The following is a registered trademark of Du Pont:

TEFLON®,
TEFZEL®,
VITON®

The following is a trademark of Haynes International Incorporated:

HASTELLOY™

The following is a registered trademark of Rosemount Incorporated:

HART®

WARNING notices as used in this manual apply to hazards or unsafe practices which could result in personal injury or death.

CAUTION notices apply to hazards or unsafe practices which could result in property damage.

NOTES highlight procedures and contain information which assist the operator in understanding the information contained in this manual.

---

All software, including design, appearance, algorithms and source codes, is copyrighted by Elsag Bailey Process Automation and is owned by Elsag Bailey Process Automation or its suppliers.

---

POSSIBLE PROCESS UPSETS
Maintenance must be performed only by qualified personnel and only after securing equipment controlled by this product. Adjusting or removing this product while it is in the system may upset the process being controlled. Some process upsets may cause injury or damage.

---

NOTICE
The information contained in this document is subject to change without notice.

Elsag Bailey Process Automation, its affiliates, employees, and agents, and the authors of and contributors to this publication specifically disclaim all liabilities and warranties, express and implied (including warranties of merchantability and fitness for a particular purpose), for the accuracy, currency, completeness, and/or reliability of the information contained herein and/or for the fitness for any particular use and/or for the performance of any material and/or equipment selected in whole or part with the user of or in reliance upon information contained herein. Selection of materials and/or equipment is at the sole risk of the user of this publication.

This document contains proprietary information of Elsag Bailey Process Automation, and is issued in strict confidence. Its use, or reproduction for use, for the reverse engineering, development or manufacture of hardware or software described herein is prohibited. No part of this document may be photocopied or reproduced without the prior written consent of Elsag Bailey Process Automation.

# Table of Contents

SAFETY SUMMARY .................................................. I

READ FIRST ......................................................... III

1.0 INTRODUCTION ................................................ 1-1
   1.1 General ...................................................... 1-1
       1.1.1 Description ........................................... 1-1
       1.1.2 Construction .......................................... 1-3
   1.2 Model Number Breakdown .................................. 1-4
       1.2.1 Model 10DX3119 ....................................... 1-4
   1.3 Specifications ............................................. 1-6

2.0 INSTALLATION ................................................. 2-1
   2.1 Inspection .................................................. 2-1
       2.4.1 Orientation .......................................... 2-5
       2.4.2 Pipe Connections ..................................... 2-5
   2.5 Grounding Procedure ...................................... 2-8
       2.5.1 General ............................................... 2-8
       2.5.2 Conductive Pipeline .................................. 2-8
       2.5.3 Non-Conductive or Electrically Insulated Pipeline .. 2-12
       2.5.4 Grounding Probes (2 required) ..................... 2-12
   2.6 Electrical Interconnection ................................ 2-13
       2.6.1 General ............................................... 2-13

3.0 OPERATION and START-UP ...................................... 3-1

4.0 FUNCTIONAL DESCRIPTION ................................... 4-1
   4.1 Basic Operating Principle .................................. 4-1
       4.1.1 Signal Voltage Generation .......................... 4-1
       4.1.2 Magnet Coil Drive Circuits ......................... 4-2
       4.1.3 Volumetric Flow Rate Measurement .................. 4-2
   4.2 Operating Characteristics ................................ 4-3
       4.2.1 Liquid Variables ..................................... 4-3
           4.2.1.1 Liquid Conductivity ............................ 4-3
           4.2.1.2 Liquid Temperature ............................. 4-4
           4.2.1.3 Other Liquid Variables ......................... 4-5
       4.2.2 Metering Characteristics ............................ 4-5

5.0 CIRCUIT DESCRIPTION ........................................ 5-1
   5.1 Primary Signals ............................................ 5-1
   5.2 Constant Meter Factor (CMF) PC Assembly ................ 5-1
6.0 MAINTENANCE ................................. 6-1
  6.1 General .................................. 6-1
  6.2 System Troubleshooting .................. 6-1
  6.3 Static Test ............................... 6-2
    6.3.1 Magnet Coil Check .................. 6-2
    6.3.2 Electrode Check ..................... 6-4
    6.3.3 Primary CMF Board .................. 6-4
  6.4 Electrode Disassembly ................. 6-6
    6.4.1 Inspection .......................... 6-6
    6.4.2 Electrode Replacement ............. 6-6
  6.5 Electronic Parts Replacement ......... 6-7

7.0 PARTS LIST ................................. 7-1
List of Figures

FIGURE 1-1. CUTAWAY VIEW OF TYPICAL FLOWMETER ............................................ 1-1
FIGURE 1-2. ELECTRONICS COMPARTMENT WITHOUT SIGNAL CONVERTER .............. 1-2
FIGURE 1-3. CONDUCTIVITY GRAPH ................................................................. 1-9
FIGURE 2-1. PROPER HOISTING TECHNIQUE ..................................................... 2-1
FIGURE 2-2. OUTLINE DIMENSIONS, 16" TO 36" METER SIZE ............................. 2-3
FIGURE 2-3. TYPICAL PIPING DIAGRAMS ......................................................... 2-7
FIGURE 2-4. GROUNDING PROCEDURE; NON-INSULATED PIPELINE .................. 2-9
FIGURE 2-5. GROUNDING PROCEDURE; INSULATED PIPELINE ........................... 2-10
FIGURE 2-6. GROUNDING RINGS AND GASKETS .............................................. 2-11
FIGURE 2-7. GROUNDING PROBE (OPTIONAL) ................................................... 2-12
FIGURE 2-8. CONDUIT ENTRY SEAL INSTALLATION .......................................... 2-14
FIGURE 3-1. TYPICAL INSTRUMENT TAG ......................................................... 3-1
FIGURE 3-2. PRIMARY MOUNTED PC ASSEMBLIES ........................................... 3-2
FIGURE 4-1. BASIC OPERATING PRINCIPLE ..................................................... 4-1
FIGURE 5-1. SCHEMATIC FOR PRIMARY WIRING WHEN USING REMOTE CONVERTER ... 5-2
FIGURE 5-2. SCHEMATIC FOR CMF BOARD ..................................................... 5-4
FIGURE 6-1. EXPLODED VIEW, BASIC FLOWMETER PARTS ................................ 6-8
FIGURE 7-1. EXPLODED VIEW, ELECTRODE ASSEMBLIES ............................... 7-2

List of Tables

TABLE 1-1. CAL FACTOR & CAPACITY ............................................................. 1-8
TABLE 1-2. CAPACITY TABLE ...................................................................... 1-9
TABLE 2-1. PROTECTOR PLATE AND GROUNDING RING PART NUMBERS ........... 2-9
TABLE 6-1. METER COIL RESISTANCE ............................................................. 6-3
SAFETY SUMMARY

GENERAL WARNINGS

POSSIBLE PROCESS UPSETS
Maintenance must be performed only by qualified personnel and only after securing equipment controlled by this product. Adjusting or removing this product while it is in the system may upset the process being controlled. Some process upsets may cause injury or damage.

RETURN OF EQUIPMENT
All Flowmeters and/or Signal Converters being returned to Bailey-Fischer & Porter for repair must be free of any hazardous materials (acids, alkalis, solvents, etc.). A Material Safety Data Sheet (MSDS) for all process liquids must accompany returned equipment. Contact Bailey-Fischer & Porter for authorization prior to returning equipment.

INSTRUCTION MANUALS
Do not install, maintain or operate this equipment without reading, understanding and following the proper Bailey-Fischer & Porter instructions and manuals, otherwise injury or damage may result.

ELECTRICAL SHOCK HAZARD
Equipment powered by AC line voltage constitutes a potential electric shock hazard to the user. Make certain that the system power input leads are disconnected from the operating branch circuit before attempting electrical interconnections or service.

SPECIFIC WARNINGS

ELECTRICAL SHOCK HAZARD. Equipment powered by an AC line voltage constitutes a potential electric shock hazard to the user. Make certain that the system power input leads are disconnected from the operating branch circuit before attempting electrical interconnections. (pg. 2-13)

ELECTRICAL SHOCK HAZARD. Equipment powered by an AC line voltage presents a potential electric shock hazard. Servicing of the Magnetic Flowmeter or Signal Converter should only be attempted by a qualified electronics technician. (pg. 6-1)

ELECTRICAL SHOCK HAZARD. Equipment powered by an AC line voltage presents a potential electric shock hazard to the user. Make certain that the system power is disconnected before making the following ohmmeter checks. (pg. 6-2)

Do not attempt electrode inspection or replacement with a filled or pressurized pipeline. Personal injury may result. (pg. 6-6)
<table>
<thead>
<tr>
<th>SPECIFIC CAUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not pass hoisting cable (rope, strap, etc.) through the flowmeter. Sharp objects or strains could tear or puncture the meter liner. (pg. 2-1)</td>
</tr>
<tr>
<td>Never allow any support for the Magnetic Flowmeter to bear upon the inner surface of the meter pipe section, as the liner may become damaged. (pg. 2-2)</td>
</tr>
<tr>
<td>Do Not use a DC ohmmeter for this measurement as polarization effects will produce completely erroneous data. (pg. 4-3)</td>
</tr>
<tr>
<td>For TEFLOLn lined meters, replacement of the electrodes must not be attempted in the field. The meter must be returned to the factory for electrode replacement. (pg. 6-6)</td>
</tr>
<tr>
<td>Exercise extreme care when withdrawing electrode from its seat so the little or no tension is exerted on the connecting electrode wire. If this wire should break within the meter housing, the meter is not repairable. (pg. 6-7)</td>
</tr>
</tbody>
</table>
READ FIRST

WARNING

INSTRUCTION MANUALS
Do not install, maintain, or operate this equipment without reading, understanding and following the proper Bailey-Fischer & Porter instructions and manuals, otherwise injury or damage may result.

