

# **!!!DANGER!!!**

# DO NOT USE THIS EQUIPMENT TO PURGE TOXIC OR FLAMMABLE GAS

# AND

DO NOT USE THIS EQUIPMENT UNDER FLAMMABLE, VOLATILE OR TOXIC ENVIRONMENTAL CONDITIONS

## **Recortest 4 Water Jacket Cylinder Testing System**



Galiso Incorporated 22 Ponderosa Ct. Montrose, CO 81401 800-854-3789 970-249-0233

# List of Figures

- 1: Start-up and Calibration
- 2: Rec4 Settings Home Screen
- 3: Error Messaging System; REC4 Contact Information Screen
- 4: Edit Error Database
- 5: Settings Navigation
- 6: Add and Edit Calibration Cylinders
- 7: <Delete Calibration Cylinder> button
- 8: Cylinder <Serial Numbers> pre-entry method
- 9: <Customers> screen
- 11: <Codes> screen
- 12: <Pressure Units> screen
- 13: <Save> and <Save As> function
- 14: <Export Code Table>
- 15 :< Export Results>
- 16: <Delete Records>
- 17: Go to test screens
- 18: Start-up screen from R4 Settings
- 19: Choosing a calibrated cylinder
- 20: Calibration target pressure
- 21: Other qualification test parameters
- 22: <All Cal Data Ready> button
- 23: Single Jacket Data Ready
- 24: Calibration target cut-off percentage
- 25: Actual pressure and target percentage displays
- 26: <Restart>; <Start> and <Stop> buttons
- 27: Menu Line
- 28: <Data Entry> screen; Add/Edit Cylinders window
- 29: Choosing a pre-entered cylinder
- 30: <Set Manual Code> window
- 31: Pretest parameters
- 32: Qualification test parameters
- 33: <Data Entry> screen command line and jacket status information
- 34: Retesting a failed cylinder

- 35: Failed tests
- 36: Disposition codes key
- 37: <Test Results> screen
- 38: <Create Report> criteria options
- 39: Report form
- 40: <Export Report> save option
- 41: <Graph> Screen
- 42: Pressure Bleed
- 43: <Diagram> screen
- 44: <Fail Visual> screen
- 45: Error messages
- Section 2: Quick Start and Reference Guide
- Section 3: Principles and Structure
- Section 4: Instrument Detail
- Section 5: Installation and General Maintenance
- Section 6: Hardware Diagnostics and Troubleshooting

#### Introduction:

This manual is for the operator to read and study before using the Galiso model Rec4 Steel Jacket System.

Text items bracketed between these symbols, "<\_>" signify a clickable button or tab, or a text field to be entered by the operator.

#### **Operations:**

Figure 1: Start-up and Calibration

Recortest 4 Hydrotest Calibration - Operator:tjc			
REC4 Settings Ca	alibration <u>Data Entry</u> <u>Test Results</u>	<u>Graph Diagram Fail Visual</u>	Clear Log Out
1Data Ready         Customer/Manufacturer Information         Cylinder S/N         SCC9504-0211A ×         Gas Service         Qualification Test Parameters         OT Target Pressure         OT Hold Time         300         PSI         OT Target Pressure         OT Tot Exp Min         S3.7         OT Tot Exp Mex         54.7	2Data Ready Customer/Manufacturer Information Cylinder S/N SCC9504-0211A ¥ Gas Service CAL Qualification Test Parameters OTT arget Pressure 3000 ¥ PSI OT Hold Time 30 OT Fail % Perm OT Tot Exp Min 53.7 OT Tot Exp Max 54.7	3Data Ready         Customer/Manufacturer Information         Cylinder S/N       SCC9504-0211A *         Gas Service       CAL         Qualification Test Parameters         OT Target Pressure       PSI         OT Hold Time       30         OT Fail % Perm       10         OT Tot Exp Min       OT Tot Exp Mex	4Data Ready         Customer/Manufacturer Information         Cylinder S/N       SCC9504-0211A Y         Gas Service       CAL         Qualification Test Parameters         QT Target Pressure       Y         QT Hold Time       30         QT Fail % Perm       10         QT Tot Exp Min       Q
Jacket 1 Status	%     OK     Pressure       Jacket 2 Status	2 PSI 0.1 % Restart	Jacket 4 Status
Cylinder S/N	Cylinder S/N	Cylinder S/N	Cylinder S/N
Target Pressure 3000	Target Pressure 3000	Target Pressure	Target Pressure
Actual Test Press	Actual Test Press	Actual Test Press	Actual Test Press
Hold Time	Hold Time	Hold Time	Hold Time
Total Exp	Total Exp	Total Exp	Total Exp
Act % Perm	Act % Perm	Act % Perm	Act % Perm
Elastic Expansion	Elastic Expansion	Elastic Expansion	Elastic Expansion
Test Disposition	Test Disposition	Test Disposition	Test Disposition
Calibration Test Parameters	Calibration Test Parameters	Calibration Test Parameters	Calibration Test Parameters
Total Exp Min	Total Exp Min	Total Exp Min	Total Exp Min
Total Exp Max	Total Exp Max	Total Exp Max	Total Exp Max
Total Expansion -11.6	Total Expansion -13.6	Total Expansion	Total Expansion

