

# Certificate of Conformance

## Triad Measurement

We hereby certify that the material described in this report is in conformance with all applicable PO and drawing requirements, except as noted on approved SDR's, and that the material has been inspected to verify conformance to the applicable documents. We also certify that the weights and dimensions supplied in conjunction with this certification are actual. The Packing List will be complete and accurate and that the Material Markings, and Shipping Identification will be in accordance with the applicable "Shipping Instructions". All material released directly to a port has been packaged and preserved per the latest revision of process specification P23E-AL-0255.

GE PURCHASE ORDER NUMBER 180337693 LINE NUMBER 001 SEQUENCE: \_\_\_\_\_

GE DRAWING/PART NUMBER 371A5914P001G297893 UNIT NUMBER 297893

DRAWING REVISION 1 QUANTITY 1

MATERIAL EX-FACTORY LOCATION\* (City, State, Country) Logan , UT , USA

ALL SHORTAGES ARE DOCUMENTED VIA SDR

☐ YES ☒ N/A

APPROVED SDR'S ARE LISTED BELOW

☐ YES ☒ N/A

SDR(S) \_\_\_\_\_

IS THERE ANY HAZARDOUS MATERIAL IN THIS SHIPMENT ?

☐ YES ☒ NO

IF YES, I HAVE PROVIDED MATERIAL SAFETY DATA SHEET(S) TO GE

☐ YES ☐ NO ☒ N/A

ARE THERE "NON-ARTICLES" IN THIS SHIPMENT ?

☐ YES ☒ NO

IF YES, I HAVE LISTED THE PRODUCT COMPOSITION NUMBER  
(CAS#) BELOW

CAS#(S) \_\_\_\_\_

LISA MITCHELL

10/29/2001

Supplier Quality Representative

Date

CUSTOMER/PROJECT NAME \*\* INTERGEN DEVELOPMENT CO. / INA STANDARD PLANT-REDBUD

ML NUMBER \*\* 0639

\* Please identify the location of the factory that your equipment will be transporting from.

\*\* Please identify the Customer/Project Name if known. Used for shipping reference only.

# Certificate of Conformance

## Triad Measurement

We hereby certify that the material described in this report is in conformance with all applicable PO and drawing requirements, except as noted on approved SDR's, and that the material has been inspected to verify conformance to the applicable documents. We also certify that the weights and dimensions supplied in conjunction with this certification are actual. The Packing List will be complete and accurate and that the Material Markings, and Shipping Identification will be in accordance with the applicable "Shipping Instructions". All material released directly to a port has been packaged and preserved per the latest revision of process specification P23E-AL-0255.

GE PURCHASE ORDER NUMBER 180337693 LINE NUMBER 002 SEQUENCE: \_\_\_\_\_

GE DRAWING/PART NUMBER 371A5914P001G297894 UNIT NUMBER 297894

DRAWING REVISION 1 QUANTITY 1

MATERIAL EX-FACTORY LOCATION\* (City, State, Country) Logan , UT , USA

ALL SHORTAGES ARE DOCUMENTED VIA SDR

☐ YES ☒ N/A

APPROVED SDR'S ARE LISTED BELOW

☐ YES ☒ N/A

SDR(S) \_\_\_\_\_

IS THERE ANY HAZARDOUS MATERIAL IN THIS SHIPMENT ?

☐ YES ☒ NO

IF YES, I HAVE PROVIDED MATERIAL SAFETY DATA SHEET(S) TO GE

☐ YES ☐ NO ☒ N/A

ARE THERE "NON-ARTICLES" IN THIS SHIPMENT ?

☐ YES ☒ NO

IF YES, I HAVE LISTED THE PRODUCT COMPOSITION NUMBER  
(CAS#) BELOW

CAS#(S) \_\_\_\_\_

LISA MITCHELL

01/14/2002

Supplier Quality Representative

Date

CUSTOMER/PROJECT NAME \*\* INTERGEN DEVELOPMENT CO. / INA STANDARD PLANT-REDBUD

ML NUMBER \*\* 0639

\* Please identify the location of the factory that your equipment will be transporting from.

\*\* Please identify the Customer/Project Name if known. Used for shipping reference only.

# Certificate of Conformance

## Triad Measurement

We hereby certify that the material described in this report is in conformance with all applicable PO and drawing requirements, except as noted on approved SDR's, and that the material has been inspected to verify conformance to the applicable documents. We also certify that the weights and dimensions supplied in conjunction with this certification are actual. The Packing List will be complete and accurate and that the Material Markings, and Shipping Identification will be in accordance with the applicable "Shipping Instructions". All material released directly to a port has been packaged and preserved per the latest revision of process specification P23E-AL-0255.

GE PURCHASE ORDER NUMBER 180337693 LINE NUMBER 003 SEQUENCE: \_\_\_\_\_

GE DRAWING/PART NUMBER 371A5914P001G297895 UNIT NUMBER 297895

DRAWING REVISION 1 QUANTITY 1

MATERIAL EX-FACTORY LOCATION\* (City, State, Country) Logan , UT , USA

ALL SHORTAGES ARE DOCUMENTED VIA SDR

☐ YES ☒ N/A

APPROVED SDR'S ARE LISTED BELOW

☐ YES ☒ N/A

SDR(S) \_\_\_\_\_

IS THERE ANY HAZARDOUS MATERIAL IN THIS SHIPMENT ?

☐ YES ☒ NO

IF YES, I HAVE PROVIDED MATERIAL SAFETY DATA SHEET(S) TO GE

☐ YES ☐ NO ☒ N/A

ARE THERE "NON-ARTICLES" IN THIS SHIPMENT ?

☐ YES ☒ NO

IF YES, I HAVE LISTED THE PRODUCT COMPOSITION NUMBER  
(CAS#) BELOW

CAS#(S) \_\_\_\_\_

LISA MITCHELL

01/17/2002

Supplier Quality Representative

Date

CUSTOMER/PROJECT NAME \*\* INTERGEN DEVELOPMENT CO. / INA STANDARD PLANT-REDBUD

ML NUMBER \*\* 0639

\* Please identify the location of the factory that your equipment will be transporting from.

\*\* Please identify the Customer/Project Name if known. Used for shipping reference only.

# Certificate of Conformance

## Triad Measurement

We hereby certify that the material described in this report is in conformance with all applicable PO and drawing requirements, except as noted on approved SDR's, and that the material has been inspected to verify conformance to the applicable documents. We also certify that the weights and dimensions supplied in conjunction with this certification are actual. The Packing List will be complete and accurate and that the Material Markings, and Shipping Identification will be in accordance with the applicable "Shipping Instructions". All material released directly to a port has been packaged and preserved per the latest revision of process specification P23E-AL-0255.

GE PURCHASE ORDER NUMBER 180337693 LINE NUMBER 004 SEQUENCE: \_\_\_\_\_

GE DRAWING/PART NUMBER 371A5914P001G297896 UNIT NUMBER 297896

DRAWING REVISION 1 QUANTITY 1

MATERIAL EX-FACTORY LOCATION\* (City, State, Country) Logan , UT , USA

ALL SHORTAGES ARE DOCUMENTED VIA SDR ☐ YES ☒ N/A

APPROVED SDR'S ARE LISTED BELOW ☐ YES ☒ N/A

SDR(S) \_\_\_\_\_

IS THERE ANY HAZARDOUS MATERIAL IN THIS SHIPMENT ? ☐ YES ☒ NO

IF YES, I HAVE PROVIDED MATERIAL SAFETY DATA SHEET(S) TO GE ☐ YES ☐ NO ☒ N/A

ARE THERE "NON-ARTICLES" IN THIS SHIPMENT ? ☐ YES ☒ NO

IF YES, I HAVE LISTED THE PRODUCT COMPOSITION NUMBER  
(CAS#) BELOW

CAS#(S) \_\_\_\_\_

LISA MITCHELL

02/11/2002

Supplier Quality Representative

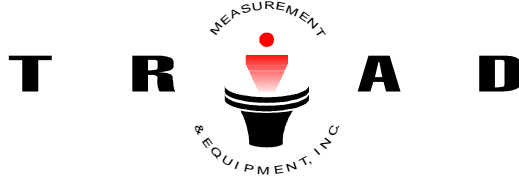
Date

CUSTOMER/PROJECT NAME \*\* INTERGEN DEVELOPMENT CO. / INA STANDARD PLANT-REDBUD

ML NUMBER \*\* 0639

\* Please identify the location of the factory that your equipment will be transporting from.

\*\* Please identify the Customer/Project Name if known. Used for shipping reference only.



## ***Spare Parts List***

Triad Job Number: 9091

Serial Number: 21-3543

General Electric Turbine Number: 297893

GE Drawing Number: 371A5914P001

GE Purchase Order Number: 180337693

GE P.O. Line Item Number: 001

### ***Recommended Spare Parts for above referenced:***

1. **Orifice Plate:** 1 each - 8" 600# Paddle Type Plate, 1/8" thick, 316SS

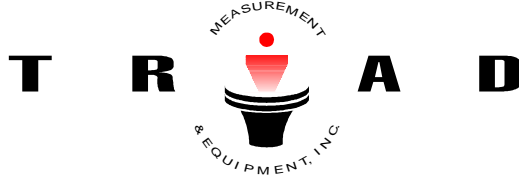
**Part Number:** PTOP 21-3543

**Lead Time:** 2 Weeks

2. **Gaskets:** 2 each - 8" 600# 1/8" Flex ring gasket

**Part Number:** GASK 21-3543

**Lead Time:** 1 Week



## ***Spare Parts List***

Triad Job Number: 9091

Serial Number: 21-3544

General Electric Turbine Number: 297894

GE Drawing Number: 371A5914P001

GE Purchase Order Number: 180337693

GE P.O. Line Item Number: 002

### ***Recommended Spare Parts for above referenced:***

1. **Orifice Plate:** 1 each - 8" 600# Paddle Type Plate, 1/8" thick, 316SS

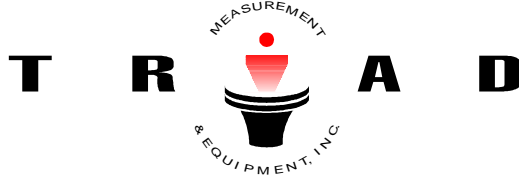
**Part Number:** PTOP 21-3544

**Lead Time:** 2 Weeks

2. **Gaskets:** 2 each - 8" 600# 1/8" Flex ring gasket

**Part Number:** GASK 21-3544

**Lead Time:** 1 Week



## ***Spare Parts List***

Triad Job Number: 9091

Serial Number: 21-3545

General Electric Turbine Number: 297895

GE Drawing Number: 371A5914P001

GE Purchase Order Number: 180337693

GE P.O. Line Item Number: 003

### ***Recommended Spare Parts for above referenced:***

1. **Orifice Plate:** 1 each - 8" 600# Paddle Type Plate, 1/8" thick, 316SS

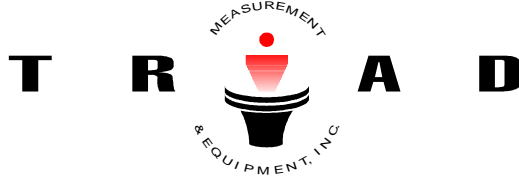
**Part Number:** PTOP 21-3545

**Lead Time:** 2 Weeks

2. **Gaskets:** 2 each - 8" 600# 1/8" Flex ring gasket

**Part Number:** GASK 21-3545

**Lead Time:** 1 Week



## ***Spare Parts List***

Triad Job Number: 9091

Serial Number: 21-3546

General Electric Turbine Number: 297896

GE Drawing Number: 371A5914P001

GE Purchase Order Number: 180337693

GE P.O. Line Item Number: 004

### ***Recommended Spare Parts for above referenced:***

1. **Orifice Plate:** 1 each - 8" 600# Paddle Type Plate, 1/8" thick, 316SS

**Part Number:** PTOP 21-3546

**Lead Time:** 2 Weeks

2. **Gaskets:** 2 each - 8" 600# 1/8" Flex ring gasket

**Part Number:** GASK 21-3546

**Lead Time:** 1 Week



ORIFICE® Program Flow Element Calculation

Page 1 of 1

Tag.....: SN213543	Date.....: 9/26/2001 14:17
Service.: FUEL GAS GR0672	
Spec No.: GE DWG 371A5914	EFD(P&ID): GE P.O. 18037693
Line No.:	Equip No.: 371A5914P001G297893
Customer: GE POWER SYSTEMS	
Project#: INTERGEN BECHTEL #1	Shop Ord.: 9091
Revision: 00	Calc. By.: k fountain
CalcType: Beta Ratio (Bore)	Pgm. Vers: 1.16L
Equ. Ref: AGA 3, 3rd edition.	FluidType: Gas