RETURN OF EQUIPMENT
All Flowmeters and/or Signal Converters being returned to Bailey-Fischer & Porter for repair must be free of any hazardous materials (acids, alkalis, solvents, etc). A Material Safety Data Sheet (MSDS) for all process liquids must accompany returned equipment. Contact Bailey-Fischer & Porter for authorization prior to returning equipment.

Read these instructions before starting installation;
save these instructions for future reference.

The following information is applicable to all magnetic flowmeters supplied after March 1992. Each of these meters is provided with a corrosion resistant NEMA 4X finish.

The NEMA 4X rating applies to the meter body and electronics enclosure only. The following accessories (if supplied) may not meet NEMA 4X unless specifically ordered as NEMA 4X:

- meter flanges
- meter installation hardware: studs, nuts, bolts
- enclosure mounting hardware for pipe or wall mounting
- conduit hardware

This product is painted with a high performance epoxy paint. The corrosion protection provided by this finish is only effective if the finish is unbroken. It is the users' responsibility to "touch-up" any damage that has occurred to the finish during shipping or installation of the product. Special attention must be given to: meter flange bolting, pipe mounting of electronics, conduit entries and covers that are removed to facilitate installation or repair. For continued corrosion protection throughout the product life, it is the users' responsibility to maintain the product finish. Incidental scratches and other finish damage must be repaired and promptly re-painted with approved touch-up paint. Provide the model number and size of your product to the nearest Bailey-Fischer & Porter representative to obtain the correct touch-up paint.
1.0 INTRODUCTION

1.1 General

1.1.1 Description

The Bailey-Fischer & Porter Model 10DX3119 Magnetic Flowmeter is a compact, volumetric, liquid flow rate detector that uses as the process transducing method the characteristic of a conductive liquid to generate an induced voltage when flowing through a magnetic field. The amplitude of the voltage produced is directly proportional to the flow rate of the metered fluid.

Being a completely obstructionless metering instrument, the Bailey-Fischer & Porter Model 10DX3119 Magnetic Flowmeter can be used to meter liquids without regard to heterogeneous consistency and is as independent of the tendency to plug or foul as the pipeline in which it is mounted. An inherent advantage of obstructionless construction is that pressure losses are reduced to levels occurring in equivalent lengths of equal diameter pipeline. This reduces or conserves pressure source requirements in new or existing hydraulic lines as compared to other metering methods. The compact size of the meter results in a unit which requires no additional support other

FIGURE 1-1. CUTAWAY VIEW OF TYPICAL FLOWMETER
than that used normally on pipe runs. Short laying lengths minimize the need for altering existing pipe runs to accommodate metering. A basic construction of non-corrosive wetted parts and a variety of meter lining materials permit metering of most corrosive and reactant liquids.

Factors such as liquid viscosity and density require no compensation and have no effect on the measurement accuracy of the Magnetic Flowmeter. Metering limitations are confined to a minimum threshold of electrical conductivity inherent to the liquid being metered. The degree of liquid conductivity has no effect upon metering accuracy as long as it is greater than this minimum level. Process temperature is limited only to the extent that it may affect conductivity and, like liquid pressure, to the extent that it cannot exceed the meter material specification limits.

The associated electronics package is called the Signal Converter and can be either integrally or remotely mounted. A typical Magnetic Flowmeter is shown in Figure 1-1, Cutaway View. Figure 1-2 shows the electronics housing. The Magnetic Flowmeter without the electronic package is used with a remote Signal Converter. A remote mounted Signal Converter is recommended if 1) the vibration specification limit is exceeded and/or 2) the process liquid temperature exceeds the value given for that ambient temperature listed in 1.3 Specifications.

The Signal Converter contains a magnet driver network that is used to power the meter’s magnet coils. The steady state magnetic field principle utilized in meter operation is known as the MAG-X design concept and provides optimum zero point stability at an optimized operating frequency. For additional detail, refer to the Section titled Functional Description. Operation and Maintenance procedures for the associated Signal Converter are given in the Instruction Bulletin provided for the particular microprocessor-based Converter, as applicable.

**FIGURE 1-2. ELECTRONICS COMPARTMENT WITHOUT SIGNAL CONVERTER**
1.1.2 Construction

The Bailey-Fischer & Porter Model 10DX3119 Magnetic Flowmeter consists of a flanged, stainless steel pipe spool which serves as a meter body. A pair of arched, oval shaped magnet coils fit on opposite sides of the meter spool outer surface as shown in Figure 1-1. The carbon steel housing provides a flow return path for the magnetic field generated by the coils. Unless otherwise specified, the meter flanges are stainless steel and mate with ANSI Class 150 pipe flanges.

An insulating interior liner of either TEFLOW (PTFE), neoprene, polyurethane or VITON is inserted into the spool and turned-out against the flange faces. Two cylindrical electrodes are mounted diametrically opposed within the central portion of the meter body and are completely insulated from the metal pipe. The end surfaces of the standard electrodes are virtually flush with the inner surface of the insulating liner and come into contact with the liquid to be metered. Bullet nosed electrodes are mounted in a similar way; however, these electrodes protrude slightly beyond the inner surface of the liner. Two access ports provide access to the meter electrode areas. Figure 1-1 shows pipe end caps being used to cover the electrode access port; most meters are constructed using a pipe plug to seal the access port.

Electrode and magnet coil wiring is brought out through two access holes in the top of the meter body. Typically, electrical interconnections enter the electronic housing through a watertight cable seal fitting (see Figure 1-1). The use of metal electrical conduit is recommended for both physical protection of signal wiring and for reduction of spurious electrical signals and interference.
1.2 Model Number Breakdown

Refer to the Bailey-Fischer & Porter data sheet or data tag on the equipment for the model number of the instrument furnished. The details of a specific number are as follows:

### 1.2.1 Model 10DX3119

<table>
<thead>
<tr>
<th>Engineering Reference</th>
<th>Design Level</th>
<th>Replacement for 10DX1465</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obstructionless Magnetic Flowmeter</td>
<td>A</td>
<td>E</td>
<td>Z</td>
</tr>
</tbody>
</table>

#### Liner Material

- Hard Rubber
- Soft Rubber
- Polyurethane
- PTFE TEFLO®
- Neoprene
- Linatex
- Other

<table>
<thead>
<tr>
<th>Size</th>
<th>Flange Connection</th>
<th>Flange Material</th>
<th>Protector Plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inches (mm)</td>
<td>AWWA Class B for sizes ≥ 30&quot;</td>
<td>Carbon Steel</td>
<td>None Required</td>
</tr>
<tr>
<td>14&quot; (350)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>16&quot; (400)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>18&quot; (450)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>20&quot; (500)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>24&quot; (600)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>28&quot; (700)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>30&quot; (750)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>32&quot; (800)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>36&quot; (900)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>40&quot; (1000)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>42&quot; (1100)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>48&quot; (1200)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>54&quot; (1400)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>60&quot; (1500)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>64&quot; (1600)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>66&quot; (1650)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>72&quot; (1800)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
<tr>
<td>78&quot; (2000)</td>
<td></td>
<td>304 Stainless Steel</td>
<td>316 Stainless Steel</td>
</tr>
</tbody>
</table>

#### Flange Connection

- AWWA Class B for sizes ≥ 30"
- AWWA Class D for sizes ≥ 30"
- DIN PN 6
- DIN PN 10
- DIN PN 16
- DIN PN 25
- ANSI Class 150 for sizes ≤ 24"
- ANSI Class 300 for sizes ≤ 24"
- Other

#### Flange Material

- Carbon Steel
- 304 Stainless Steel
- 316 Stainless Steel

#### Protector Plate

- None Required
- 316 Stainless Steel
- HASTELLOY C
1.2.1 Model Number 10DX3119 (continued)

<table>
<thead>
<tr>
<th>Electrode Type</th>
<th>Electrode Material</th>
<th>Certification</th>
<th>Enclosure Classification</th>
<th>Process Temperature Range</th>
<th>Line Excitation Frequency</th>
<th>Customer Information Language</th>
<th>Remote Signal Converter Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flush</td>
<td>316 Stn. Steel</td>
<td>General Purpose</td>
<td>IEC 529 IP 65, NEMA 4X</td>
<td>Teflon F 250°F (120°C)</td>
<td>50 Hz / 6-1/4 Hz</td>
<td>English</td>
<td>50XM1000</td>
</tr>
<tr>
<td>Bullet Nose</td>
<td>HASTELLOY® B</td>
<td></td>
<td>Accidental Submergence, IEC 529 IP 67</td>
<td>Teflon, Expanded Temperature, &lt; 356°F (180°C)</td>
<td>50 Hz / 12-1/2 Hz</td>
<td></td>
<td>50XM1000 + 50SD1000**</td>
</tr>
<tr>
<td>Slurry Service</td>
<td>HASTELLOY® C</td>
<td></td>
<td></td>
<td>Hard Rubber / Soft Rubber / Latex, &lt; 170°F (77°C)</td>
<td>60 Hz / 7-1/2 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Titanium</td>
<td></td>
<td></td>
<td>Neoprene / Polyurethane, &lt; 190°F (88°C)</td>
<td>60 Hz / 15 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tantalum</td>
<td></td>
<td></td>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Teflon/Tefzel only)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Platinum / Iridium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Teflon/Tefzel only)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zirconium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Only available up to 24 inch size.

** This configuration must be specified for meter sizes larger than 24 inches.
1.3 Specifications

Power Requirements  See 1.2 Model Number Breakdown

Power Consumption  Refer to Converter Instruction Bulletin

Flowmeter Characteristics

Meter Size/Flow Capacity  See TABLE 1-1.

Span  Factory set at specified range between extremes listed in TABLE 1-1; can be field adjusted.