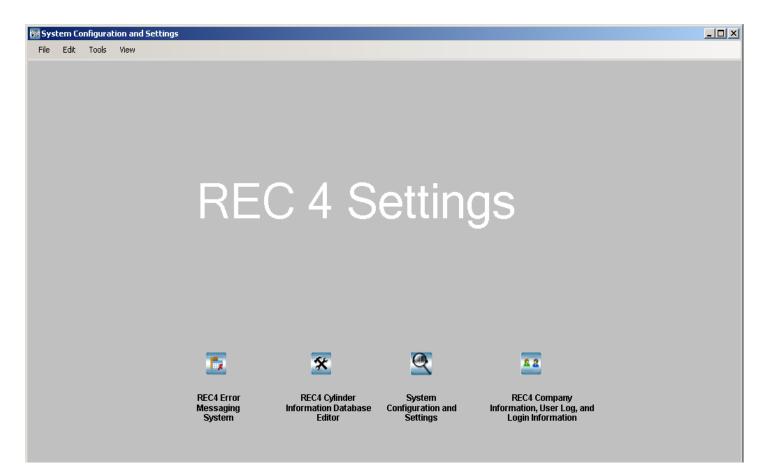
The start-up screen is the calibration screen. Here you can verify the calibration of the expansion and pressure to ensure 24 hours of accurate testing. The computer automatically calculates and adjusts the allowable minimum and maximum expansions for the pressure measured. This makes it much easier for you to verify calibration. You do not have to be perfectly accurate in hitting the pressure point because the computer calculates the allowable +/- 1% min and max expansions from the current pressure reading.

You can only access the settings program from this screen.

You can only log-off and/or close the test program from this screen.

#### Rec 4 Settings Program

Figure 2: Rec4 Settings Home Screen



The Rec4 Settings program is where all settings and user defined parameters are made. It can only be accessed through the calibration screen by permitted users. To return to the testing screens, click <Tools>, <Open Test Forms>.

Figure 3: Error Messaging System; REC4 Contact Information Screen

System Configuration and Settings			
File Edit Tools View			
REC4 Contact Information Edit Error Databas	se		
Email_Address   Title	Phone_Number	Name	
j.okulski@galiso Software Engin		John Okulski	
Email Address j.okulski@galiso.com	_		
Display Name John Okulski	_		
Title Software Engineer	_		
	_		
Phone Number 9702490233			
K K 1 M Add of			

Upon the event of an error, you may inform others via e-mail. Here is where you can input the e-mail addresses. Errors range from operator errors to machine function (system) errors.

#### Figure 4: Edit Error Database

😸 System	Configuration and Settings			_ 0
File Edi	it Tools View			
REC4 Cont	tact Information Edit Error Database			
	Description	Alternate_Description	Path	Customer_Ema_
	The REC4 System has a bowl communication failure with Bowl#1.		C:\Galiso_Wav_Files\bowl_1_comm_failure_echo.wav	
T	The REC4 System has a bowl communication failure with Bowl#2.		C:\Galiso_Wav_Files\bowl_2_comm_failure_echo.wav	
Т	The REC4 System has a bowl communication failure with Bowl#3.		C:\Galiso_Wav_Files\bowl_3_comm_failure_echo.wav	
Т	The REC4 System has a bowl communication failure with Bowl#4.		C:\Galiso_Wav_Files\bowl_4_comm_failure_echo.wav	<b>V</b>
Т	The REC4 System has a communication failure with the pressure transducer.		$C:\Galiso\_Wav\_Files\hydro\_press\_transducer\_comm\_failure\_echo.wav$	<b>V</b>
Т	The REC4 System has a communication failure between the PC and the PLC.		C:\Galiso_Wav_Files\pcplccommerror.wav	
В	3owl #1 on the REC4 system failed to stabilize.		C:\Galiso_Wav_Files\bowl_1_stable_failure_echo.wav	V
В	3owl #1 on the REC4 system has failed to zero prior to testing.		C:\Galiso_Wav_Files\bowl_1_failed_to_zero_echo.wav	
В	Bowl #2 on the REC4 system failed to stabilize.		C:\Galiso_Wav_Files\bowl_2_stable_failure_echo.wav	
Alternate E (255 Char I		Email Error Message	V	
M	<b>∢1 ▶ H</b> of			