---

Fluid.....	FUEL GAS	
Element....., Type	Conc Orifice, Flange Tap	
, Material	316 SS	
, Beta Ratio @ 68.00 Deg F	0.6998 d/D	
, Bore @ 68.00 Deg F	5.5848 d, Inches	
Pipe....., Schedule 40S and Size	8.0000 Inches	
, Material	304 SS	
, Inside Dia @ 68.00 Deg F	7.9810 D, Inches	
Base....., Pressure at Std Cond	14.7000 Pb, Pounds/Sq In Absolute	
, Temperature at Std Cond	60.0000 Tb, Deg Fahrenheit	
Local....., Atmospheric Pressure	14.7000 Pg, Pounds/Sq In Absolute	
Pressure...., Flowing at Upstream	450.0000 Pf, Pounds/Sq In Gauge	
, Maximum Differential	138.5000 Hm, Inches Wtr Col	
, Normal Differential	67.8650 Hn, Inches Wtr Col	
, Permanent Loss @Max Flow	72.3820 Lm, Inches Wtr Col	
, Permanent Loss @Norm Flow	35.4672 Ln, Inches Wtr Col	
, Drop For Critical Flow	271.4062 Hc, Pounds/Sq In	
Temperature, Flowing	365.0000 Tf, Deg Fahrenheit	
Flow....., Maximum, Mass Conditions	23.8000 Qm, Mass Pounds/Second	
, Normal, Mass Conditions	16.6600 Qn, Mass Pounds/Second	
, Ratio (Norm/Max Flow)	70.0000 %, Percent	
, Reynolds Nmbr @Max Flow	3,977,607.8149 RDm	
, Reynolds Nmbr @Norm Flow	2,784,325.4704 RDn	
Fluid Prop., Specific Gravity	0.5773 SG	
, Viscosity @ Flowing	0.0170 Centipoise	
, Ratio of Specific Heats	1.2700 Cp/Cv	
, Compress Calc Method	Entered	
, Compressibility @ Flowing	0.9965 Zf	
, Calculated Flow Density	0.8813 Rhof, Lbs/Cu Ft	
Factors....., Calculated at Normal Flow		
, Discharge Coefficient	0.6020 C	
, Velocity Approach Factor	1.1469 Ev	
, Gas Expansion Factor	0.9980 Y1	
, Comb Thermal Expan Factor	1.0055 Fa	

---

ORIFICE® is a registered trademark of FlowSoft Inc., St. Charles, MO 63303  
All rights reserved, 1979 - 1997

---

Notes: None

ORIFICE® Program Flow Element Calculation

Page 1 of 1

Tag.....: SN213544	Date.....: 9/26/2001 14:17
Service.: FUEL GAS GR0672	
Spec No.: GE DWG 371A5914	EFD(P&ID): GE P.O. 18037693
Line No.:	Equip No.: 371A5914P001G297894
Customer: GE POWER SYSTEMS	
Project#: INTERGEN BECHTEL #2	Shop Ord.: 9091
Revision: 00	Calc. By.: k fountain
CalcType: Beta Ratio (Bore)	Pgm. Vers: 1.16L
Equ. Ref: AGA 3, 3rd edition.	FluidType: Gas

---

Fluid.....	FUEL GAS	
Element....., Type	Conc Orifice, Flange Tap	
, Material	316 SS	
, Beta Ratio @ 68.00 Deg F	0.6998 d/D	
, Bore @ 68.00 Deg F	5.5848 d, Inches	
Pipe....., Schedule 40S and Size	8.0000 Inches	
, Material	304 SS	
, Inside Dia @ 68.00 Deg F	7.9810 D, Inches	
Base....., Pressure at Std Cond	14.7000 Pb, Pounds/Sq In Absolute	
, Temperature at Std Cond	60.0000 Tb, Deg Fahrenheit	
Local....., Atmospheric Pressure	14.7000 Pg, Pounds/Sq In Absolute	
Pressure...., Flowing at Upstream	450.0000 Pf, Pounds/Sq In Gauge	
, Maximum Differential	138.5000 Hm, Inches Wtr Col	
, Normal Differential	67.8650 Hn, Inches Wtr Col	
, Permanent Loss @Max Flow	72.3820 Lm, Inches Wtr Col	
, Permanent Loss @Norm Flow	35.4672 Ln, Inches Wtr Col	
, Drop For Critical Flow	271.4062 Hc, Pounds/Sq In	
Temperature, Flowing	365.0000 Tf, Deg Fahrenheit	
Flow....., Maximum, Mass Conditions	23.8000 Qm, Mass Pounds/Second	
, Normal, Mass Conditions	16.6600 Qn, Mass Pounds/Second	
, Ratio (Norm/Max Flow)	70.0000 %, Percent	
, Reynolds Nmbr @Max Flow	3,977,607.8149 RDm	
, Reynolds Nmbr @Norm Flow	2,784,325.4704 RDn	
Fluid Prop., Specific Gravity	0.5773 SG	
, Viscosity @ Flowing	0.0170 Centipoise	
, Ratio of Specific Heats	1.2700 Cp/Cv	
, Compress Calc Method	Entered	
, Compressibility @ Flowing	0.9965 Zf	
, Calculated Flow Density	0.8813 Rhof, Lbs/Cu Ft	
Factors....., Calculated at Normal Flow		
, Discharge Coefficient	0.6020 C	
, Velocity Approach Factor	1.1469 Ev	
, Gas Expansion Factor	0.9980 Y1	
, Comb Thermal Expan Factor	1.0055 Fa	

---

ORIFICE® is a registered trademark of FlowSoft Inc., St. Charles, MO 63303  
All rights reserved, 1979 - 1997

---

Notes: None

ORIFICE® Program Flow Element Calculation

Page 1 of 1

Tag.....: SN213545	Date.....: 9/26/2001 14:17
Service.: FUEL GAS GR0672	
Spec No.: GE DWG 371A5914	EFD(P&ID): GE P.O. 18037693
Line No.:	Equip No.: 371A5914P001G297895
Customer: GE POWER SYSTEMS	
Project#: INTERGEN BECHTEL #3	Shop Ord.: 9091
Revision: 00	Calc. By.: k fountain
CalcType: Beta Ratio (Bore)	Pgm. Vers: 1.16L
Equ. Ref: AGA 3, 3rd edition.	FluidType: Gas

---

Fluid.....	FUEL GAS	
Element....., Type	Conc Orifice, Flange Tap	
, Material	316 SS	
, Beta Ratio @ 68.00 Deg F	0.6998 d/D	
, Bore @ 68.00 Deg F	5.5848 d,	Inches
Pipe....., Schedule 40S and Size	8.0000	Inches
, Material	304 SS	
, Inside Dia @ 68.00 Deg F	7.9810 D,	Inches
Base....., Pressure at Std Cond	14.7000 Pb,	Pounds/Sq In Absolute
, Temperature at Std Cond	60.0000 Tb,	Deg Fahrenheit
Local....., Atmospheric Pressure	14.7000 Pg,	Pounds/Sq In Absolute
Pressure...., Flowing at Upstream	450.0000 Pf,	Pounds/Sq In Gauge
, Maximum Differential	138.5000 Hm,	Inches Wtr Col
, Normal Differential	67.8650 Hn,	Inches Wtr Col
, Permanent Loss @Max Flow	72.3820 Lm,	Inches Wtr Col
, Permanent Loss @Norm Flow	35.4672 Ln,	Inches Wtr Col
, Drop For Critical Flow	271.4062 Hc,	Pounds/Sq In
Temperature, Flowing	365.0000 Tf,	Deg Fahrenheit
Flow....., Maximum, Mass Conditions	23.8000 Qm,	Mass Pounds/Second
, Normal, Mass Conditions	16.6600 Qn,	Mass Pounds/Second
, Ratio (Norm/Max Flow)	70.0000 %,	Percent
, Reynolds Nmbr @Max Flow	3,977,607.8149	RDm
, Reynolds Nmbr @Norm Flow	2,784,325.4704	RDn
Fluid Prop., Specific Gravity	0.5773	SG
, Viscosity @ Flowing	0.0170	Centipoise
, Ratio of Specific Heats	1.2700	Cp/Cv
, Compress Calc Method	Entered	
, Compressibility @ Flowing	0.9965	Zf
, Calculated Flow Density	0.8813	Rhof, Lbs/Cu Ft
Factors....., Calculated at Normal Flow		
, Discharge Coefficient	0.6020	C
, Velocity Approach Factor	1.1469	Ev
, Gas Expansion Factor	0.9980	Y1
, Comb Thermal Expan Factor	1.0055	Fa

---

ORIFICE® is a registered trademark of FlowSoft Inc., St. Charles, MO 63303  
All rights reserved, 1979 - 1997

---

Notes: None

ORIFICE® Program Flow Element Calculation

Page 1 of 1

Tag.....: SN213546	Date.....: 9/26/2001 14:17
Service.: FUEL GAS GR0672	
Spec No.: GE DWG 371A5914	EFD(P&ID): GE P.O. 18037693
Line No.:	Equip No.: 371A5914P001G297896
Customer: GE POWER SYSTEMS	
Project#: INTERGEN BECHTEL #4	Shop Ord.: 9091
Revision: 00	Calc. By.: k fountain
CalcType: Beta Ratio (Bore)	Pgm. Vers: 1.16L
Equ. Ref: AGA 3, 3rd edition.	FluidType: Gas

---

Fluid.....	FUEL GAS	
Element....., Type	Conc Orifice, Flange Tap	
, Material	316 SS	
, Beta Ratio @ 68.00 Deg F	0.6998 d/D	
, Bore @ 68.00 Deg F	5.5848 d,	Inches
Pipe....., Schedule 40S and Size	8.0000	Inches
, Material	304 SS	
, Inside Dia @ 68.00 Deg F	7.9810 D,	Inches
Base....., Pressure at Std Cond	14.7000 Pb,	Pounds/Sq In Absolute
, Temperature at Std Cond	60.0000 Tb,	Deg Fahrenheit
Local....., Atmospheric Pressure	14.7000 Pg,	Pounds/Sq In Absolute
Pressure..., Flowing at Upstream	450.0000 Pf,	Pounds/Sq In Gauge
, Maximum Differential	138.5000 Hm,	Inches Wtr Col
, Normal Differential	67.8650 Hn,	Inches Wtr Col
, Permanent Loss @Max Flow	72.3820 Lm,	Inches Wtr Col
, Permanent Loss @Norm Flow	35.4672 Ln,	Inches Wtr Col
, Drop For Critical Flow	271.4062 Hc,	Pounds/Sq In
Temperature, Flowing	365.0000 Tf,	Deg Fahrenheit
Flow....., Maximum, Mass Conditions	23.8000 Qm,	Mass Pounds/Second
, Normal, Mass Conditions	16.6600 Qn,	Mass Pounds/Second
, Ratio (Norm/Max Flow)	70.0000 %,	Percent
, Reynolds Nmbr @Max Flow	3,977,607.8149	RDm
, Reynolds Nmbr @Norm Flow	2,784,325.4704	RDn
Fluid Prop., Specific Gravity	0.5773	SG
, Viscosity @ Flowing	0.0170	Centipoise
, Ratio of Specific Heats	1.2700	Cp/Cv
, Compress Calc Method	Entered	
, Compressibility @ Flowing	0.9965	Zf
, Calculated Flow Density	0.8813	Rhof, Lbs/Cu Ft
Factors...., Calculated at Normal Flow		
, Discharge Coefficient	0.6020	C
, Velocity Approach Factor	1.1469	Ev
, Gas Expansion Factor	0.9980	Y1
, Comb Thermal Expan Factor	1.0055	Fa

---

ORIFICE® is a registered trademark of FlowSoft Inc., St. Charles, MO 63303  
All rights reserved, 1979 - 1997