Rangeability  100:1

Minimum Fluid Conductivity  5 μS/cm

System Accuracy:

<table>
<thead>
<tr>
<th>Frequency Output</th>
<th>Flowrate</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2% CAL Factor</td>
<td>±0.01% CAL Factor</td>
<td></td>
</tr>
<tr>
<td>≥2% CAL Factor</td>
<td>±0.5% of Rate</td>
<td></td>
</tr>
</tbody>
</table>

Meter Calibration Factor  specified on primary data tag (equal to max flow capacity in engineering units). This factor is equivalent to a flow velocity of 33.33 ft/s in the metering tube.

RFI Protection  Class 2-abc-0.1% (10 V/m-20 to 1000 MHz) per SAMA Standard PMC 33.1-1978. Standard with integral Converters; not available with remote Converter.

Environmental Limits

Enclosure Classification (Standard Meter w/integral or remote signal Converter)  IEC 529 IP65; NEMA 4X, indoor or outdoor installation

Accidental Submergence Option (w/integral or remote signal Converter)  IEC 529 IP67; 30 ft. H2O/48h (9m H2O/48 h)

Relative Humidity  10% to 90%
Ambient Temperature Limits at primary

<table>
<thead>
<tr>
<th>10DX3119</th>
<th>Remote Mounted</th>
<th>Integrally Mounted</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40 to 65°C</td>
<td>-10 to 55°C</td>
<td>(-40 to 150°F)</td>
</tr>
</tbody>
</table>

Note: Electronics must be remote mounted when combined process and ambient temperatures exceed 120°C (248°F) for the microprocessor-based converter.

Process Limits

Liner Temperature

- TEFLON / VITON: 150°C (302°F)
- Polyurethane / Neoprene: 88°C (191°F)

Physical Characteristics

Outline Dimensions

- NEMA 4 & Accidental Submergence: See Figure 2-2

Vibration Limit (w/ Integral Converter)

- 5 to 14 Hz, 0.10"; 14 to 200 Hz, 1 g

NOTE: A remote mounted Signal Converter must be used when vibration limit is exceeded.

Signal Cable for remote Converter (supplied by Bailey-Fischer & Porter, when applicable)

- Standard Length: 30 ft (9 m)
- Optional Length: Up to 100 ft (30 m) available in 10 ft increments, as specified.

Materials of Construction

- Meter Liner: PTFE (TEFLON), Polyurethane, Neoprene or VITON, as specified.
- Electrode Assembly: see Section 1.2 Model Number Breakdown
- Meter Spool: Stainless steel, epoxy finish
- Flanges: Stainless steel
- Meter Housing: Carbon steel, epoxy finish
- Electronics Housing: die case aluminum, epoxy finish, 316 SST attachment screws, gasketed covers
## TABLE 1-2. CAPACITY TABLE
(30 in. through 78 in. Sizes)

<table>
<thead>
<tr>
<th>METER SIZE</th>
<th>FLOW RANGES 0 TO VALUE TABULATED</th>
<th>CAPACITY SETTING (IF NOT SPECIFIED BY CUSTOMER)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MINIMUM</td>
<td>MAXIMUM</td>
</tr>
<tr>
<td></td>
<td>gpm</td>
<td>m³/h</td>
</tr>
<tr>
<td>750</td>
<td>30</td>
<td>3,630</td>
</tr>
<tr>
<td>900</td>
<td>36</td>
<td>5,370</td>
</tr>
<tr>
<td>1100</td>
<td>42</td>
<td>7,400</td>
</tr>
<tr>
<td>1200</td>
<td>48</td>
<td>9,400</td>
</tr>
<tr>
<td>1400</td>
<td>54</td>
<td>12,100</td>
</tr>
<tr>
<td>1500</td>
<td>60</td>
<td>14,800</td>
</tr>
<tr>
<td>1700</td>
<td>66</td>
<td>17,900</td>
</tr>
<tr>
<td>1800</td>
<td>72</td>
<td>20,200</td>
</tr>
<tr>
<td>2000</td>
<td>78</td>
<td>25,600</td>
</tr>
</tbody>
</table>

### CAL FACTOR

Each 10DX3119 meter in sizes 30 in. through 78 in. is calibrated at the factory and the individual meter's unique cal factor is indicated on a tag attached to the side of the meter body. See the instructions for the converter in the Converter/Driver for details on programming the converter to use this cal factor. Note that this is a truly PROGRAMMABLE factor; do NOT follow converter instructions for using a "constant meter factor."

The range requested by the customer is also marked on the tag attached to the meter.

![Conductivity Graph](image-url)

**Figure 1-3. Conductivity Graph**
2.0 INSTALLATION

2.1 Inspection

The Series 10DX3119 Magnetic Flowmeter and the associated Signal Converter are normally combined for shipment. For example, the 14" size meter is shipped in a heavy-duty carton which is specially designed to protect the equipment during shipment. The 16" and larger size meters are strapped to a wooden skid that both protects the metering system and facilitates handling of this heavy equipment with a fork lift truck (typical). A table of meter weights is provided on the outline dimension drawing (see Figure 2-2). An itemized list of all items included in the shipment is attached to the package or container.

Inspect all items included in the shipment immediately for indications of damage which may have occurred during shipment. A thorough visual inspection of the shipment contents is normally all that is required to determine whether damage is evident. All claims of damage should be reported to the shipping agent involved before attempting to install or operate this equipment. If damage is such that faulty operation is likely to result, the damage should be brought to the attention of the Bailey-Fischer & Porter Service Department.

Performing inspection at the installation site is preferred because it is easier to transport the meter and Signal Converter in the original shipping container. Should it be necessary to lift the Magnetic Flowmeter, attach the cables from a winch or block and tackle to the lifting lugs in the meter flanges as shown in Figure 2-1. The cable used must be able to support meter weights as tabulated on the outline dimension diagram. The cable must be long enough to form an angle of 45° or more between the lifting line and the meter pipe axis. **DO NOT** try to lift the meter by attaching cables to the electrode bosses.

**CAUTION:** Do not pass hoisting cable (rope, strap, etc) thru the flowmeter. Sharp objects or strains could tear or puncture the meter liner.
2.2 Meter Handling

The exposed liner material on the faces of both meter flanges are susceptible to damage if mishandled. Do not "walk" the meter on its ends. Always use the protective end covers when the meter is transported. These protective end covers can be removed for inspection and must be removed before mounting the meter in the pipeline.

**CAUTION**

Never allow any support for the Magnetic Flowmeter to bear upon the inner surface of the meter pipe section, as the liner may become damaged.

As shown in Figure 2-6, Bailey-Fischer & Porter has developed a liner protector/grounding ring for the 14 inch TEFLOW linened meters. These protector plates are turned on both the inside and outside edges. Turning the inside edge protects the leading edge of the meter liner from process abrasion. Turning the outside edge reduces the probability that a prying tool will be jammed against the liner during removal of the meter from the line.

**NOTE**

When liner protector plates/grounding rings are attached to the meter flanges, do not remove them; removal will cause the TEFLOW liner to have a tendency to curl away from the meter flange and can be easily damaged.

A TEFLOW liner of the flowmeter must be protected at all times for two reasons.

- the TEFLOW can be damaged by sharp objects or cut by undue pressure
- if the pressure on the flanges is relieved the TEFLOW will tend to curl away from the flange

Also included in the shipping crate is an installation kit, which consists of the following items:

a) Two gaskets,
b) One package of talc powder
c) Required seal fittings (depending on model).

The proper use of these items as described in the following text, and the proper employment of them during installation is necessary to maintain a valid instrument warranty.
NOTES:
1. ALL DIMENSIONS ARE IN INCHES. DIMENSIONS IN PARENTHESES ( ) ARE IN MILLIMETERS.
2. DIMENSIONS GUARANTEED ONLY IF THIS PRINT IS CERTIFIED.
3. ALL DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCE OF ±1/8 INCH (3mm) UNLESS OTHERWISE SPECIFIED.
4. FLANGE BOLT HOLES STRADDLE CENTERLINES.
5. METERING TUBE MUST BE COMPLETELY FILLED WITH LIQUID TO INSURE ACCURACY.
6. POWER & SIGNAL CONNECTION SUPPLIED WITH 1/2 NPT WATERTIGHT CONDUIT CONNECTION.
7. THIS DRAWING IS THIRD ANGLE PROJECTION AS SHOWN.

FIGURE 2-2. OUTLINE DIMENSIONS, 16" to 36" METER SIZE (NEMA 4 & ACCIDENTAL SUBMERSION OPTION)
2.3 Location

The Flowmeter is suitable for either indoor or outdoor installation. When selecting the installation site, consideration should be given to the ambient and process temperature limits, as stated in Section 1.3 Specifications. Consideration should be given to access for servicing the meter. The standard meter is rated NEMA 4, watertight, and will thus stand rain and hose down. If flooding is a problem, the optional IEC 529 IP67 flowmeter is well suited for occasional submersion.

The internally mounted Signal Converter includes RFI filters that provide excellent protection against radiated RFI/EMI. Therefore, stray electromagnetic and electrostatic fields, low power radio transmissions, etc. will have no effect upon the operating characteristics of the electronic package of the Magnetic Flowmeter system. It is recommended, however, that the meter not be installed within the immediate proximity of heavy induction equipment.

Outline dimensions of the Flowmeter are shown in Figure 2-2. Provide access for wiring interconnections and occasional servicing of the integrally mounted Signal Converter. At least 5 inches overhead clearance is required for cover removal. Outline dimensions of the optional Remote Mounted Signal Converter are given in the Instruction Bulletin supplied with the Signal Converter.

The installation site must be provided with a convenient source of power as specified for the Signal Converter. The power line should have a disconnect switch, and suitable fuse or circuit breaker as shown on the applicable interconnection diagram (provided in the Instruction Bulletin supplied with the Signal Converter). If the pipeline is not a good ground, a suitable earth ground must be made available in proximity to the installation site.

