8 DIA BLACK
0062	208512	18	TIE CABLE 1/16 TO 5/8 DIA 3.6
0064	205296	3	TIE WRAP ADHESIVE PAD

Item No.	Part No.	Quantity	Description
0066	204272	2	TERMINAL RING 10 16-14 AWG
0067	208485	14	WIRE THERMOCOUPLE DUPLEX TYPE

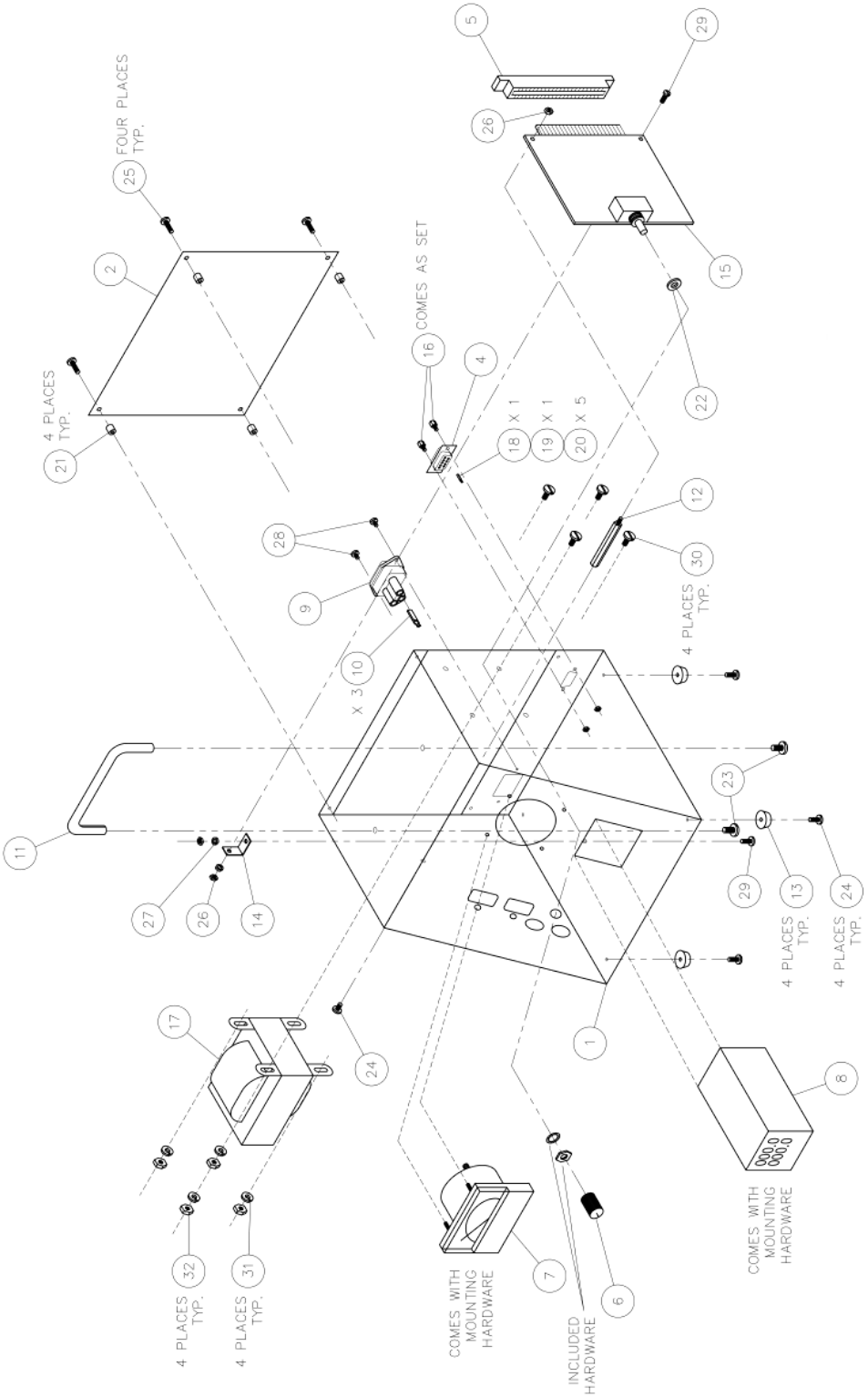

Figure 8-3 Enclosure Assembly

Table 8-4 Cable Assembly, P/N 203538, Revision B

Item No.	Part No.	Quantity	Description
0001	206244	52	WIRE 20 AWG 2 PAIR TWISTED FOIL SH
0002	100123131	1	CONNECTOR, 9 PIN, PLUG
0003	203820	1	CONNECTOR CONSTANTAN MALE PIN
0004	203821	1	CONNECTOR CONSTANTAN FEMALE SOCKET
0005	203822	1	CONNECTOR IRON MALE PIN
0006	203823	1	CONNECTOR IRON FEMALE SOCKET
0007	203824	5	CONNECTOR STD GOLD PL BRASS MP
0008	203825	5	CONNECTOR STD GLD PL PHOS BRONZE
0009	208485	52	WIRE THERMOCOUPLE DUPLEX TYPE
0010	205408	1	TUBING HEAT SHRINK FLAME RETARDENT
0014	203829	2	CONNECTOR BACKSHELL w/GROMMET
0015	203827	1	CONNECTOR BODY D TYPE MALE 9 PIN