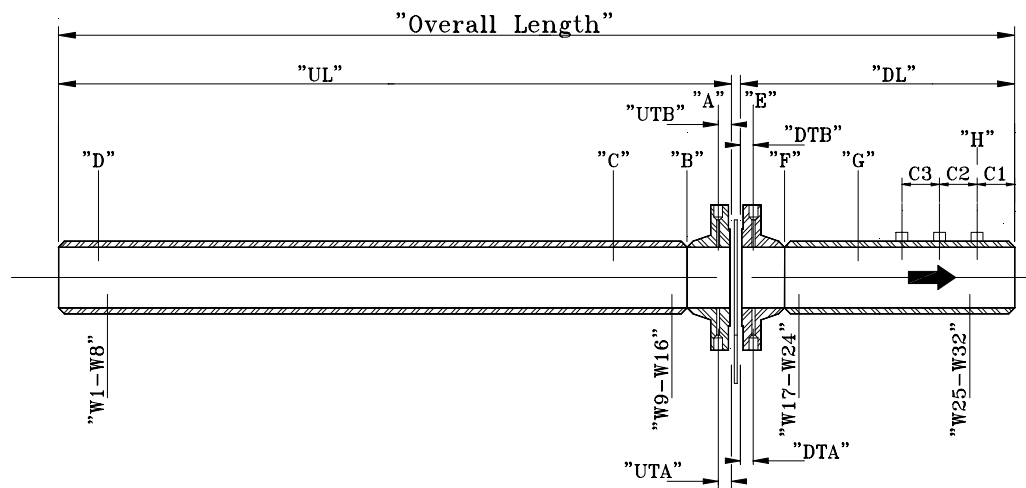
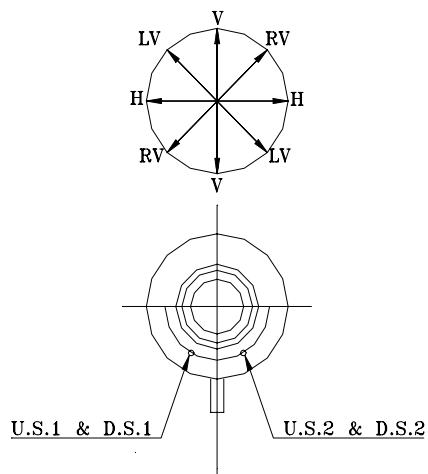
---

Notes: None

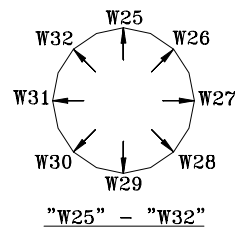
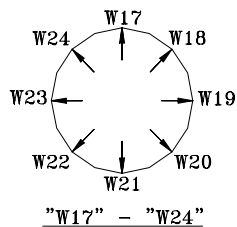
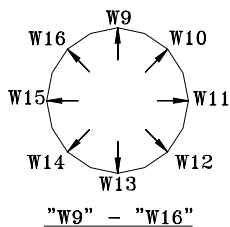
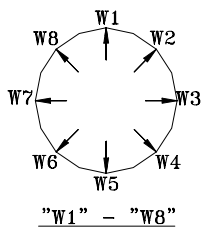


Customer: General Electric  
 Cust. P.O. No.: 180337693  
 Item No.: 1

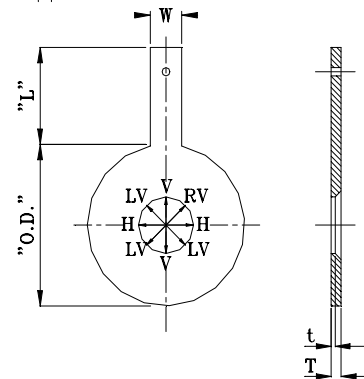
Triad Job No.: 9091  
 Serial No.: 21-3543  
 Part No.: 371A5914



METER TUBE DIMENSIONS



WALL THICKNESS READINGS



ORIFICE PLATE DIMENSIONS

# ORIFICE RUN MEASUREMENT DIMENSIONS (INCHES)

"UL"	"UTA"	"UTB"	"DL"	"DTA"	"DTB"
173.875	0.8750	0.8710	47.875	0.8780	0.8740

Gasket Thickness 0.1250 Orifice thickness 0.25 Overall Length 222.250 HT# U.S. Pipe: HT# U.S. Flg.:  
 "C1" 6.000 "C2" "C3" HT# D.S. Pipe: HT# D.S. Flg.:

UPSTREAM LOCATIONS					DOWNSTREAM LOCATIONS				
AXIS	"A" @ TAP	"B" @ WELD	"C" 2D FROM ORF. PLT.	"D" 6" FROM END	"E" @ TAP	"F" @ WELD	"G" 2D FROM ORF. PLT.	"H" 6" FROM END	AXIS
V	7.987	7.983	7.981	7.978	7.983	7.982	7.982	7.987	V
RV	7.987	7.984	7.984	7.980	7.983	7.981	7.979	7.976	RV
H	7.987	7.982	7.983	7.982	7.983	7.983	7.984	7.980	H
LV	7.987	7.982	7.983	7.980	7.983	7.984	7.990	7.991	LV
AVG.	7.987	7.983	7.983	7.980	7.983	7.983	7.984	7.984	AVG.
CALIBRATED SIZE: 7.98700					CALIBRATED SIZE: 7.98300				

Mic'd Orifice Bore: 5.5850 Nominal pipe size 8 inches Beta Ratio: 0.6993  
 Meter tube temp. when measurements were made at 60 degrees F

## ECCENTRICITY:

$$E \leq 0.0025(D_m) / 0.1 + 2.3bm4$$

Where,	U.S. 1	Calc. Radius to cL of Dowel	Measured Radius	Deviation
Dm = 7.987	U.S. 2	6.5625	6.5690	0.0065
$\beta = 0.69926$	D.S. 1	6.5625	6.5630	0.0005
E ≤ 0.03072 Max Deviation	D.S. 2	6.5625	6.5600	0.0025
			6.5650	0.0025

Deviation is within tolerance

## INSIDE PIPE CONDITION

Measure the internal surface roughness of the meter tube at approximately the same axial locations as those used to determine and verify the meter tube internal diameter (Dm) as those shown in Eccentricity table above.

Measurement 1	32	Microinches (Ra)	Measurement 2	32	Microinches (Ra)
Measurement 3	32	Microinches (Ra)	Measurement 4	32	Microinches (Ra)

Average surface finish 32 Microinches (Ra)

Is the average surface finish less than 250 microinches (Ra)? YES  
 Is the pipe free of irregularities such as grooves, scoring, ETC.? YES

## SECTION 1 - WITHIN THE FIRST DIAMETER (Dm) UPSTREAM OF THE ORIFICE PLATE

Largest Dia.= 7.987 Dmax Smallest Dia.= 7.982 Dmin

$$\frac{D_{max} - D_m}{D_m} \times 100 = 0.00000\% < \text{or} = 0.25\% \text{ Within Tolerance}$$

$$\frac{D_{min} - D_m}{D_m} \times 100 = 0.06260\% < \text{or} = 0.25\% \text{ Within Tolerance}$$

WALL THICKNESS READINGS			
W1-W8	W9-W16	W17-W24	W25-W32
341.000	354.000	312.000	306.000
324.000	340.000	399.000	337.000
308.000	323.000	309.000	335.000
328.000	310.000	324.000	330.000
316.000	318.000	329.000	335.000
337.000	323.000	358.000	344.000
341.000	334.000	323.000	346.000
338.000	336.000	321.000	330.000
AVG.	329.1250	329.7500	334.3750

Orifice Plate Measurements			
"V"	5.5850	"OD"	12.6250
"RV"	5.5850	"T"	0.1270
"H"	5.5850	"t"	0.1270
"LV"	5.5850	"L"	5.0000
Average	5.5850	"W"	1.2500

**SECTION 2 - ALL METER TUBE DIAMETER MEASUREMENTS UPSTREAM OF THE ORIFICE PLATE**

Largest Dia.= 7.987 Dmax Smallest Dia.= 7.981 Dmin

Dmax - Dmin

Dm x 100= 0.07512% < or = 0.50% ..... **Within Tolerance**

**SECTION 3 - ALL METER TUBE DIAMETER MEASUREMENTS DOWNSTREAM OF THE ORIFICE PLATE**

Largest Dia.= 7.990 Dmax Smallest Dia.= 7.979 Dmin

Dmax - Dm

Dm x 100= 0.08769% < or = 0.50% ..... **Within Tolerance**

Dmin - Dm

Dm x 100= 0.05011% < or = 0.50% ..... **Within Tolerance**

**FLANGE TAP CONSTRUCTION**

Specified tap location from face of flange	0.8750	inches	
Measured tap location for "UTA"	0.8750	inches.....	<b>Tap hole is within tolerance</b>
Measured tap location for "UTB"	0.8710	inches.....	<b>Tap hole is within tolerance</b>
Measured tap location for "DTA"	0.8780	inches.....	<b>Tap hole is within tolerance</b>
Measured tap location for "DTB"	0.8740	inches.....	<b>Tap hole is within tolerance</b>

The tap location tolerance for NPS 4" and larger is  
0.03" for 0.75 beta ratio  
The tap location tolerance for NPS smaller than 4" is  
0.015" for 0.75 beta ratio

Specified drill thru diameter	0.5000	inches	
Measured drill thru diameter for "UTA"	0.5000	inches.....	<b>Drill thru is within tolerance</b>
Measured drill thru diameter for "UTB"	0.5000	inches.....	<b>Drill thru is within tolerance</b>
Measured drill thru diameter for "DTA"	0.5000	inches.....	<b>Drill thru is within tolerance</b>
Measured drill thru diameter for "DTB"	0.5000	inches.....	<b>Drill thru is within tolerance</b>

The drill thru for NPS 4" and larger is 0.500" +/-0.0156"  
The drill thru for NPS 2" and 3" is 0.375" +/-0.0156"  
The drill thru for NPS 1 1/2" and smaller is 0.25"  
+/-"0.0156"

**TAP HOLE CONDITION**

- ☒ Good - Burr free edge
- ☐ Fair - Burr free edge, rounded but within 0.0625d
- ☐ Poor - Burrs or corrosion present

Orifice Meter Tube Is **Accepted**

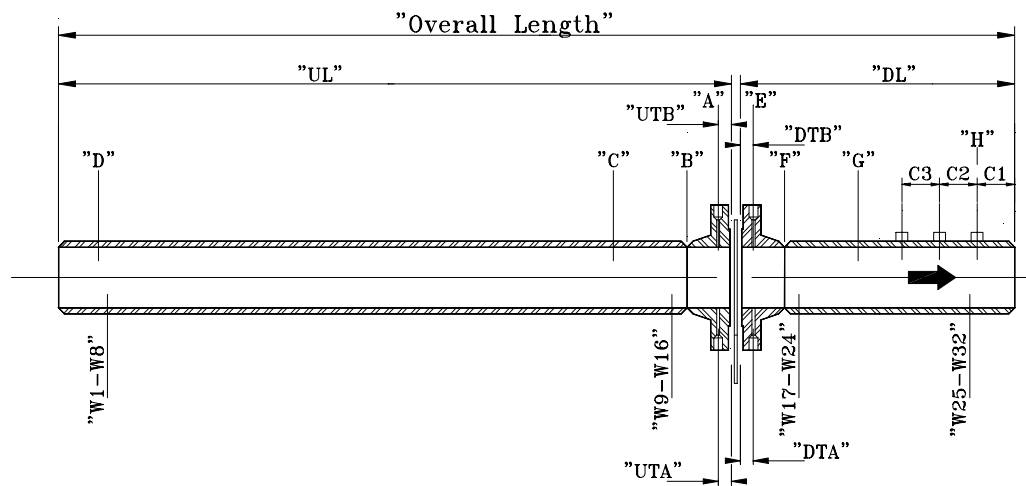
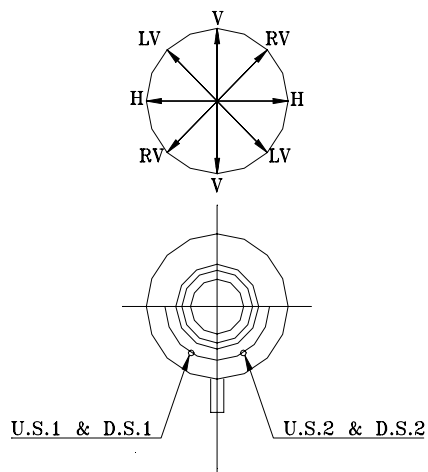
Inspected and recorded By: **Bruce Henderson**