In-line meter maintenance is minimized as no operating adjustments are required in the Magnetic Flowmeter. Servicing accessibility is of secondary importance unless greasy sludges or liquids bearing insulating materials which tend to coat pipe walls are to be metered. However, sufficient access room should be allocated to facilitate electrical interconnection and permit field replacement of electrodes should the need arise.
2.4 Mounting

2.4.1 Orientation

The Bailey-Fischer & Porter Model 10DX3119 Magnetic Flowmeter may be installed in horizontal, vertical or sloping pipe runs. However, precautions must be taken to assure that the metering tube is filled at all times during measurement. A vertical installation, with the pipe line carrying fluid upwards assures a filled hydraulic line under low flow rate conditions and also minimizes wear on the meter lining by abrasive grit. Horizontal installations should be made with the meter in the lower section of a pipeline to assure a filled meter condition.

For horizontal or sloping installations the meter should be placed so that the electronic housing of the meter is on top. This will align the meter electrodes in a lateral plane. Positioning the meter in this way eliminates the possibility of entrained air acting as an electrode insulator. (Electrodes must not be on "top" when the meter is horizontally mounted.)

The Magnetic Flowmeter must be oriented in accordance with the direction of process flow, as indicated by the FLOW arrow on the meter data tag. For accurate metering, a straight pipe run equivalent to a minimum of three straight pipe diameters are required upstream of the meter, measured from the center of the meter. See Figure 2-6 for recommended piping diagrams.

If a throttling valve is required, it is strongly recommended that it be placed downstream of the meter. Upstream valves can create turbulence that result in undesirable air pockets and may affect the meter's accuracy or cause its output to be noisy. If greasy sludges or insulting materials which tend to coat pipe walls are to be metered, it is recommended that in addition to standard block valves and bypass line, a clean-out tee be installed to facilitate meter cleaning without removal or interruption of the process.

2.4.2 Pipe Connections

Standard meter piping connections are made by means of flanges that conform to ANSI standards (or any other standards specified) in outside diameter and bolt circle. The bearing surfaces of the flanges are insulated with the meter pipe liner. Figure 2-2 provides outline and mounting dimensions of the standard Series 10DX3119 Magnetic Flowmeter. Outline and mounting dimensions for a remote mounted Signal Converter are shown in the Instruction Bulletin supplied with the Signal Converter.

It is generally recommended that two pipe spools be installed, one on each end fitting of the Magnetic Flowmeter, while it is out of the pipeline in order to minimize the possibility of damage to the meter pipe and flange liner during mounting. Lined spool pieces and/or special length spools are available on special order. (Exception - see NOTE below. TEFLOM Lined Meters).

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEFLOM Lined Meters</td>
</tr>
<tr>
<td>Bailey-Fischer &amp; Porter has developed a protector plate for Teflon lined meters. This protector plate is available in 316 stainless steel, Hastelloy &quot;C&quot; and Alloy 20 materials for 14&quot; size Magnetic Flowmeters (see Table 2-1 for part numbers). When specified at time-of-purchase, two protector plates (one on each flange face) are factory installed and serve to prevent damage to the liner during either shipment, installation or removal of the meter from the process line.</td>
</tr>
</tbody>
</table>
A pair of the proper gaskets to suit the particular lining option of the meter supplied is included within the installation kit which accompanies the Magnetic Flowmeter. Before connections are made, the bearing surfaces of neoprene, VITON or polyurethane-lined meter flanges, their gaskets and adjacent pipeline flanges must be thoroughly dusted with the talc gasket powder provided with the installation kit. This is done to prevent possible damage to the meter lining or gaskets, should the meter be removed from the line.

The standard coarse thread flange bolts supplied by the user must be well lubricated and tightened in even increments around the flange surface. Bolt torque should be limited to that which will produce a positive seal for the application.
2.5 Grounding Procedure

2.5.1 General

Satisfactory operation of Bailey-Fischer & Porter Magnetic Flowmeter Systems requires that careful attention be paid to proper grounding techniques. A good ground is one that is in contact with the earth over a large conductive area. An excellent example of this is a cold water pipe which is buried in the earth and travels many miles in its distribution system. A great number of pipe branches form a large conductive area of contact which provides a low resistance connection to earth. A hot water or steam pipe must first return to a boiler before it becomes a cold water pipe, and therefore, its greater length of ungrounded path offers a less desirable ground bus. A metallic structural member of a building, such as a supporting "I" beam, may be a good earth ground, but it is a second choice to a cold water pipe.

Meter grounding requirements are really a combination of standard grounding methods and a bonding of the meter body to the process liquid. The most important of these is the process bonding, which is nothing more than ensuring that the meter body is in contact with the process liquid at both ends of the meter body. Basically, the bonding procedure places an electrical short circuit across the meter, thereby routing any stray current around the liquid in the meter (rather than through it).

From the point of view of grounding there are two basic types of piping systems:

- electrically conductive pipeline: the process liquid comes in contact with conductive pipe. This piping requires that each meter flange be connected with a bonding wire to the adjacent pipeline flange as shown in Figure 2-7. The grounding procedure to use with conductive pipeline is described in 2.5.2.

- non-conductive or electrically insulated pipeline: the pipeline may be made of an electrically non-conductive material (plastic pipe, bituminous-coated cast iron pipe, concrete, etc.) or lined with a non-conductive material (rubber, TEFLOM, etc). These non-conductive pipelines require the use of metal grounding rings or grounding probes (see Figures 2-8 through 2-10) to bond the process liquid to ground. The grounding procedure to use with a non-conductive pipeline is described in 2.5.3.

Proper grounding of the Magnetic Flowmeter is required for optimum system performance.

2.5.2 Conductive Pipeline

If the flowmeter is included as part of a conductive pipeline that is not electrically insulated from the liquid to be metered, the following grounding procedure should be followed. Refer to Figure 2-7 to supplement the text.

1) Drill and tap both pipeline flanges adjacent to the bonding connections on the flowmeter. The lugs on the bonding cables are sized for metric M6 fasteners (a 1/4" hex head bolt).
2) Obtain a bright metal surface around the edges of the tapped hole with a file or burnishing tool.
3) Attach the bonding wire and another length of ground wire to the flanges as shown. Use internal tooth lockwashers as shown in the detail. The wire to the good external ground should be #12 AWG, or heavier, copper wire.
### FIGURE 2-4. GROUNDING PROCEDURE; NON-INSULATED PIPELINE

<table>
<thead>
<tr>
<th>FLANGE RATING (ANSI)</th>
<th>304 SS</th>
<th>316 SS</th>
<th>HAST. C</th>
<th>ALLOY 20</th>
<th>254 SMO</th>
<th>254 SMO</th>
</tr>
</thead>
<tbody>
<tr>
<td>RING MATERIAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GASKET MATERIAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NEOPRENE GASKET</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLANGE SIZE (Inches)</td>
<td>BASIC PART NUMBER</td>
<td>PART NUMBER/SUFFIX*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>GROUNDING RING</td>
<td>PROTECTOR PLATE/GROUNDING RING</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>614B</td>
<td>452U12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>644B</td>
<td>452U12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>009U09</td>
<td>452U26</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>009U10</td>
<td>452U38</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>644B</td>
<td>021U14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>009U11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>009U12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>644B</td>
<td>021U15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>009U13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>009U14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>644B</td>
<td>021U16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>009U15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>009U16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>644B</td>
<td>021U17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>009U17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>009U18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>644B</td>
<td>021U17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>009U19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>644B</td>
<td>021U17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>009U20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Add suffix to basic part number to form the complete part number, e.g., 644B009U11 for a 16" grounding ring with a NEOPRENE gasket

**TABLE 2-1. PROTECTOR PLATE AND GROUNDING RING PART NUMBERS**
FIGURE 2-5. GROUNDING PROCEDURE; INSULATED PIPELINE
FIGURE 2-6. GROUNDING RINGS and GASKETS
2.5.3 Non-Conductive or Electrically Insulated Pipeline

If the flowmeter is included as part of a non-conductive or liquid insulated pipeline (such as totally plastic pipe, ceramic lined iron pipe, or cast pipe with internal bitumastic coating), the following grounding procedures apply. Refer to Figure 2-8 to supplement the following text.

1) Usually, for this service, the meter has been specified to have liner protector/grounding rings. If not, obtain a pair of grounding rings and attach them to the meter as shown in Figure 2-8. No gasket is required between the grounding ring and the meter since it mates with the liner. However, a gasket is required between the grounding ring and the process flange of the pipeline.

2) Attach the bonding wire and another length of ground wire to the tab of the grounding ring. Use internal tooth lockwashers and hex head nut and bolts for attachment as shown in the detail on Figure 2-8. The wire to the good ground should be #12 AWG, or heavier, copper wire.

2.5.4 Grounding Probes (2 required)

The grounding probe shown in Figure 2-10 can be substituted for grounding rings in many applications when non-conductive or electrically insulated pipe is used. The pipeline must be drilled and tapped as shown in Figure 2-10, with the grounding probes installed adjacent to each of the pipeline mounting flanges. Connect a grounding strap or wire from each probe to the meter flanges.

![Diagram of grounding probe](SI-6706-A)

**FIGURE 2-7. GROUNDING PROBE (OPTIONAL)**
2.6 Electrical Interconnection

2.6.1 General

The Series 10DX3119 Magnetic Flowmeter may be furnished with either an integrally or remotely mounted (optional) Signal Converter. Interconnection wiring is arranged differently for the two systems. Interconnection details are provided in the Instruction Bulletin provided with the Signal Converter.

WARNING

ELECTRICAL SHOCK HAZARD. Equipment powered by AC line voltage constitutes a potential electric shock hazard to the user. Make certain that the system power input leads are disconnected from the operating branch circuit before attempting electrical interconnections.