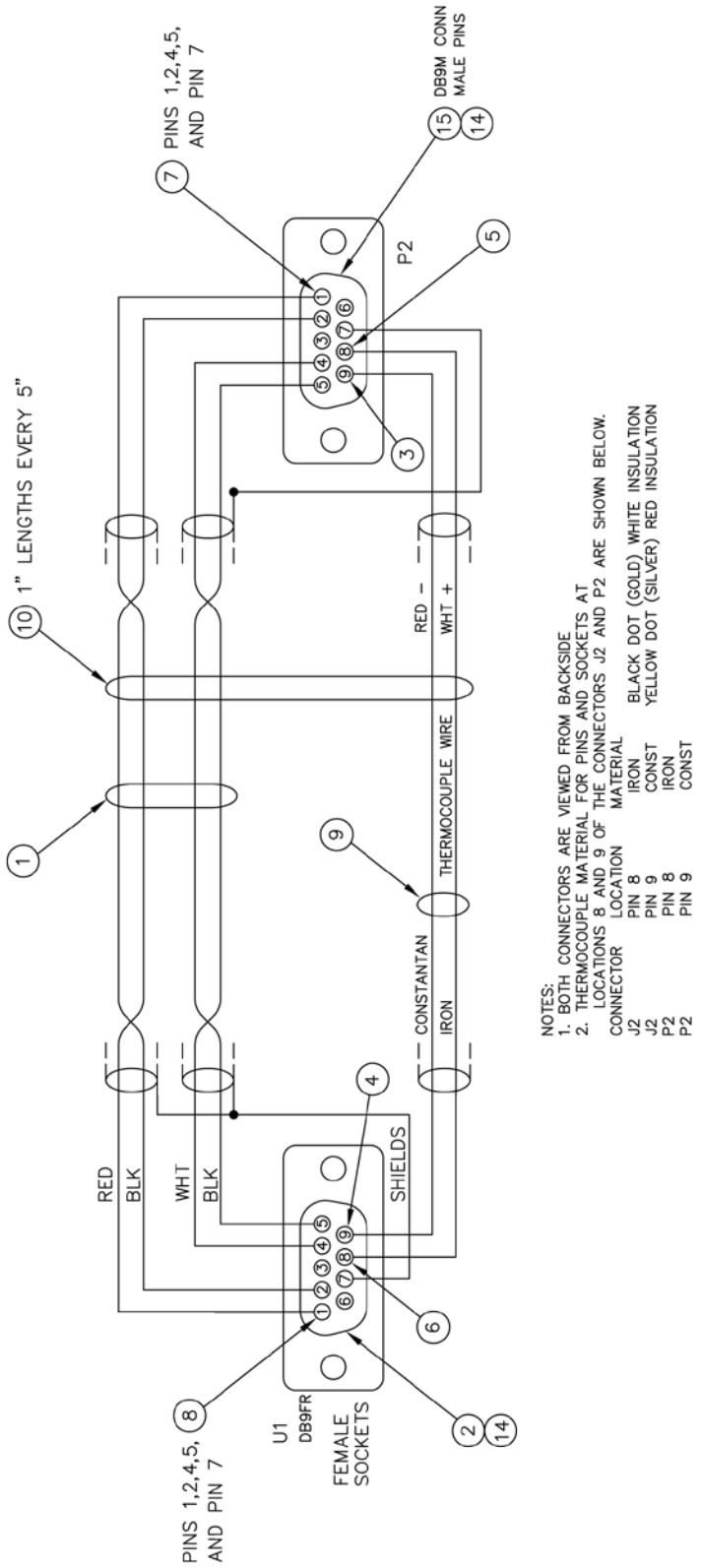

Figure 8-4 Cable Assembly

9 Warranty and Returns

9.1 Warranty

Fann Instrument Company warrants only title to the equipment, products and materials supplied and that the same are free from defects in workmanship and materials for one year from date of delivery. THERE ARE NO WARRANTIES, EXPRESS OR IMPLIED OF MERCHANTABILITY, FITNESS OR OTHERWISE BEYOND THOSE STATED IN THE IMMEDIATELY PRECEDING SENTENCE. Fann's sole liability and Customer's exclusive remedy in any cause of action (whether in contract, tort, breach of warranty or otherwise) arising out of the sale, lease or use of any equipment, products or materials is expressly limited to the replacement of such on their return to Fann or, at Fann's option, to the allowance to Customer of credit for the cost of such items. In no event shall Fann be liable for special, incidental, indirect, consequential or punitive damages. Notwithstanding any specification or description in its catalogs, literature or brochures of materials used in the manufacture of its products, Fann reserves the right to substitute other materials without notice. Fann does not warrant in any way equipment, products, and material not manufactured by Fann, and such will be sold only with the warranties, if any, that are given by the manufacturer thereof. Fann will only pass through to Customer the warranty granted to it by the manufacturer of such items.

9.2 Returns

For your protection, items being returned must be carefully packed to prevent damage in shipment and insured against possible damage or loss. Fann will not be responsible for damage resulting from careless or insufficient packing.

Before returning items for any reason, authorization must be obtained from Fann Instrument Company. When applying for authorization, please include information regarding the reason the items are to be returned.

Our correspondence address:

Fann Instrument Company
P.O. Box 4350
Houston, Texas USA 77210

Telephone: 281-871-4482
Toll Free: 800-347-0450
FAX: 281-871-4446

Email fannmail@fann.com

Our shipping address:

Fann Instrument Company
14851 Milner Road, Gate 5
Houston, Texas USA 77032