Date: October 30, 2001

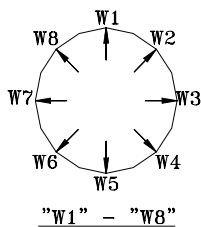


Customer: General Electric  
 Cust. P.O. No.: 180337693  
 Item No.: 2

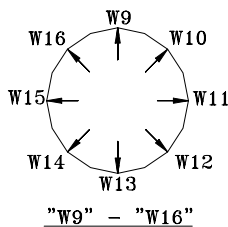
Triad Job No.: 9091  
 Serial No.: 21-3544  
 Part No.: 371A5914



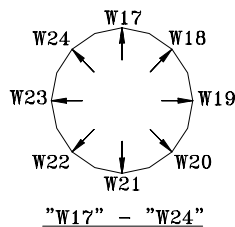
METER TUBE DIMENSIONS



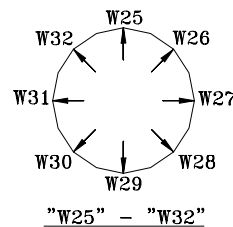
"W1" - "W8"



"W9" - "W16"

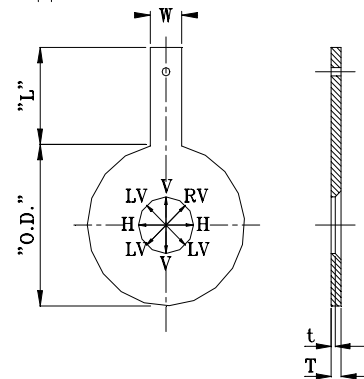


"W17" - "W24"



"W25" - "W32"

WALL THICKNESS READINGS



ORIFICE PLATE DIMENSIONS



# ORIFICE RUN MEASUREMENT DIMENSIONS (INCHES)

"UL"	"UTA"	"UTB"	"DL"	"DTA"	"DTB"
173.875	0.8700	0.8730	42.875	0.8710	0.8760

Gasket Thickness 0.1250 Orifice thickness 0.25 Overall Length 217.250 HT# U.S. Pipe: HT# U.S. Flg.:  
 "C1" 5.750 "C2" "C3" HT# D.S. Pipe: HT# D.S. Flg.:

UPSTREAM LOCATIONS					DOWNSTREAM LOCATIONS				
AXIS	"A" @ TAP	"B" @ WELD	"C" 2D FROM ORF. PLT.	"D" 6" FROM END	"E" @ TAP	"F" @ WELD	"G" 2D FROM ORF. PLT.	"H" 6" FROM END	AXIS
V	7.985	7.985	7.985	7.985	7.984	7.983	7.983	7.975	V
RV	7.985	7.985	7.984	7.983	7.984	7.983	7.983	7.974	RV
H	7.985	7.985	7.982	7.981	7.984	7.983	7.983	7.973	H
LV	7.985	7.985	7.984	7.982	7.984	7.983	7.983	7.974	LV
AVG.	7.985	7.985	7.984	7.983	7.984	7.983	7.983	7.974	AVG.
CALIBRATED SIZE: 7.98500					CALIBRATED SIZE: 7.98400				

Mic'd Orifice Bore: 5.5860 Nominal pipe size 8 inches Beta Ratio: 0.6996  
 Meter tube temp. when measurements were made at 50 degrees F

## ECCENTRICITY:

$$E \leq 0.0025(D_m) / 0.1 + 2.3bm4$$

Where, U.S. 1

Dm = 7.985 U.S. 2

β = 0.69956 D.S. 1

E ≤ 0.03067 Max Deviation D.S. 2

Calc. Radius to cL of Dowel

6.5625

6.5625

6.5625

6.5625

Measured Radius

6.5400

6.5450

6.5700

6.5900

Deviation

0.0225

0.0175

0.0075

0.0275

Deviation is within tolerance

## INSIDE PIPE CONDITION

Measure the internal surface roughness of the meter tube at approximately the same axial locations as those used to determine and verify the meter tube internal diameter (Dm) as those shown in Eccentricity table above.

Measurement 1 32 Microinches (Ra) Measurement 2 32 Microinches (Ra)  
 Measurement 3 32 Microinches (Ra) Measurement 4 32 Microinches (Ra)

Average surface finish 32 Microinches (Ra)

Is the average surface finish less than 250 microinches (Ra)? YES

Is the pipe free of irregularities such as grooves, scoring, ETC.? YES

## SECTION 1 - WITHIN THE FIRST DIAMETER (Dm) UPSTREAM OF THE ORIFICE PLATE

Largest Dia.= 7.985 Dmax Smallest Dia.= 7.985 Dmin

Dmax - Dm

Dm x 100= 0.00000% < or = 0.25% ..... Within Tolerance

Dmin - Dm

Dm x 100= 0.00000% < or = 0.25% ..... Within Tolerance

WALL THICKNESS READINGS			
W1-W8	W9-W16	W17-W24	W25-W32
334.000	336.000	311.000	294.000
332.000	318.000	310.000	330.000
344.000	327.000	312.000	334.000
344.000	349.000	328.000	347.000
329.000	363.000	330.000	288.000
324.000	323.000	282.000	346.000
332.000	321.000	331.000	341.000
320.000	325.000	298.000	343.000
AVG.	332.3750	332.7500	312.7500

Orifice Plate Measurements			
"V"	5.5860	"OD"	12.6250
"RV"	5.5860	"T"	0.1300
"H"	5.5860	"t"	0.1300
"LV"	5.5860	"L"	5.0000
Average	5.5860	"W"	1.2500

**SECTION 2 - ALL METER TUBE DIAMETER MEASUREMENTS UPSTREAM OF THE ORIFICE PLATE**

Largest Dia.=	7.985	Dmax	Smallest Dia.=	7.982	Dmin
---------------	-------	------	----------------	-------	------

$\frac{D_{max} - D_{min}}{D_m} \times 100 =$	0.03757%	< or = 0.50% .....	<b>Within Tolerance</b>
--	----------	--------------------	-------------------------

**SECTION 3 - ALL METER TUBE DIAMETER MEASUREMENTS DOWNSTREAM OF THE ORIFICE PLATE**

Largest Dia.=	7.984	Dmax	Smallest Dia.=	7.983	Dmin
---------------	-------	------	----------------	-------	------

$\frac{D_{max} - D_m}{D_m} \times 100 =$	0.00000%	< or = 0.50% .....	<b>Within Tolerance</b>
--	----------	--------------------	-------------------------

$\frac{D_{min} - D_m}{D_m} \times 100 =$	0.01253%	< or = 0.50% .....	<b>Within Tolerance</b>
--	----------	--------------------	-------------------------

**FLANGE TAP CONSTRUCTION**

Specified tap location from face of flange	0.8750	inches	
Measured tap location for "UTA"	0.8700	inches.....	<b>Tap hole is within tolerance</b>
Measured tap location for "UTB"	0.8730	inches.....	<b>Tap hole is within tolerance</b>
Measured tap location for "DTA"	0.8710	inches.....	<b>Tap hole is within tolerance</b>
Measured tap location for "DTB"	0.8760	inches.....	<b>Tap hole is within tolerance</b>

The tap location tolerance for NPS 4" and larger is  
0.03" for 0.75 beta ratio  
The tap location tolerance for NPS smaller than 4" is  
0.015" for 0.75 beta ratio

Specified drill thru diameter	0.5000	inches	
Measured drill thru diameter for "UTA"	0.5000	inches.....	<b>Drill thru is within tolerance</b>
Measured drill thru diameter for "UTB"	0.5000	inches.....	<b>Drill thru is within tolerance</b>
Measured drill thru diameter for "DTA"	0.5000	inches.....	<b>Drill thru is within tolerance</b>
Measured drill thru diameter for "DTB"	0.5000	inches.....	<b>Drill thru is within tolerance</b>

The drill thru for NPS 4" and larger is 0.500" +/-0.0156"  
The drill thru for NPS 2" and 3" is 0.375" +/-0.0156"  
The drill thru for NPS 1 1/2" and smaller is 0.25"  
+/-"0.0156"

**TAP HOLE CONDITION**

<input checked="" type="checkbox"/> X	Good - Burr free edge
<input type="checkbox"/>	Fair - Burr free edge, rounded but within 0.0625d
<input type="checkbox"/>	Poor - Burrs or corrosion present

Orifice Meter Tube Is **Accepted**

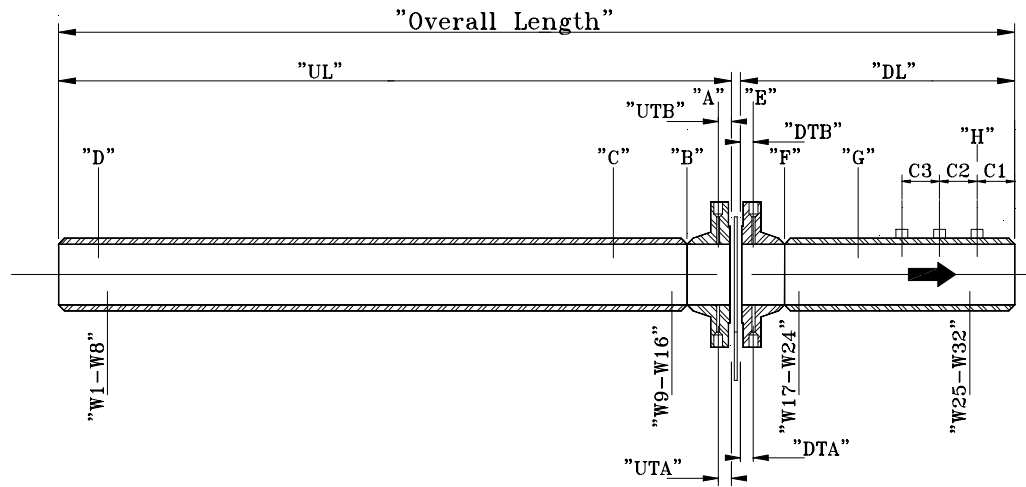
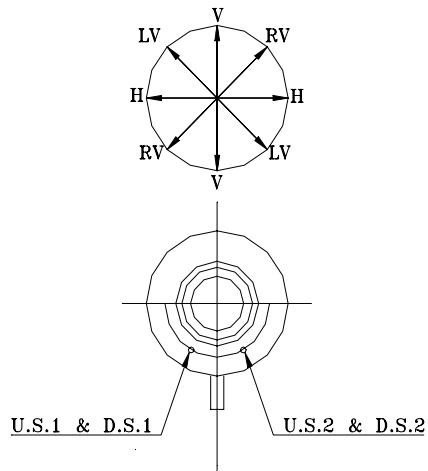
Inspected and recorded By: **Bruce Henderson**

Date: January 9, 2002

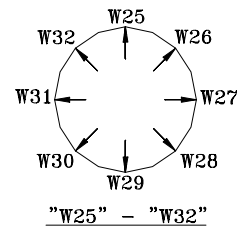
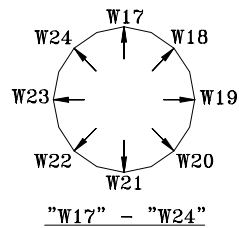
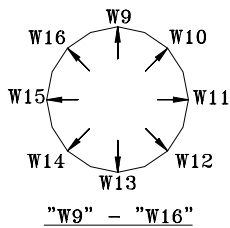
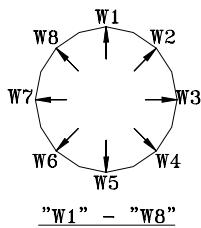


Customer: General Electric  
 Cust. P.O. No.: 180337693  
 Item No.: 3

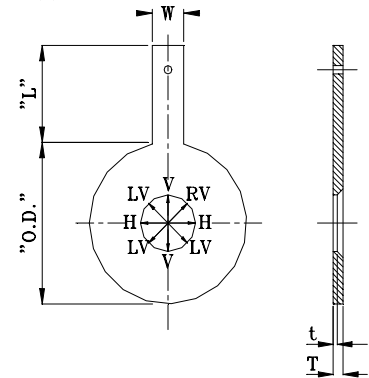
Triad Job No.: 9091  
 Serial No.: 21-3545  
 Part No.: 371A5914