Regardless of the interconnection procedure used, the grounding procedures given in Section 2.5 must be followed.

2.7 Conduit Seal and Pressure Relief

In accordance with the National Electrical Code (NEC) ANSI/NFPA 70, Article 501-5(f)(3), the flowmeters include a conduit entry seal and pressure relief to prevent the process fluid from entering the electrical conduit system. This safety feature is available for NPT fittings only and considers the remote possibility of a primary seal failure, in which case, the secondary seal will prevent the process from entering the electrical conduit system. The secondary seal consists of the following:

- Integral Converter - Feed-through’s between the electronics housing and field wiring (customer connection) junction box.

- Remote Primary - Conduit entry cable seal on meter customer connection box.

It is the user’s responsibility to properly install the conduit entry cable seal fitting supplied with the signal cable provided with the remote mounted signal converter. This will ensure proper performance of this safety feature. See Figure 2-8.

A pressure relief is provided in the electronics housing for the integrally mounted signal converter and in the customer connection box on the remote mounted Flowmeter. In both housings, the pressure relief is located in the center of the cover joint on the side opposite from the conduit connection. If the primary seal should fail, the pressure relief will vent the process preventing an over pressurization and potentially dangerous failure of the electronics housing.

It is the user’s responsibility to be aware of this safety feature and to consider the unlikely event of its functioning. Based on knowledge of the process and meter application, the user should consider the installation orientation of the meter and possible use of deflectors to safely direct the vented process.
3.0 OPERATION and START-UP

The Bailey-Fischer & Porter Series 10DX3119 Magnetic Flowmeter (which includes the integral or remote Signal Converter) is precision calibrated at the factory for the values stated on the instrument tag. If specific values were not specified, the meter is calibrated at some nominal maximum flow rate and for a 4-20 mA current output span. In either case, the calibration data is noted on the instrument data tag as shown in Figure 3-1. The basic primary mounted electronic components are identified in Figure 3-2.

There are no operating controls that require field adjustment unless the full scale range setting was not specified. If a change in the full scale range setting is required, refer to the Instruction Bulletin supplied with the Signal Converter. If no change is required, the equipment is ready for operation as received.

Prior to initial system start up, verify that the meter is properly installed; check flow direction, wiring interconnection and grounding as discussed in Section 2.0 Installation. Particular attention should be paid to the meter grounding procedures; improper grounding may result in unsatisfactory performance.

Start flow through the process piping system that includes the meter. Allow a nominal flow through the pipeline for several minutes to purge entrapped air. The pipeline must be full for accurate flow measurement.

Apply the ac power for the 10DX3119 Magnetic Flowmeter by closing the external switch or circuit breaker; there are no switches inside of the equipment. Also energize any auxiliary equipment associated with the flow metering system, such as remote analog recorders, controllers or rate indicators.

Initiate process flow through the pipeline. Flow measurement and concurrent output signal transmission will commence with flow through the meter. Information concerning operation of the Signal Converter is provided in the Instruction Bulletin supplied with the Converter.

FIGURE 3-1. TYPICAL INSTRUMENT TAG
FIGURE 3-2. PRIMARY MOUNTED PC ASSEMBLIES

* DELETE WHEN SIGNAL CONVERTER IS INTEGRALLY MOUNTED.

(2) 1/2" NPT CONDUIT CONNECTION
4.0 FUNCTIONAL DESCRIPTION

The Magnetic Flowmeter body houses two signal electrodes and the flux producing magnet coils, as shown schematically in Figure 4-1. Normally, the NEMA 4 and accidental submergence type meters have their primary interconnection wiring terminated at a printed circuit assembly located in the base of the meter housing.

The primary provides two output signals to the associated Signal Converter:
- an electrode signal that contains the flow rate information
- the reference signal which is proportional to the magnet excitation current
  (Theoretically, this reference signal is proportional to the flux density in the metering section.)

The reference voltage is derived across a precision "constant meter factor" resistance network that is connected in series with the magnet coils. Changes in magnet drive voltage, which cause a variation of flow signal, will simultaneously cause a proportional variation of the reference voltage. The circuitry will provide an exact ratio and thereby provide immunity to power supply variation. The magnet coil drive circuitry is contained in the Signal Converter. A detailed discussion of primary meter operation is provided in 5.0 Circuit Description.

4.1 Basic Operating Principle

4.1.1 Signal Voltage Generation

The operating principle of the Bailey-Fischer & Porter Model 10DX3119 Magnetic Flowmeter is based upon Faraday's Law of Induction which states that the voltage induced across any conductor as it moves at right angles through a magnetic field will be proportional to the velocity of that conductor. This principle finds common application in direct and alternating current generators. Essentially, the Bailey-Fischer & Porter Magnetic Flowmeter constitutes a modified form of an AC generator.

Figure 4-1 graphically illustrates the basic operating principle. A magnetic field, "B", being generated in a plane which is perpendicular to the axis of the meter pipe. A disk of the metered liquid can be considered as a conductor. The transverse length "D" is equal to the meter pipe diameter. Since the velocity "V" of the liquid disk is directed along the axis of the meter pipe, a voltage, signal "Es", will be induced within this liquid which is mutually perpendicular to the direction of the liquid velocity and the flux linkages of the magnetic field; i.e., in the axial direction of the meter electrodes.

FIGURE 4-1. BASIC OPERATING PRINCIPLE
This electrode voltage is the summation of all incremental voltages developed within each liquid particle that passes under the influence of the magnetic field.

This may be expressed mathematically as:

(Equation #1)

\[ E_s = \frac{1}{\alpha} \frac{B D V}{A} \]

where:

- \( E_s \) = induced electrode voltage
- \( B \) = magnetic field strength
- \( D \) = meter pipe diameter
- \( \alpha \) = dimensionless constant
- \( V \) = liquid velocity

Thus, the metered liquid constitutes a continuous series of conductive liquid disks moving through a magnetic field. The more rapid the rate of liquid flow, the greater the instantaneous value of signal voltage as monitored at the meter electrodes.

### 4.1.2 Magnet Coil Drive Circuits

In many conventional Magnetic Flowmeters the integral magnet coils are driven directly by the customer’s 50/60 Hz power service. Notably, however, the design of the Bailey-Fischer & Porter Series 10DX3119 Magnetic Flowmeter uses magnet drive circuits which are alternately energized bi-directionally at a low frequency rate as commanded by the associated Converter/Driver assembly.

### 4.1.3 Volumetric Flow Rate Measurement

The Bailey-Fischer & Porter Magnetic Flowmeter is a volumetric flow rate measuring instrument. This can be shown by substituting the physical equivalent of liquid velocity into equation #1 as follows:

(Equation #2)

\[ V = \frac{Q}{A} = \frac{4Q}{\pi D^2} \]

Substituting for \( V \) in equation #1

\[ E_s = \frac{1}{\alpha} \frac{B D \cdot 4Q}{\pi D^2} \]

and solving for \( Q \):

\[ Q = \frac{\pi D^2}{4} \cdot \frac{E_s}{B} \]

Since \( B = \beta E_r \)

and since \( \alpha, D \) and \( \beta \) are constant:
(Equation #3)

\[ Q = \gamma \frac{E_s}{E_r} \]

where:

- \( Q \) = volumetric flow rate
- \( A \) = cross-sectional area
- \( D \) = pipe section diameter
- \( E_s \) = induced signal voltage
- \( E_r \) = reference voltage
- \( B \) = magnetic flux density
- \( \alpha \) = dimensionless constant
- \( \beta \) \& \( \gamma \) = dimensional constant
- \( V \) = liquid velocity

Therefore, volumetric flow rate is directly proportional to the induced signal voltage as measured by the Bailey-Fischer & Porter Magnetic Flowmeter.

### 4.2 Operating Characteristics

#### 4.2.1 Liquid Variables

##### 4.2.1.1 Liquid Conductivity

The Magnetic Flowmeter requires a liquid conductivity of 5 microsiemens per centimeter or higher for operation. This minimum liquid conductivity requirement is not affected by the length of the signal interconnection cable when remote mounting of the Signal Converter is required, as long as the Bailey-Fischer & Porter supplied interconnection cable (with driven shields) is utilized. The nominal maximum transmission distance is limited to (30 meters) 100 feet; however standard cable length is 30 feet (9 m) unless otherwise specified.

The conductivity of a given liquid, \( \sigma \), may be determined experimentally under a filled meter condition, as follows:

1) Remove the Converter housing cover. Disconnect the electrode signal interconnection leads from terminals "1" and "2" of the Signal Converter. (These leads should be identified so that they will be properly reconnected.)

2) Measure the resistance between signal leads "1" and "2" with an AC ohmmeter.

**CAUTION**

Do not use a DC ohmmeter for this measurement as polarization effects will produce completely erroneous data.
The conductivity of the process liquid (in microsiemens/cm) may be determined from the electrode AC resistance measurement (in megohms) by substitution of values in the following equation.

\[
\sigma = \frac{1}{(R_{AC} - 0.072) \times \text{Electrode Dia, in cm}}
\]

where,

0.072 is the electrode barrier resistance in megohms; i.e., 36 k x 2/10^6

and,

typical electrode diameter is 0.375" (0.952 cm)

For example, assuming the measured AC electrode resistance (full pipe and zero flow) is 192,000 ohms and electrode diameter is 0.952 cm, then

\[
\sigma = \frac{1}{(0.192 - 0.072) \times 0.952} = 8.75 \mu\text{s/cm}
\]

This is above the threshold for specified measurement accuracy for the particular liquid, meter size and Signal Converter combination. Liquid conductivities at the operating temperature may also be determined from standard reference works for many pure liquids. Bailey-Fischer & Porter Field Engineers are equipped to determine the conductivities of special liquids at the user's site as an engineering service.