METER TUBE DIMENSIONS



WALL THICKNESS READINGS



ORIFICE PLATE DIMENSIONS

# ORIFICE RUN MEASUREMENT DIMENSIONS (INCHES)

"UL"	"UTA"	"UTB"	"DL"	"DTA"	"DTB"
173.875	0.8750	0.8780	47.875	0.8720	0.8770

Gasket Thickness 0.1250 Orifice thickness 0.25 Overall Length 222.250 HT# U.S. Pipe: HT# U.S. Flg.:  
 "C1" 6.000 "C2" "C3" HT# D.S. Pipe: HT# D.S. Flg.:

UPSTREAM LOCATIONS					DOWNSTREAM LOCATIONS				
AXIS	"A" @ TAP	"B" @ WELD	"C" 2D FROM ORF. PLT.	"D" 6" FROM END	"E" @ TAP	"F" @ WELD	"G" 2D FROM ORF. PLT.	"H" 6" FROM END	AXIS
V	7.976	7.975	7.971	7.973	7.978	7.974	7.969	7.977	V
RV	7.976	7.975	7.984	7.983	7.978	7.983	7.983	7.974	RV
H	7.976	7.975	7.973	7.980	7.978	7.983	7.983	7.973	H
LV	7.976	7.975	7.984	7.982	7.978	7.983	7.983	7.974	LV
AVG.	7.976	7.975	7.978	7.980	7.978	7.981	7.980	7.975	AVG.
CALIBRATED SIZE: 7.97600					CALIBRATED SIZE: 7.97800				

Mic'd Orifice Bore: 5.5850 Nominal pipe size 8 inches Beta Ratio: 0.7002  
 Meter tube temp. when measurements were made at 50 degrees F

## ECCENTRICITY:

$$E \leq 0.0025(D_m) / 0.1 + 2.3bm4$$

Where, U.S. 1

Dm = 7.976 U.S. 2

$\beta = 0.70023$  D.S. 1

$E \leq 0.03054$  Max Deviation D.S. 2

Calc. Radius to cL of Dowel

6.5625

6.5625

6.5625

6.5625

Measured Radius

6.5500

6.5700

6.5800

6.5900

Deviation

0.0125

0.0075

0.0175

0.0275

Deviation is within tolerance

## INSIDE PIPE CONDITION

Measure the internal surface roughness of the meter tube at approximately the same axial locations as those used to determine and verify the meter tube internal diameter (Dm) as those shown in Eccentricity table above.

Measurement 1 32 Microinches (Ra) Measurement 2 32 Microinches (Ra)  
 Measurement 3 32 Microinches (Ra) Measurement 4 32 Microinches (Ra)

Average surface finish 32 Microinches (Ra)

Is the average surface finish less than 250 microinches (Ra)? YES

Is the pipe free of irregularities such as grooves, scoring, ETC.? YES

## SECTION 1 - WITHIN THE FIRST DIAMETER (Dm) UPSTREAM OF THE ORIFICE PLATE

Largest Dia.= 7.976 Dmax Smallest Dia.= 7.975 Dmin

$\frac{D_{max} - D_m}{D_m}$

x 100= 0.00000% < or = 0.25% ..... Within Tolerance

$\frac{D_{min} - D_m}{D_m}$

x 100= 0.01254% < or = 0.25% ..... Within Tolerance

WALL THICKNESS READINGS			
W1-W8	W9-W16	W17-W24	W25-W32
336.000	347.000	320.000	332.000
348.000	340.000	315.000	331.000
344.000	329.000	326.000	339.000
354.000	327.000	308.000	336.000
346.000	314.000	301.000	332.000
336.000	329.000	335.000	339.000
335.000	321.000	328.000	348.000
336.000	326.000	332.000	343.000
AVG.	341.8750	329.1250	320.6250
			337.5000

Orifice Plate Measurements			
"V"	5.5850	"OD"	12.6250
"RV"	5.5850	"T"	0.1280
"H"	5.5850	"t"	0.1280
"LV"	5.5850	"L"	5.0000
Average	5.5850	"W"	1.2500

**SECTION 2 - ALL METER TUBE DIAMETER MEASUREMENTS UPSTREAM OF THE ORIFICE PLATE**

Largest Dia.= 7.984 Dmax Smallest Dia.= 7.971 Dmin

Dmax - Dmin

Dm x 100= 0.16299% < or = 0.50% ..... **Within Tolerance**

**SECTION 3 - ALL METER TUBE DIAMETER MEASUREMENTS DOWNSTREAM OF THE ORIFICE PLATE**

Largest Dia.= 7.983 Dmax Smallest Dia.= 7.969 Dmin

Dmax - Dm

Dm x 100= 0.06267% < or = 0.50% ..... **Within Tolerance**

Dmin - Dm

Dm x 100= 0.11281% < or = 0.50% ..... **Within Tolerance**

**FLANGE TAP CONSTRUCTION**

Specified tap location from face of flange 0.8750 inches

Measured tap location for "UTA" 0.8750 inches..... **Tap hole is within tolerance**

Measured tap location for "UTB" 0.8780 inches..... **Tap hole is within tolerance**

Measured tap location for "DTA" 0.8720 inches..... **Tap hole is within tolerance**

Measured tap location for "DTB" 0.8770 inches..... **Tap hole is within tolerance**

The tap location tolerance for NPS 4" and larger is  
0.03" for 0.75 beta ratio

The tap location tolerance for NPS smaller than 4" is  
0.015" for 0.75 beta ratio

Specified drill thru diameter 0.5000 inches

Measured drill thru diameter for "UTA" 0.5000 inches..... **Drill thru is within tolerance**

Measured drill thru diameter for "UTB" 0.5000 inches..... **Drill thru is within tolerance**

Measured drill thru diameter for "DTA" 0.5000 inches..... **Drill thru is within tolerance**

Measured drill thru diameter for "DTB" 0.5000 inches..... **Drill thru is within tolerance**

The drill thru for NPS 4" and larger is 0.500" +/-0.0156"

The drill thru for NPS 2" and 3" is 0.375" +/-0.0156"

The drill thru for NPS 1 1/2" and smaller is 0.25"  
+/-"0.0156"

**TAP HOLE CONDITION**

☒ Good - Burr free edge

☐ Fair - Burr free edge, rounded but within 0.0625d

☐ Poor - Burrs or corrosion present

Orifice Meter Tube Is **Accepted**

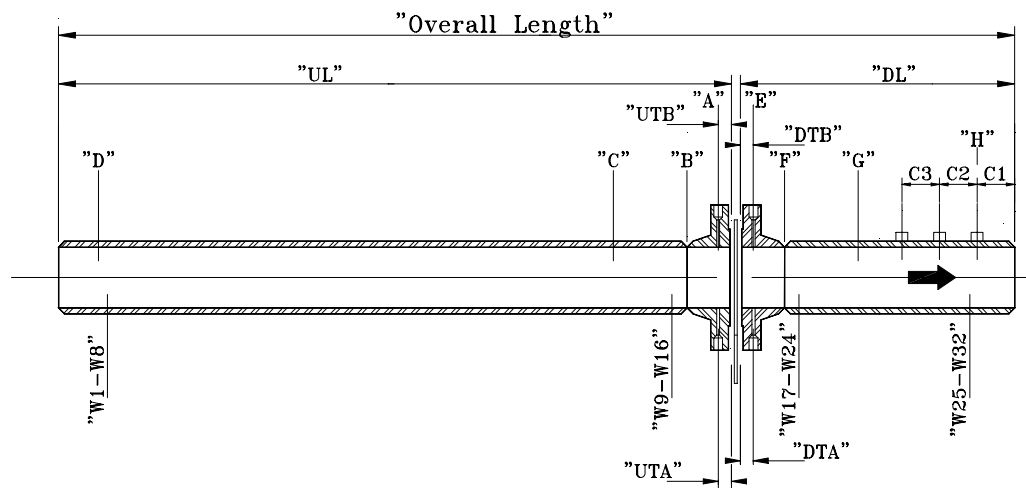
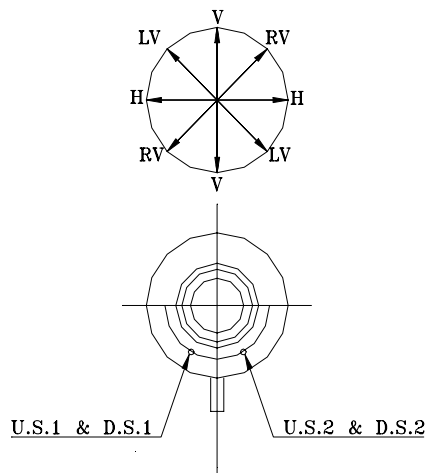
Inspected and recorded By: **Bruce Henderson**

Date: January 9, 2002

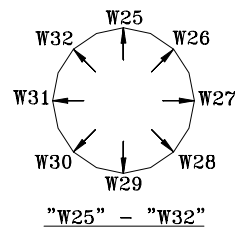
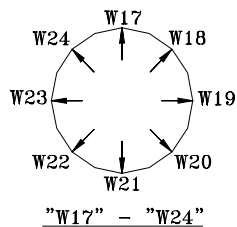
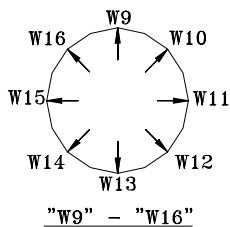
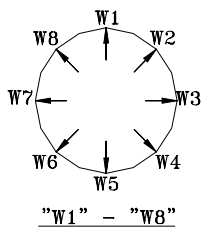


Customer: General Electric  
 Cust. P.O. No.: 180337693  
 Item No.: 4

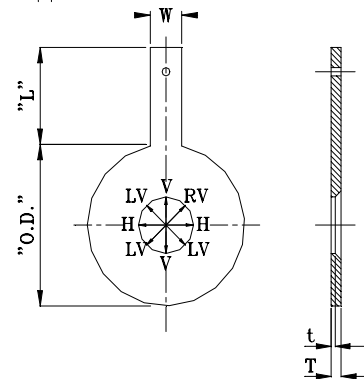
Triad Job No.: 9091  
 Serial No.: 21-3546  
 Part No.: 371A5914



METER TUBE DIMENSIONS



WALL THICKNESS READINGS



ORIFICE PLATE DIMENSIONS

# ORIFICE RUN MEASUREMENT DIMENSIONS (INCHES)

"UL"	"UTA"	"UTB"	"DL"	"DTA"	"DTB"
174.000	0.8760	0.8750	47.875	0.8760	0.8730

Gasket Thickness 0.1250 Orifice thickness 0.25 Overall Length 222.375 HT# U.S. Pipe: HT# U.S. Flg.:  
 "C1" 5.750 "C2" "C3" HT# D.S. Pipe: HT# D.S. Flg.:

UPSTREAM LOCATIONS					DOWNSTREAM LOCATIONS				
AXIS	"A" @ TAP	"B" @ WELD	"C" 2D FROM ORF. PLT.	"D" 6" FROM END	"E" @ TAP	"F" @ WELD	"G" 2D FROM ORF. PLT.	"H" 6" FROM END	AXIS
V	7.987	7.982	7.983	7.973	7.986	7.984	7.983	7.990	V
RV	7.987	7.987	7.983	7.983	7.986	7.983	7.983	7.974	RV
H	7.987	7.975	7.983	7.980	7.986	7.983	7.983	7.973	H
LV	7.987	7.975	7.984	7.982	7.986	7.983	7.983	7.974	LV
AVG.	7.987	7.980	7.983	7.980	7.986	7.983	7.983	7.978	AVG.
CALIBRATED SIZE: 7.98700					CALIBRATED SIZE: 7.98600				

Mic'd Orifice Bore: 5.5860 Nominal pipe size 8 inches Beta Ratio: 0.6994  
 Meter tube temp. when measurements were made at 50 degrees F

## ECCENTRICITY:

$$E \leq 0.0025(D_m) / 0.1 + 2.3bm4$$

Where, U.S. 1

Dm = 7.987 U.S. 2

β = 0.69939 D.S. 1

E ≤ 0.03071 Max Deviation D.S. 2

Calc. Radius to cL of Dowel

6.5625

6.5625

6.5625

6.5625

Measured Radius

6.5900

6.5640

6.5630

6.5620

Deviation

0.0275

0.0015

0.0005

0.0005

Deviation is within tolerance

## INSIDE PIPE CONDITION

Measure the internal surface roughness of the meter tube at approximately the same axial locations as those used to determine and verify the meter tube internal diameter (Dm) as those shown in Eccentricity table above.

Measurement 1 32 Microinches (Ra) Measurement 2 32 Microinches (Ra)  
 Measurement 3 32 Microinches (Ra) Measurement 4 32 Microinches (Ra)

Average surface finish 32 Microinches (Ra)

Is the average surface finish less than 250 microinches (Ra)? YES

Is the pipe free of irregularities such as grooves, scoring, ETC.? YES

## SECTION 1 - WITHIN THE FIRST DIAMETER (Dm) UPSTREAM OF THE ORIFICE PLATE

Largest Dia.= 7.987 Dmax Smallest Dia.= 7.975 Dmin

$\frac{D_{max} - D_m}{D_m} \times 100 =$

0.00376% < or = 0.25% ..... Within Tolerance

$\frac{D_{min} - D_m}{D_m} \times 100 =$

0.15024% < or = 0.25% ..... Within Tolerance

WALL THICKNESS READINGS			
W1-W8	W9-W16	W17-W24	W25-W32
317.000	315.000	326.000	321.000
336.000	321.000	315.000	335.000
334.000	325.000	339.000	348.000
333.000	329.000	357.000	354.000
311.000	292.000	310.000	310.000
335.000	332.000	331.000	362.000
325.000	312.000	334.000	355.000
313.000	324.000	327.000	349.000
AVG.	325.5000	318.7500	329.8750
			341.7500

Orifice Plate Measurements			
"V"	5.5860	"OD"	12.6250
"RV"	5.5860	"T"	0.1300
"H"	5.5860	"t"	0.1300
"LV"	5.5860	"L"	5.0000
Average	5.5860	"W"	1.2500

**SECTION 2 - ALL METER TUBE DIAMETER MEASUREMENTS UPSTREAM OF THE ORIFICE PLATE**

Largest Dia.= 7.987 Dmax Smallest Dia.= 7.975 Dmin

Dmax - Dmin

Dm x 100= 0.15400% < or = 0.50% ..... **Within Tolerance**

**SECTION 3 - ALL METER TUBE DIAMETER MEASUREMENTS DOWNSTREAM OF THE ORIFICE PLATE**

Largest Dia.= 7.986 Dmax Smallest Dia.= 7.983 Dmin

Dmax - Dm

Dm x 100= 0.00000% < or = 0.50% ..... **Within Tolerance**

Dmin - Dm

Dm x 100= 0.03757% < or = 0.50% ..... **Within Tolerance**

**FLANGE TAP CONSTRUCTION**

Specified tap location from face of flange	0.8750	inches	
Measured tap location for "UTA"	0.8760	inches.....	<b>Tap hole is within tolerance</b>
Measured tap location for "UTB"	0.8750	inches.....	<b>Tap hole is within tolerance</b>
Measured tap location for "DTA"	0.8760	inches.....	<b>Tap hole is within tolerance</b>
Measured tap location for "DTB"	0.8730	inches.....	<b>Tap hole is within tolerance</b>

The tap location tolerance for NPS 4" and larger is  
0.03" for 0.75 beta ratio  
The tap location tolerance for NPS smaller than 4" is  
0.015" for 0.75 beta ratio

Specified drill thru diameter	0.5000	inches	
Measured drill thru diameter for "UTA"	0.5000	inches.....	<b>Drill thru is within tolerance</b>
Measured drill thru diameter for "UTB"	0.5000	inches.....	<b>Drill thru is within tolerance</b>
Measured drill thru diameter for "DTA"	0.5000	inches.....	<b>Drill thru is within tolerance</b>
Measured drill thru diameter for "DTB"	0.5000	inches.....	<b>Drill thru is within tolerance</b>

The drill thru for NPS 4" and larger is 0.500" +/-0.0156"  
The drill thru for NPS 2" and 3" is 0.375" +/-0.0156"  
The drill thru for NPS 1 1/2" and smaller is 0.25"  
+/-"0.0156"

**TAP HOLE CONDITION**

- ☒ Good - Burr free edge
- ☐ Fair - Burr free edge, rounded but within 0.0625d
- ☐ Poor - Burrs or corrosion present

Orifice Meter Tube Is **Accepted**

Inspected and recorded By: **Bruce Henderson**

Date: January 19, 2002



# ORIFICE FLOW METER CALIBRATION

SERIAL NUMBER 21-3543

SERIAL NUMBER 21-3544

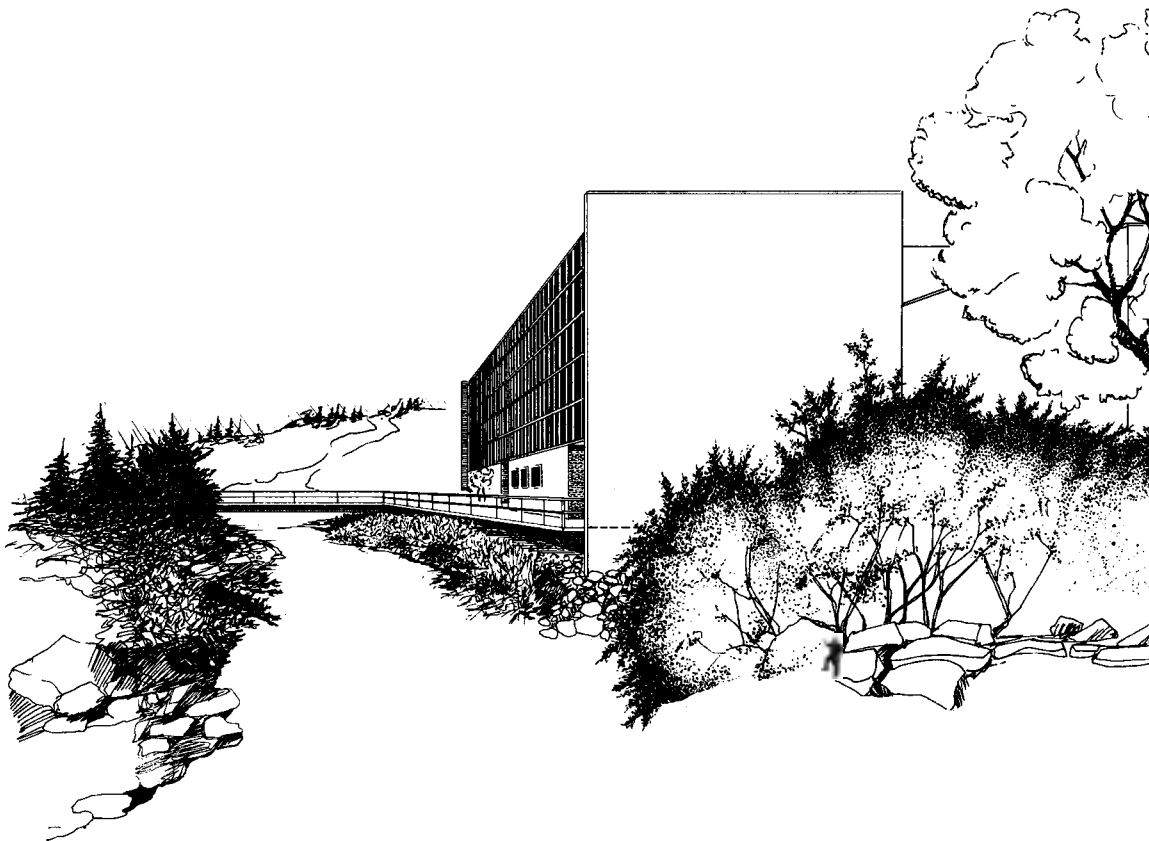
SERIAL NUMBER 21-3545

SERIAL NUMBER 21-3546

Prepared for

Triad Measurement & Equipment, Inc.

February 2002



**UTAH WATER RESEARCH LABORATORY**

# ORIFICE FLOW METER CALIBRATION

Serial Number 21-3543

Serial Number 21-3544

Serial Number 21-3545

Serial Number 21-3546

Submitted to:

Triad Measurement & Equipment, Inc.

P.O. Box 684

Humble, Texas 77338

By:

Steven L. Barfuss, P.E.

Utah Water Research Laboratory

8200 Old Main Hill

Logan, UT 84322-8200

and

Utah State University Research Foundation

1780 North Research Park Way

North Logan, UT 84341

February 2002

Hydraulics Report No. 1097

## INTRODUCTION

Utah State University Research Foundation was contracted by Triad Measurement & Equipment, Inc. to perform a flow calibration at the Utah Water Research Laboratory (UWRL) in Logan, Utah on four orifice flow meters manufactured by Triad. The pipe I.D. and the orifice bore (throat) for each meter was: (SN21-3543) 7.987 inches, 5.5848 inches; (SN21-3544) 7.985 inches, 5.5848 inches; (SN21-3545) 7.9760 inches, 5.5848 inches; and (SN21-3546) 7.9870 inches, 5.5848 inches. Each orifice tube assembly was approximately 18 feet long. A cold-water test was performed to determine the discharge coefficient for the meter.

## EXPERIMENT SETUP

The 8-inch orifice meter assemblies were installed in the laboratory's 12-inch test line. Standard wall 12-inch piping was used both upstream (~30 feet) and downstream (~15 feet) from each meter spool. Laboratory instrumentation was connected to flange pressure taps on each meter for differential pressure measurements.

## FLOW COEFFICIENT

The meter coefficient C was calculated using the following equation:

$$C = \frac{Q\sqrt{1-\beta^4}}{A_o\sqrt{(2g\Delta H)}}$$

in which Q is the actual flow rate in cubic feet per second,  $A_o$  is the area of the meter's throat in square feet, g is the acceleration of gravity (32.17 feet per second squared), and  $\Delta H$  is the meter differential pressure reading in feet of water. The orifice beta ratio ( $\beta$ ) is defined as the ratio of the meter's throat diameter to the meter's inlet diameter.

## PROCEDURE

Water was supplied to the test line using a 1770rpm 100hp pump. The flow rate and differential pressure were measured for each run. The water temperature was also measured. Pressure

measurements were taken from the flange taps opposite the tab on the orifice plate. A “C” was stamped into the flange next to the calibrated pressure taps.

Flow measurements were made using the laboratory’s volumetric tanks and weigh tanks. The volumetric and weigh tanks are primary flow measurement devices that are regularly calibrated and are traceable to the National Institute of Standards and Technology.

Orifice meter differentials were measured using both standard U-tube manometers filled with either Meriam Blue fluid (s.g. 1.75 @ 55°F) or mercury (s.g. 13.56 @ 55°F), readable to the nearest 0.5 millimeter, and a Rosemount differential transmitter. Parallel measurements of the transmitter reading and the manometer differential were made to ensure accuracy. The manometers and Rosemount transmitters were referenced to zero at a no flow condition prior to any data collection. The transmitter output was averaged during each individual run using an averaging Fluke volt/amp meter. Measurements were immediately fed into a computer to display deviations in test results before any flow change was made.

## **RESULTS**

Tables 1 through 4 summarize the test results for each meter (SN#21-3543, SN#21-3544, SN#21-3545, SN#21-3546). Figures 1 through 4 are plots of the Reynolds number versus the meter discharge coefficient.