4.2.1.2 Liquid Temperature

Having established the minimum liquid conductivity requirements for a given application, any liquid which exhibits equal or higher conductivity may be metered without concern for any system compensating adjustments. However, due regard for the effect of the liquid conductivity versus temperature should be considered.

Most liquids exhibit a positive temperature coefficient of conductivity. It is possible for certain marginal liquids to become sufficiently non-conductive at lower temperatures so as to hamper accurate metering; whereas, the same liquid at higher or normal environmental temperatures may be metered with optimum results. The possibility of an adverse temperature conductivity characteristic should be investigated before attempting to meter such a liquid. Liquid or ambient temperatures are also limited by the meter materials specification.

Other normal effects of temperature, such as influence upon liquid viscosity and density, the size of the metering area, and the flux density of the magnetic field, have negligible or no effect upon metering accuracy.
4.2.1.3 Other Liquid Variables

Other liquid variables such as viscosity, density and liquid pressure have no direct influence on metering accuracy. Liquid density has no effect on volumetric flow rate since only the area of the meter pipe and liquid velocity are required to determine the rate of flow. Viscosity and metering pressure are restricted to physical limitations alone, such as the leakage pressure of the meter pipe flange connections.

4.2.2 Metering Characteristics

The metering pipe must be completely filled at all times for accurate results. Where there is possibility of operation with a partially filled horizontal pipeline, it is recommended that the Magnetic Flowmeter be installed in a vertical section of that pipeline such that liquid flow moves upward. A vertical installation also offers the advantage of an even distribution of liner wear in the event that solid abrasives are being carried along in the liquid stream.

The Bailey-Fischer & Porter Magnetic Flowmeter will measure the total amount of material passing in the liquid stream. The meter will not, for instance, differentiate between the amount of liquid and the amount of entrained gases. Also, in the case of a slurry, it will not differentiate the amount of liquid from solids. If the liquid to mixant ratio is of importance to process control, then separate measurements of the concentration of the desired medium must be made and appropriate correction factors must be applied to the Magnetic Flowmeter output.

In applications involving variable quantities of uniformly dispersed, non-conductive mixing agents, it must be ascertained that the higher concentrations of mixant will not drive the average conductivity of the liquid mixture below the minimum conductivity level for the given installation.
5.0 CIRCUIT DESCRIPTION

5.1 Primary Signals

The Magnetic Flowmeter body houses two signal electrodes and the flux producing magnet coils, as shown schematically in Figures 5-1 & 5-2. All primary interconnection wiring is terminated at the CMF/ZERO pc board located in the base of the meter housing.

The primary provides two output signals to the associated Signal Converter; one, an electrode signal that contains the flow rate information, and two, the reference signal which is proportional to the magnet excitation current (theoretically, this reference signal is proportional to the flux density in the metering section). The reference voltage is derived across a precision "constant meter factor" resistance network that is connected in series with the magnet coils. Changes in magnet drive voltage, which cause a variation of flow signal, will simultaneously cause a proportional variation of the reference voltage. The circuitry will provide an exact ratio and thereby provide immunity to power supply variation. The magnet coil drive circuitry is contained in the Signal Converter.

For meters larger than 24 inches in diameter, the reference resistance network is contained within the 50SD1000 signal converter. In this case, the equivalent circuitry in the primary is disabled.

The (gated) magnet driver operates at a frequency that permits magnetic flux in the primary to reach a steady state level during the last 25% of each half period of magnet excitation. By using sampling techniques, the flow (differential mode) signal is measured only during the intervals that magnetic flux is constant \( \frac{d\phi}{dt} = 0 \).

Therefore, zero instability due to changing flux is eliminated by use of the MAG-X design concept (sampling technique), providing a meter totally free of zero drift. A thorough discussion of Signal Converter operation is provided in the Instruction Bulletin supplied with the particular Signal Converter.

5.2 Constant Meter Factor (CMF) PC Assembly

The CMF Assembly provides several functions. These include:

1. Establishes interconnections between the primary internal wiring and the secondary.

2. Permits adjustment of meter calibration factors to a fixed value for each nominal size primary (see Note).

3. Permits adjustment of primary zero.

4. Establishes proper wiring connections for integrally or remotely mounted Converters.
FIGURE 5-1. SCHEMATIC for PRIMARY WIRING WHEN USING REMOTE CONVERTER
NOTE - CMF EXCEPTION

Certain combinations of meter size and Signal Converter cannot supply sufficient magnet current to achieve the CAL FACTOR given in Table 1-1. The user should verify that the CAL FACTOR given on the meter data tag (see Figure 3-1) is being used in the associated Signal Converter, especially as this factor can be different than the standardized value given in Table 1-1.

A circuit schematic of the primary CMF board is shown in Figure 5-2. The meter calibration factor is established by a voltage division off the R5 current sensing resistor, first by a coarse network consisting of R6 through R12, and then by a fine adjustment via potentiometer R14. These values may only be re-established by noting the open positions of shunt S1 and measuring (out of circuit) the values of R14 (each end to wiper) and R15.

System zero is established with the aid of transformer T1, through whose primary winding the magnet coil current flows. The center tap connection of the respective secondary windings of T1 are connected in series with each electrode signal.

One secondary winding removes from electrode signal 2 the voltage impulse which occurs as a result of coil voltage reversal (see waveform). This signal is factory adjusted to a minimum, using an oscilloscope connected to the input amplifying system of the Converter. The adjustment is very sensitive and thus extreme care must be exercised when setting potentiometer R3.

Electrode circuit 1 receives a signal from the other secondary winding, and is integrated via capacitor C2 and potentiometer R2 so as to produce a square wave. This adjustment removes residual offset not corrected by the previous adjustment.

Connections to the Converter are established as follows. For remotely mounted Converters, the magnet coils are driven via the connection of J3 to P3 (see inset in Figure 5-1), while the 686B630 Adapter Board routes the reference and electrode signals to the proper positions of J1, J2, and their corresponding RFI filters. Typical wiring is shown in Figure 5-1.
FIGURE 5-2. SCHEMATIC for CMF BOARD
6.0 MAINTENANCE

6.1 General

Except for an occasional performance verification check, there is no required routine maintenance for the Model 10DX3119 Magnetic Flowmeter. As the meter has no moving parts, the necessity for specifying or requiring replacement parts is limited. For example, electrodes can be replaced in neoprene, polyurethane or VITON-lined meters without removal of the meter from the pipeline (replacement of electrodes in TEFLON lined meters must be performed by the factory).

The associated electronic Signal Converter can be replaced as a complete assembly, as described in the Instruction Bulletin provided with the particular Signal Converter. Bailey-Fischer & Porter offers a Repair/Exchange Program to facilitate replacement of a defective Converter assembly. If the equipment is beyond the warranty limit, under this program a fixed price will be charged to the account of Buyer for replacement of defective equipment, with appropriate credit issued when the repairable unit is received by Bailey-Fischer & Porter (charges prepaid).

Special service or installation problems should be referred to the manufacturer's Service Department or to the local Bailey-Fischer & Porter field office with complete information as to the nature of the difficulty. Instructions covering corrective measures will be furnished promptly. When communicating with Bailey-Fischer & Porter in regard to replacement of a defective assembly, it is important to refer to the complete instrument serial number and model number to assure that the correct replacement will be supplied. This information is provided on the manufacturing specification sheet supplied with the Magnetic Flowmeter, and on the instrument data tag.

6.2 System Troubleshooting

In the event faulty operation of the Magnetic Flowmeter is evident, the following procedure can be used as a guide to isolate the malfunctioning device to either the primary meter or the Signal Converter. A standard V-O-M type multimeter and an oscilloscope are suitable for making most of the test measurements.

To supplement the following discussion refer to:

Section 5.0 Circuit Description
Figure 5-1 Primary Wiring, Remote Converter
Figure 5-2 Schematic Diagram for Primary CMF Board
Signal Converter Assembly ... refer to applicable Instruction Bulletin

WARNING

ELECTRICAL SHOCK HAZARD. Equipment powered by an AC line voltage presents a potential electric shock hazard. Servicing of the Magnetic Flowmeter or Signal Converter should only be attempted by a qualified electronics technician.
If improper meter operation is suspected, proceed as outlined below:

1. Remove access covers from customer junction box and electronics compartment of primary. Remove access cover from remote Signal Converter housing, if applicable. Inspect for evidence of condensate in junction box. If condensate is present, de-energize system power source. Conduit seals must be used at cable entrances to prevent entry of condensate. Allow interior of junction box to dry completely before restoring system power. If condensation is present on the surface of either PC board, the board(s) may have sustained permanent damage (even after the condensation has dried) and should be replaced.

2. The Signal Converter available for the 10DX3119 Magnetic Flowmeter is a remotely mounted Microprocessor-Based 50XM1000 Signal Converter. The user should refer to the instruction bulletin supplied with the Signal Converter for system troubleshooting procedures. A static performance test for the primary mounted components is discussed in section 6.3, below.

3. Possible causes of erroneous flow rate indication are:
   - incorrect grounding
   - excessive noise due to a heavy slurry process or a non-homogeneous process
   - loose or intermittent wiring
   - non-full or empty meter pipe
   - excess air entrained in process fluid

6.3 Static Test

If improper operation of the Magnetic Flowmeter is suspected, the following resistance measurements can be made to establish whether an electrical malfunction has occurred. A standard V-O-M type Multimeter is suitable for making the resistance checks. These measurements can be made at the Primary Base Board.

**WARNING**

ELECTRICAL SHOCK HAZARD. Equipment that operates from AC line voltage constitutes a potential electric shock hazard to the user. Make certain that the system power is disconnected before making the following ohmmeter checks.

6.3.1 Magnet Coil Check

There are two magnet coils in the meter that are connected in a series arrangement. The respective coil leads are brought up to lugs "M1 and CT1" and "CT and MR" on the CMF board in the meter electronics base. (Note that terminals CT and CT1 are internally connected via printed circuit path.) Figure 5-1 shows the actual connection method.

Before making resistance measurements, verify that the system power service has been de-energized. Remove the electronics housing cover to obtain access to the CMF board.
1) Set the ohmmeter to its lowest range; e.g., R x 1.

2) Connect the Ohmmeter test leads to terminal lugs M1 and CT1 on the CMF board. The value displayed should correspond to 1/2 of the value (±20%) indicated in Table 6-1.

3) Connect the Ohmmeter test leads to terminal lugs CT and MR. The value displayed should correspond to that obtained in Step 2 and 1/2 of the value indicated in Table 6-1 within ±20%.

If proper coil resistance is measured, it can be assumed that the magnet coils are functional. If the measurement indicates that either or both coils are "open" (infinite resistance), or shorted (zero resistance), the Magnetic Flowmeter must be replaced.

4) Carefully unsolder the four coil wires from the terminal lugs on the CMF pc board. Identify each wire to enable its proper reconnection.

5) Set the Ohmmeter to its highest range (R x 10,000) and measure in turn from wire lead M1 or MR to the meter body (case ground). The resistance readings should be infinite. If this measurement is less than 100 K ohms, the meter is defective and must be replaced.

When all measurements appear normal, the coil wires can be reconnected and the meter can be returned to service. Replace meter housing cover.

### TABLE 6-1. METER COIL RESISTANCE

<table>
<thead>
<tr>
<th>METER SIZE</th>
<th>COIL RESISTANCE (Nominal, ohms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>inches</td>
<td>(mm)</td>
</tr>
<tr>
<td>14</td>
<td>(350)</td>
</tr>
<tr>
<td>16</td>
<td>(400)</td>
</tr>
<tr>
<td>18</td>
<td>(450)</td>
</tr>
<tr>
<td>20</td>
<td>(500)</td>
</tr>
<tr>
<td>24</td>
<td>(600)</td>
</tr>
<tr>
<td>28</td>
<td>(700)</td>
</tr>
<tr>
<td>30</td>
<td>(750)</td>
</tr>
<tr>
<td>32</td>
<td>(800)</td>
</tr>
<tr>
<td>36</td>
<td>(900)</td>
</tr>
<tr>
<td>40</td>
<td>(1000)</td>
</tr>
<tr>
<td>42</td>
<td>(1100)</td>
</tr>
<tr>
<td>48</td>
<td>(1200)</td>
</tr>
<tr>
<td>54</td>
<td>(1400)</td>
</tr>
<tr>
<td>60</td>
<td>(1500)</td>
</tr>
<tr>
<td>64</td>
<td>(1600)</td>
</tr>
<tr>
<td>66</td>
<td>(1650)</td>
</tr>
<tr>
<td>72</td>
<td>(1800)</td>
</tr>
<tr>
<td>78</td>
<td>(2000)</td>
</tr>
</tbody>
</table>
6.3.2 Electrode Check

The electrode check is essentially a resistance measurement that can be made to establish that a short (or high resistance leakage path) does not exist between one, or both, electrodes and the meter body. To perform this test, the meter must be removed from the pipeline and the meter liner wiped dry. When the meter liner has been thoroughly dried, proceed as follows:

1) Disconnect and identify the electrode signal leads, 1 and 2, from the terminal board in the remote Signal Converter (or from the terminal board in the base of the meter housing). Electrode wiring is shown in Figure 5-1.

2) Place Ohmmeter on highest available range (for example: R x 10,000).

3) Connect the Ohmmeter "minus" lead to the meter ground stud and the "plus" lead to electrode 1 or terminal "1A", as applicable. This reading should be infinite. If any resistance can be measured, the meter is defective and must be replaced.

4) Check the other electrode by connecting the Ohmmeter "plus" lead to line 2 or terminal "2A". This reading must also be infinite. If any resistance can be measured, the meter is defective and must be replaced.

5) If measurement of both electrodes indicate an infinite resistance reading, the meter may then be returned to on-stream operation. In the remote Signal Converter, lines 1 and 2 from the respective electrodes must be reconnected to terminals 1 and 2 of the terminal board. Do not interchange these process signal connections.

6.3.3 Primary CMF Board
(Ref: Schematic Diagram of CMF Board, Figure 5-2)

In meters supplied for NEMA 4 and accidental submergence applications, the Primary Board is located in the base of the electronics housing as shown in Figure 6-1. This pc board includes the constant meter factor/size network (CMF/S). The CMF/S network is utilized to standardize the particular flowmeter, i.e., provide a meter CAL FACTOR that will be the same for all meters of the same size. However, in some cases, the particular combination of meter size and Signal Converter type cannot supply sufficient magnet current to produce the standardized CAL FACTOR. In these cases, the user must obtain the actual CAL FACTOR from the data provided on the instrument tag; using the CAL FACTOR given in Table 1-1 of Section 1.3 Specifications could result in erroneous flow measurement. Larger meters (larger than 24 inches in diameter) require using a 50SD1000 Universal Converter/Driver to provide the greater than 500mA coil excitation required. This also does not allow the selection of a standardized CAL FACTOR.

Replacement of the Primary CMF Board in the field is not recommended. Should board replacement become necessary, the following steps must be followed:

1. De-energize the Signal Converter power source (this will remove power from the primary). Note that the following procedure is applicable only for CMF/S assembly 686B623U01, shown in Figure 6-1.

2. Before removing the CMF Board, it will be necessary to unsolder the 6 leads from the RFI capacitors (see Figure 5-1), plus the 3 leads from the meter electrodes, and the four wires from the magnet coils. Use care to identify all leads to ensure proper reconnection.
3. When primary connections to the CMF Board have been disconnected, remove the 3 #4-40 board mounting screws. The CMF Board can now be removed from the meter base.

The following procedure is required to maintain the accuracy of the "standardized" meter Cal Factor.

4. Potentiometer R14 and resistor R15 must be carefully removed from the old circuit assembly (note the orientation of potentiometer R14). If they are in usable condition, place them into the new assembly (observe R14 orientation). If they cannot be used, then measure and record the resistance of the following to an accuracy of 0.1%:

\[ R15, \text{ R14 pin 1 - 2, R14 pin 3 - 2 ("2" is the wiper)} \]

Calculate the following:

\[ K = \frac{(R15 + \text{ R14 pin 1 - 2})}{(R15 + \text{ R14 pin 1 - 2 + R14 pin 3 - 2})} \]

5. Remove R14 and R15 from the replacement assembly. Measure R15 and adjust R14 to obtain the same "K" as calculated in step 4. Place R14 and R15 back into the circuit board, noting the proper orientation of R14.

6. Note which positions of shunt S1 were opened in the old CMF Board. Open the identical shunt positions of S1 in the replacement board.

7. Replace the CMF Board in the meter base and restore interconnection wiring.

**IMPORTANT NOTE**

If the Signal Converter has been removed from the housing, use care when reconnecting the Converter interface cable to ensure that plug P1 is in proper alignment with the pins of receptacle J1. (J1 is located on the base board in either the primary or the remote Converter housing, as the case may be.) If these connectors do not mate correctly, the Signal Converter will be inoperable and could be damaged when power is applied.

8. The metering tube must be full, but with zero flow and the system powered. An oscilloscope must be connected to TP103 (TP101 com.) of the XM Converter. R3 of the CMF assembly must be adjusted for a peak to peak waveform value of less than 0.2 volts (XM).

9. After R3 has been adjusted, R2 is to be set so that the Converter output is zero. For the XM Converter, the Converter must be placed in the bidirectional mode, low flow cutoff set to zero, and R2 set so that indication on the rate display toggles between forward and reverse.

10. Following completion of steps 4 through 9, the system may now be returned to normal operation.
6.4 Electrode Disassembly

Standard flush and bullet-nosed electrodes may be replaced in neoprene, polyurethane and VITON-lined Model 10DX3119 Magnetic Flowmeters without removal of the meter from the pipeline. Replacement of the electrodes in TEFLO lined meters is a factory procedure only and should not be attempted in the field. The seated electrodes may be inspected in all meters.

Unless specified otherwise at the time of purchase, neoprene, polyurethane and VITON-lined meters were equipped with stainless steel electrodes. A variety of electrode materials to suit a wide range of fluid conditions is given in the applicable Model Number Breakdown.

Perform the following procedure for seated electrode inspection or electrode replacement:

6.4.1 Inspection (See Figure 7-1)

1) Empty the meter pipe.

| WARNING |
| Do not attempt electrode inspection or replacement with a filled or pressurized pipeline. Personal injury may result. |

2) Unscrew and remove the 2-inch pipe plug from the 2 inch half-coupling.

3) Remove the three #10-32 x 1/2" fillister head cap screws which clamp the electrode cover on the assembly.

4) Remove the electrode cover.

5) For neoprene, polyurethane and VITON-lined meters, remove the insulator. The seated electrode and wiring are open for inspection. For inspection of TEFLO lined meters, follow steps 1) & 2) only since the electrode cavity is embedded in silicone rubber and is not accessible.

6.4.2 Electrode Replacement (All Except TEFLO lined Meters)

| CAUTION |
| For TEFLO lined meters, replacement of the electrodes must not be attempted in the field. The meter must be returned to the factory for electrode replacement. |

1) Pull the electrode from its seat in the side of the meter spool and liner. In some cases this is facilitated by partially running one of the removed #10-32 cap screws that held the electrode cover in place into the tapped hole in the electrode head and using this as a grip for electrode withdrawal. In polyurethane lined meters an 'O' ring on the underside of the electrode head also must be withdrawn.
CAUTION
Exercise extreme care when withdrawing electrode from its seat so that little or no tension is exerted on the connecting electrode wire. If this wire should break within the meter housing, the meter is not repairable.