**Table 1. Utah Water Research Laboratory Flow Meter Calibration Data**

Meter Manufacturer: Triad	Throat Diameter (in.) =	5.5848
Calibration Date: 10/12/2001	Beta Ratio =	0.6992
Meter Calibration Location: 12-inch line	Inlet Diameter (in.) =	7.9870
Purchase Order: #9091	Nominal Pipe dia. =	8-inch
Serial Number: #21-3543	Pipe Diameter (in.) =	7.987
Project name: Interger Bechtel#1		
	Water Temperature (F) =	44.0
	Water Unit Weight( pcf) =	62.42
	Kinematic viscosity (ft <sup>2</sup> /s) =	1.57E-05

Pipe Setup

Upstream: Std wall pipe

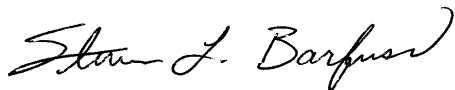
Downstream: Std wall pipe

Calibration Performed by: R.J. Geldmacher

Run No.	Flow (gpm)	Orifice $\Delta P$ (in. H <sub>2</sub> O)	Pipe Reynolds Number	C	Dev from mean (%)	Maximum Uncertainty in C (%)
1	2	3	4	5	6	7
1	3809.14	972.50	1,035,365	0.6027	-0.34%	0.15%
2	3546.24	841.88	963,908	0.6030	-0.28%	0.16%
3	3215.42	693.13	873,987	0.6026	-0.35%	0.16%
4	2950.39	583.13	801,948	0.6028	-0.31%	0.16%
5	2628.60	462.50	714,481	0.6031	-0.27%	0.17%
6	2275.55	347.50	618,520	0.6023	-0.40%	0.18%
7	1938.94	252.00	527,024	0.6026	-0.34%	0.16%
8	1662.48	185.06	451,881	0.6030	-0.29%	0.16%
9	1311.37	114.38	356,446	0.6050	0.05%	0.18%
10	969.34	62.11	263,478	0.6069	0.36%	0.16%
11	631.51	26.16	171,651	0.6092	0.75%	0.18%
12	380.67	9.38	103,469	0.6134	1.44%	0.18%

Average coefficient : **0.6047**  
Standard deviation : **0.0035**

Certified by:



Steven L. Barfuss P.E.  
Senior Engineer

All measurement equipment used for this calibration is regularly calibrated to NIST (available upon request).  
Total measurement uncertainty is less than 0.25%.

**Table 2. Utah Water Research Laboratory Flow Meter Calibration Data**

Meter Manufacturer: Triad  
Calibration Date: 1/14/2002  
Meter Calibration Location: 12-inch line  
Purchase Order: #9091-2  
Serial Number: #21-3544  
Project name: Interger Bechtel#2

Throat Diameter (in.) = 5.5848  
Beta Ratio = 0.6994  
Inlet Diameter (in.) = 7.9850  
Nominal Pipe dia. = 8-inch  
Pipe Diameter (in.) = 7.985

Pipe Setup

Upstream: Std wall pipe  
Downstream: Std wall pipe

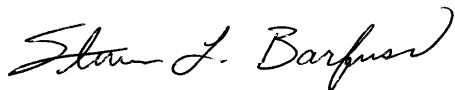
Water Temperature (F) = 38.0  
Water Unit Weight( pcf) = 62.43  
Kinematic viscosity (ft<sup>2</sup>/s) = 1.73E-05

Calibration Performed by: J.Nunley

Run No.	Flow (gpm)	Orifice $\Delta P$ (in. H <sub>2</sub> O)	Pipe Reynolds Number	C	Dev from mean (%)	Maximum Uncertainty in C (%)
1	2	3	4	5	6	7
1	3821.52	985.00	940,615	0.6007	-0.50%	0.15%
2	3540.41	845.00	871,424	0.6008	-0.47%	0.16%
3	3214.35	695.63	791,169	0.6012	-0.41%	0.16%
4	2914.51	570.63	717,367	0.6019	-0.30%	0.16%
5	2565.47	442.50	631,455	0.6016	-0.34%	0.17%
6	2253.10	340.63	554,571	0.6022	-0.24%	0.19%
7	1946.11	253.88	479,009	0.6025	-0.19%	0.16%
8	1624.66	176.81	399,889	0.6028	-0.15%	0.16%
9	1299.76	113.06	319,918	0.6030	-0.11%	0.18%
10	971.34	62.58	239,081	0.6057	0.34%	0.16%
11	651.80	27.94	160,431	0.6083	0.77%	0.18%
12	325.56	6.86	80,131	0.6132	1.58%	0.20%

Average coefficient : **0.6037**  
Standard deviation : **0.0037**

Certified by:



Steven L. Barfuss P.E.  
Senior Engineer

All measurement equipment used for this calibration is regularly calibrated to NIST (available upon request).  
Total measurement uncertainty is less than 0.25%.

**Table 3. Utah Water Research Laboratory Flow Meter Calibration Data**

Meter Manufacturer: Triad  
Calibration Date: 1/14/2002  
Meter Calibration Location: 12-inch line  
Purchase Order: #9091-3  
Serial Number: #21-3545  
Project name: Interger Bechtel#3

Throat Diameter (in.) = 5.5848  
Beta Ratio = 0.7002  
Inlet Diameter (in.) = 7.9760  
Nominal Pipe dia. = 8-inch  
Pipe Diameter (in.) = 7.976

Pipe Setup

Upstream: Std wall pipe  
Downstream: Std wall pipe

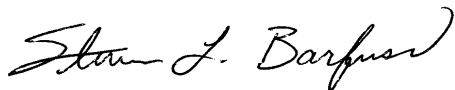
Water Temperature (F) = 38.0  
Water Unit Weight( pcf) = 62.43  
Kinematic viscosity (ft<sup>2</sup>/s) = 1.73E-05

Calibration Performed by: J.Nunley

Run No.	Flow (gpm)	Orifice $\Delta P$ (in. H <sub>2</sub> O)	Pipe Reynolds Number	C	Dev from mean (%)	Maximum Uncertainty in C (%)
1	2	3	4	5	6	7
1	3848.26	988.75	948,267	0.6033	-0.35%	0.15%
2	3556.99	844.38	876,493	0.6034	-0.33%	0.16%
3	3214.35	688.13	792,062	0.6041	-0.22%	0.16%
4	2914.51	565.63	718,176	0.6041	-0.21%	0.16%
5	2565.47	440.00	632,167	0.6029	-0.41%	0.17%
6	2253.10	338.75	555,197	0.6035	-0.32%	0.19%
7	1946.11	251.81	479,550	0.6046	-0.14%	0.16%
8	1624.66	175.31	400,340	0.6049	-0.09%	0.16%
9	1299.76	112.13	320,279	0.6051	-0.05%	0.18%
10	971.34	62.30	239,351	0.6067	0.21%	0.16%
11	651.80	27.84	160,612	0.6089	0.58%	0.18%
12	325.56	6.84	80,222	0.6135	1.33%	0.20%

Average coefficient : **0.6054**  
Standard deviation : **0.0030**

Certified by:



Steven L. Barfuss P.E.  
Senior Engineer

All measurement equipment used for this calibration is regularly calibrated to NIST (available upon request).  
Total measurement uncertainty is less than 0.25%.

**Table 4. Utah Water Research Laboratory Flow Meter Calibration Data**

Meter Manufacturer: Triad  
Calibration Date: 2/13/2002  
Meter Calibration Location: 12-inch line  
Purchase Order: #9091-4  
Serial Number: #21-3546  
Project name: Interger Bechtel#4

Throat Diameter (in.) = 5.5848  
Beta Ratio = 0.6993  
Inlet Diameter (in.) = 7.9860  
Nominal Pipe dia. = 8-inch  
Pipe Diameter (in.) = 7.986

Pipe Setup

Upstream: Std wall pipe  
Downstream: Std wall pipe

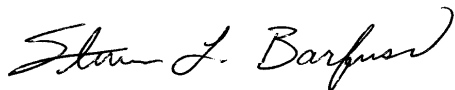
Water Temperature (F) = 38.0  
Water Unit Weight( pcf) = 62.43  
Kinematic viscosity (ft<sup>2</sup>/s) = 1.73E-05

Calibration Performed by: RJ Geldmacher, K Bringhurst

Run No.	Flow (gpm)	Orifice $\Delta P$ (in. H <sub>2</sub> O)	Pipe Reynolds Number	C	Dev from mean (%)	Maximum Uncertainty in C (%)
1	2	3	4	5	6	7
1	3842.36	983.19	945,627	0.6046	-0.29%	0.15%
2	3564.84	845.19	877,326	0.6050	-0.22%	0.16%
3	3248.56	701.31	799,488	0.6052	-0.18%	0.16%
4	2938.06	572.25	723,073	0.6059	-0.06%	0.16%
5	2545.20	431.63	626,388	0.6044	-0.31%	0.17%
6	2303.91	354.44	567,006	0.6038	-0.42%	0.18%
7	1959.67	255.13	482,287	0.6053	-0.17%	0.16%
8	1694.06	191.89	416,918	0.6034	-0.49%	0.16%
9	1294.47	111.00	318,576	0.6062	-0.02%	0.18%
10	986.99	63.97	242,904	0.6088	0.42%	0.16%
11	629.25	25.87	154,863	0.6104	0.67%	0.19%
12	337.32	7.37	83,015	0.6129	1.09%	0.20%

Average coefficient : **0.6063**  
Standard deviation : **0.0029**

Certified by:



Steven L. Barfuss P.E.  
Senior Engineer

All measurement equipment used for this calibration is regularly calibrated to NIST (available upon request).  
Total measurement uncertainty is less than 0.25%.