2) Loosen the #4-40 x 1/8" hex socket set screw in the head of the electrode. Withdraw the electrode wire with its sleeve tip from its electrical connection seat in the side of the electrode head.

3) Insert and reseat replacement electrode. For polyurethane lined meters, be certain the new 'O' ring which accompanies the new electrode is seated in the groove under the head of the electrode.

4) Reassemble by reversing the procedure given 6.4.1, steps #2) through 5). Use pipe dope on the threads of the 2-inch pipe plug when replacing it on the 2 inch half-coupling.

6.5 Electronic Parts Replacement

Any circuit malfunction which cannot be quickly identified by use of conventional voltage and resistance analysis technique should be brought to the attention of Bailey-Fischer & Porter Service Department, with complete details as to the nature of the malfunction. Recommended corrective measures and/or parts replacement, if indicated, will be transmitted promptly. Please reference the complete instrument model number and serial number in all communications or spare parts orders for the respective equipment.

The Basic Meter Parts List (Section 7.0) is cross referenced by symbol number to Figure 6-1, Exploded View. A Separate Parts List for the electrode assembly is provided with Figure 7-1.
FIGURE 6-1. EXPLODED VIEW, BASIC FLOWMETER PARTS
7.0 PARTS LIST

BASIC METER PARTS
(REF: Figure 6-1)

<table>
<thead>
<tr>
<th>KEY</th>
<th>QTY</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Cover</td>
<td>379D358U01</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>Screw, Pan Hd., #6-32 x 2-1/4 in.</td>
<td>066H228T10</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>Lockwasher, Internal Tooth</td>
<td>085F008V11</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>Signal Converter Assembly</td>
<td>See Note 2</td>
</tr>
<tr>
<td>5a</td>
<td>1</td>
<td>CMF/S Primary PC Board</td>
<td>688B623U01</td>
</tr>
<tr>
<td>5b</td>
<td>1</td>
<td>Adapter Board (for Remote Converter)</td>
<td>688B630U01</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>Screw, Flat Hd., 1/4-20 x 5/8 in.</td>
<td>032B010T10</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>Lockwasher, External Tooth</td>
<td>085H416T10</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>O-Ring, Converter Cover</td>
<td>101A834U01</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>Base, Converter</td>
<td>610B242U07</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>Ring, Threaded</td>
<td>376B079S18</td>
</tr>
<tr>
<td>11</td>
<td>2</td>
<td>Nut, Hex</td>
<td>397A088S14</td>
</tr>
<tr>
<td>12</td>
<td>2</td>
<td>Washer, External Tooth</td>
<td>085H108S10</td>
</tr>
<tr>
<td>13</td>
<td>2</td>
<td>Eyebolt - 14 through 24 in. Meters</td>
<td>124D041U02</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>124D041U03</td>
</tr>
<tr>
<td>14</td>
<td>1</td>
<td>Pipe Plug, Hex Socket</td>
<td>112A352U23</td>
</tr>
<tr>
<td>15</td>
<td>6</td>
<td>Screw, Pan Head, #10-32 x 2-1/4 in.</td>
<td>066L012T10</td>
</tr>
<tr>
<td>16</td>
<td>6</td>
<td>Lockwasher, External Tooth</td>
<td>085D010T10</td>
</tr>
<tr>
<td>17</td>
<td>6</td>
<td>Washer, Screw Retainer</td>
<td>333C596U01</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>Cover, Customer Connection Box</td>
<td>378D371U01</td>
</tr>
<tr>
<td>19</td>
<td>1</td>
<td>O-Ring, Customer Connection Box</td>
<td>101A825U01</td>
</tr>
<tr>
<td>20</td>
<td>1</td>
<td>Pipe Plug, Hex Socket (note 4)</td>
<td>112A352U22</td>
</tr>
<tr>
<td>21</td>
<td>1</td>
<td>Fitting, Pipe (Note 4)</td>
<td>364D138S11</td>
</tr>
<tr>
<td>22</td>
<td>1</td>
<td>Grommet (Note 4)</td>
<td>366A140R60</td>
</tr>
<tr>
<td>23</td>
<td>1</td>
<td>Fitting, Pipe (Note 4)</td>
<td>364D127S14</td>
</tr>
<tr>
<td>24</td>
<td>-</td>
<td>Tape, Teflon (Sealant)</td>
<td>174D001U04</td>
</tr>
<tr>
<td>25</td>
<td>1</td>
<td>O-Ring</td>
<td>101A825U01</td>
</tr>
<tr>
<td>26</td>
<td>1</td>
<td>Adapter Housing</td>
<td>365B077U02</td>
</tr>
</tbody>
</table>

Notes:

1. The meter body is not a field repairable item. In the event of failure of the meter's internal components, such as magnet coils or electrode wiring, the Magnetic Flowmeter must be returned to Bailey-Fischer & Porter for repair. All correspondence should reference the complete meter model number and serial number.

2. The same Signal Converter is used for integral and remote mounting. Refer to the Instruction Bulletin supplied for the Signal Converter model specified for the applicable replacement part number. Bailey-Fischer & Porter maintains a repair/exchange program for this assembly; simply add "RE" to the part number given in the IB Parts List. For example: Model 50CD9001 - PN 698B076U05RE.

3. Mounting hardware and gaskets must be selected according to meter size.

4. Pipe plug (Key 20) and conduit seal (Key 21, 22 & 23) are not provided with the meter when the Signal Converter is integrally mounted. Parts required are supplied with the signal cable, as specified.

5. The primary CMF PC board is not interchangeable (see procedure 6.3.3 in Maintenance section. It is suggested that the user return the Flowmeter to the factory for repair and calibration. Consult a Bailey-Fischer & Porter service representative for assistance.

7-1
### ELECTRODE ASSEMBLIES

<table>
<thead>
<tr>
<th>KEY</th>
<th>QUANTITY</th>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>Pipe Plug, 2-inch</td>
<td>112A352U24</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>Screw, Fillister Hd., 10-32 x 1/2 in.</td>
<td>004L008T10</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>Lockwasher, #10</td>
<td>085D010T10</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>Cover, Electrode (for all meters except Teflon-lined)</td>
<td>379C238U01</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>Insulator</td>
<td>377A323U08</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>Screw, Hex Socket Set, 4-40 x 1/8 in.</td>
<td>018F002T10</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>&quot;O&quot;-Ring (Polyurethane-lined meters only)</td>
<td>102G001U44</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>Electrode - See NOTE 1</td>
<td>-</td>
</tr>
</tbody>
</table>

**WARNING**

DO NOT ATTEMPT ELECTRODE INSPECTION OR REPLACEMENT WITH A FILLED OR PRESSURIZED PIPELINE. PERSONAL INJURY MAY RESULT FROM SUCH PRACTICE.

**CAUTION**

EXERCISE EXTREME CARE WHEN WITHDRAWING ELECTRODE FROM ITS SEAT THAT LITTLE OR NO TENSION IS EXERTED ON THE CONNECTING ELECTRODE WIRE. IF THIS WIRE SHOULD BREAK WITHIN THE METER PIPE, THE METER IS NOT REPAIRABLE.

---

**NOTE 1.** Referenced items may be ordered only by specifying the meter's complete Bailey-Fischer & Porter serial number.

**NOTE 2.** Replacement of the electrodes in Teflon-lined meters is a factory procedure and should not be attempted in the field since the electrode cavity is filled with a silicone rubber compound.

---

**FIGURE 7-1. EXPLODED VIEW, ELECTRODE ASSEMBLIES**
PARTS LIST (continued)

Flange Gaskets, ANSI Class 150 (2 required)

<table>
<thead>
<tr>
<th>METER SIZE</th>
<th>BASIC PART NUMBER*</th>
<th>ANSI 150</th>
<th>ANSI 125</th>
<th>ANSI 300</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 in. (350mm)</td>
<td>333N</td>
<td>817P30</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>333C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 in. (400mm)</td>
<td>333C</td>
<td>526U04</td>
<td>526U03</td>
<td>380Q10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>526U16</td>
<td>526U17</td>
<td>381Q10</td>
</tr>
<tr>
<td>18 in. (450mm)</td>
<td>333C</td>
<td>526U08</td>
<td>526U07</td>
<td>388Q10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>526U15</td>
<td>526U01</td>
<td>389Q10</td>
</tr>
<tr>
<td>20 in. (500mm)</td>
<td>333C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>526U08</td>
<td>526U07</td>
<td></td>
</tr>
<tr>
<td>24 in. (600mm)</td>
<td>333C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>526U15</td>
<td>526U01</td>
<td></td>
</tr>
<tr>
<td>30 in. (750mm)</td>
<td>333C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>526U08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36 in. (900mm)</td>
<td>333C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>526U08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36 in. (900mm)</td>
<td>333C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>526U08</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Polyurethane-lined meters are supplied with NEOPRENE gaskets.

** Add suffix to BASIC PART NUMBER to form the complete part number, e.g. 333C388Q10 for a 20 in. meter with a NEOPRENE gasket.
DOCUMENTATION QUESTIONNAIRE

Your answers to the questions below and other comments assist us in publishing better documentation. If an answer requires explanation please use space provided. All comments and suggestions become the property of Elsag Bailey Process Automation.

1. Title of Document? IB10DX3119, Sizes 14” - 78” Pub. No. 24753

2. Does this document meet your needs? ________________________________
   ________________________________
   ________________________________

3. Is the information: ________________________________
   Easily understandable? ________________________________
   ________________________________
   Properly organized? ________________________________
   ________________________________
   Complete? ________________________________
   ________________________________
   Sufficiently illustrated? ________________________________
   ________________________________

OTHER COMMENTS
(Please include page and/or figure number.)

______________________________
______________________________
______________________________
______________________________
______________________________
______________________________

Name ________________________________
Address ________________________________

No postage necessary if mailed in U.S.A.

If Bailey-Fischer & Porter employee please include department number.