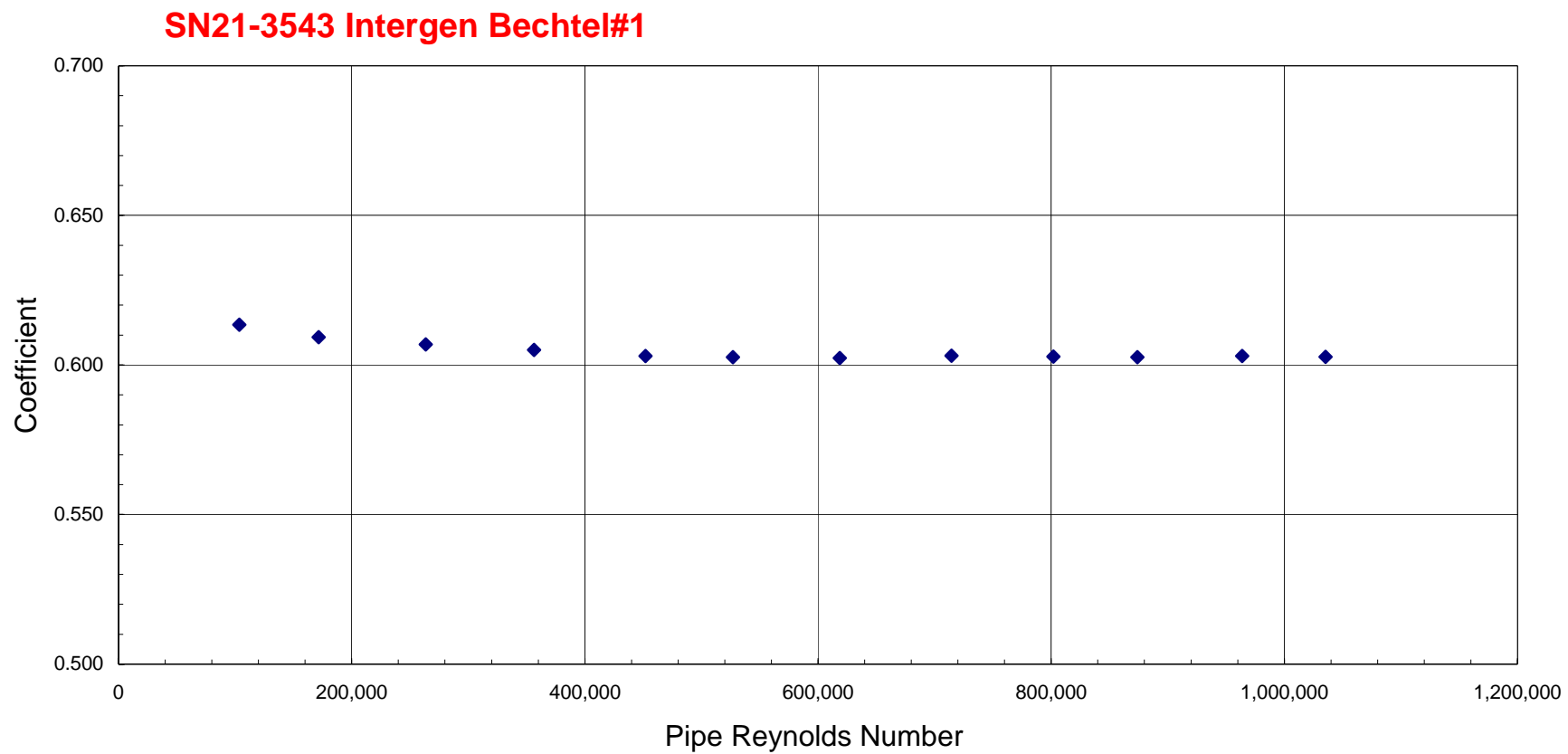


Figure 1. Discharge coefficient versus pipe Reynolds Number for meter SN#21-3543

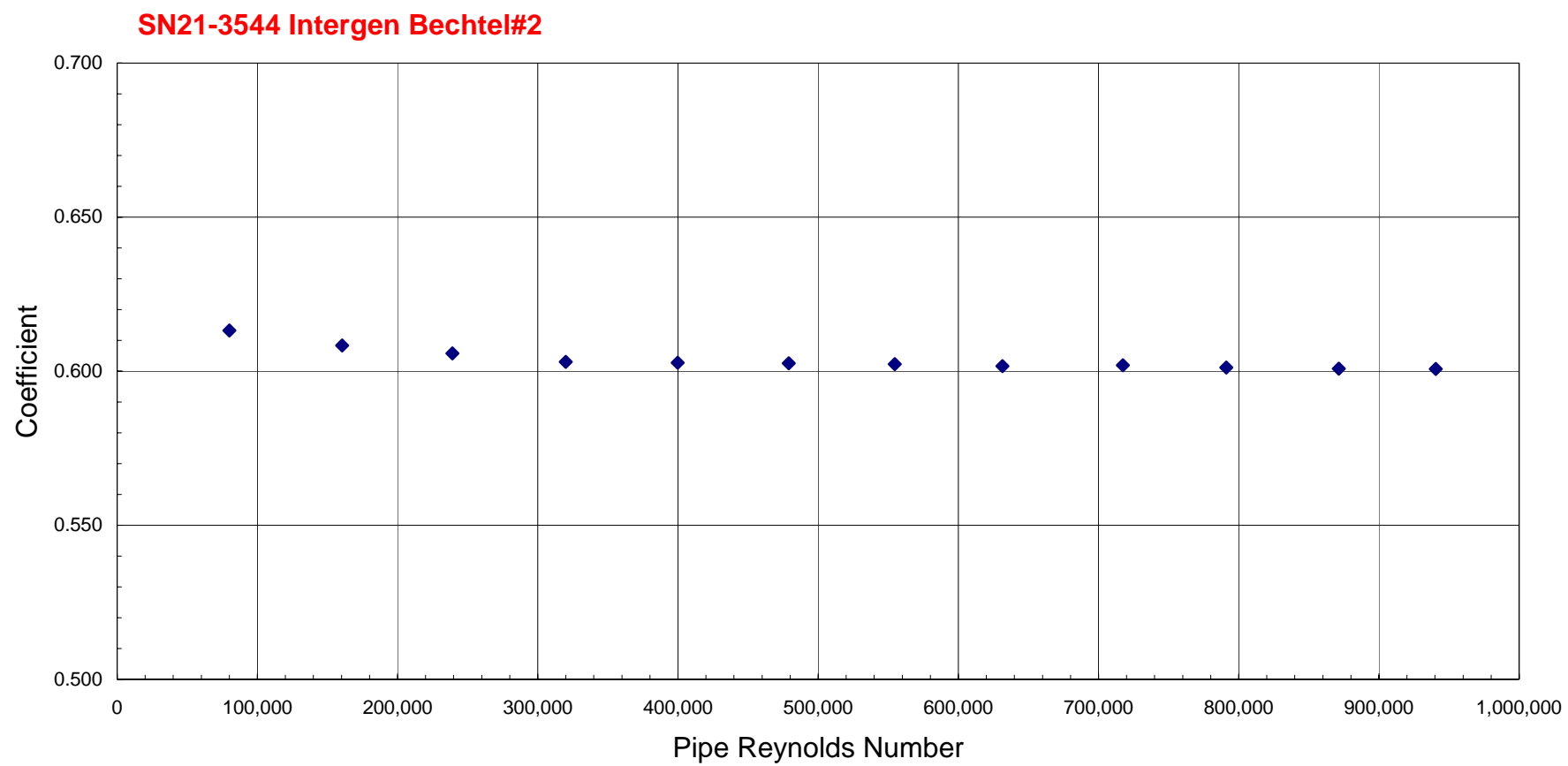


Figure 2. Discharge coefficient versus pipe Reynolds Number for meter SN#21-3544

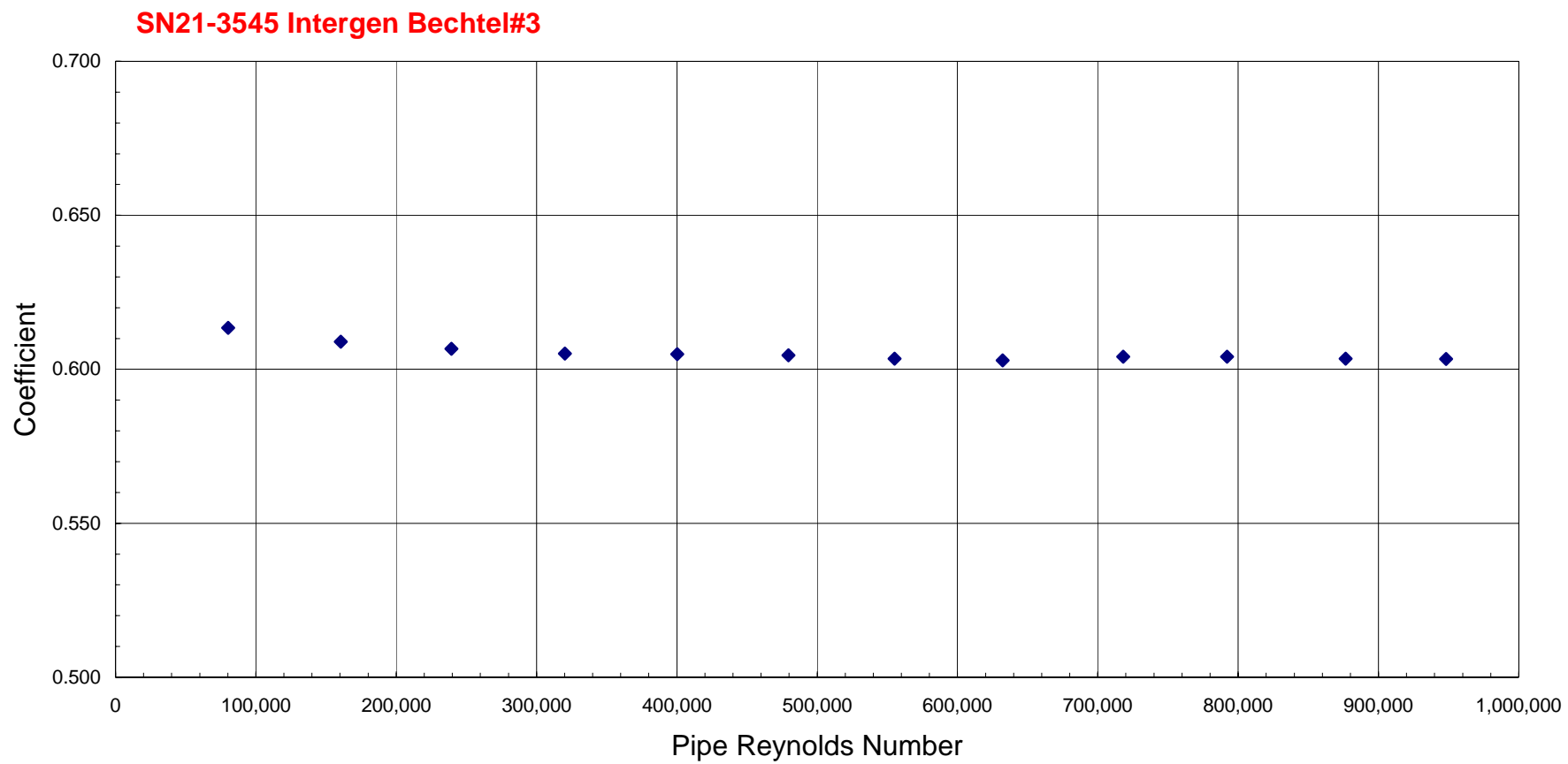


Figure 3. Discharge coefficient versus pipe Reynolds Number for meter SN#21-3545

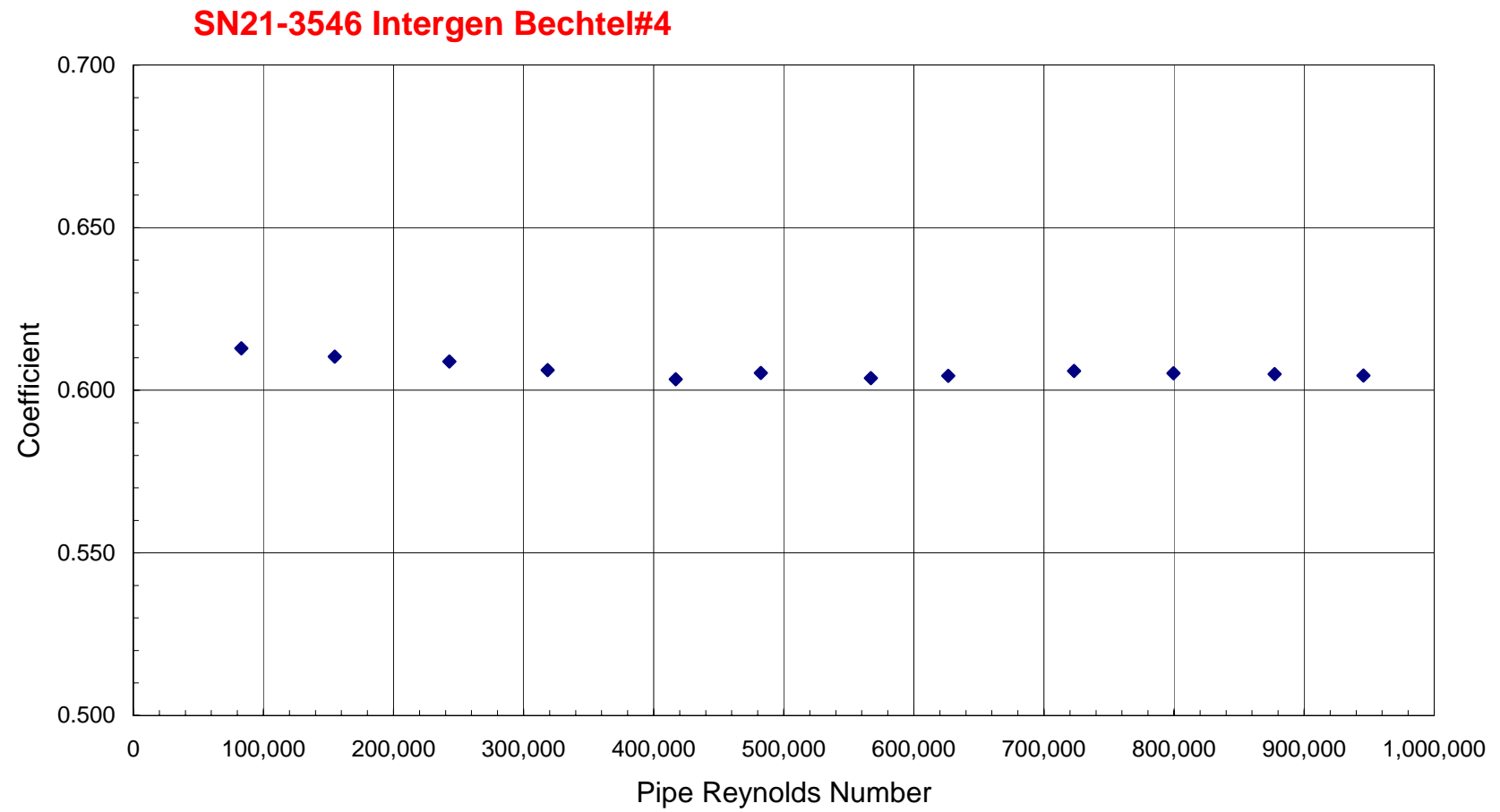


Figure 4. Discharge coefficient versus pipe Reynolds Number for meter SN#21-3546