This screen contains the error database list. The default description cannot be changed. However, you can input an alternate description in text. This will appear in a red lettered text error message on screen upon the event of the error.

There is an English speaking audible voice error report that plays in the form of a public address (PA) system, in the event of certain errors. This report may be changed to your language by recording your own .wav file and placing the filepath to it in the 'Select a .WAV file' box. You may also change it to report the error to the operator differently than the default message. Such as to include procedural steps the operator must take when receiving the particular error. For example, a 'Bowl # 1 communication error' can be customized to say, "The Rec 4 System has a communication failure with bowl #1. Please check that the bowl is powered on". In the example, the blue text was added to the audible error message. Text messages can also reflect added error information in the same manner.

If the 'Email Error Message' box is checked, upon the event of that error, everyone on the list will be notified via e-mail.

## Figure 5: Settings Navigation

🐻 Syst	em Configural	ion a	nd Settings				_ <b>_</b> ×			
File	Edit Tools	View		_						
REC4	Contact Informat		Settings Home							
			REC4 Error Database							
	Description		Code Tables		Alternate_Description Path					
•	The REC4 Sy System Configuration			with Bowl#1.		C:\Galiso_Wav_Files\bowl_1_comm_failure_echo.wav				
	The REC4 Sy		User Information	vith Bowl#2.		C:\Galiso_Wav_Files\bowl_2_comm_failure_echo.wav	V			
	The REC4 System has a bowl communication failure			with Bowl#3.		C:\Galiso_Wav_Files\bowl_3_comm_failure_echo.wav	V			
	The REC4 System has a bowl communication failure			with Bowl#4.		C:\Galiso_Wav_Files\bowl_4_comm_failure_echo.wav	V			
	The REC4 Sy	stem k	has a communication failure with I	he pressure transducer.		C:\Galiso_Wav_Files\hydro_press_transducer_comm_failure_echo.wav	V			
	The REC4 Sy	stem k	nas a communication failure betw	een the PC and the PLC.		C:\Galiso_Wav_Files\pcplccommerror.wav	V			
	Bowl #1 on th	ne REC	C4 system failed to stabilize.			C:\Galiso_Wav_Files\bowl_1_stable_failure_echo.wav	V			
	Bowl #1 on th	ne REC	C4 system has failed to zero prior	to testing.		C:\Galiso_Wav_Files\bowl_1_failed_to_zero_echo.wav	V			
	Bowl #2 on th	ne REC	C4 system failed to stabilize.			C:\Galiso_Wav_Files\bowl_2_stable_failure_echo.wav				
	lo uno u	000	SK 1 1 2 1 1 1 1 1 1	e a las						
Defau	lt Description	The F	REC4 System has a bowl commur	nication failure with Bowl#	<sup>1.</sup> Select a .WAV File.	C:\Galiso_Wav_Files\bowl_1_comm_failure_echo.wav	e			
(255 0	ate Description (har Max).				Email Error Message					
<u> </u>	• • 1	•	▶ of							

The <view> drop down menu shows the above options. From here, you can navigate to other screens in the R4 settings program.

#### <CAL Cylinders> screen

Figure 6: Add and Edit Calibration Cylinders

You can store all of the pertinent test data for the calibrated cylinders as shown above. The cylinder pressure points and expansions are saved for quick report of calibration. Using the <Select CAL Jacket> field you can verify the calibration on both jackets at the same time with 2 calibrated cylinders.

Use the <Save> button to save the cylinder information shown.

<sup>2</sup> Untitled1 - OpenOffice.org Writer          Eile Edit View Insert Format Table Iools Window Help <sup>2</sup> → Ø III 20   100	・◈│┑・┍┙╴│魯⊞・୰│船⊘│ ॼВ/凵╷═ॾॾ∣╔ः	â III ¶ Q   Q ,		<u> </u>
		₽ŧ₽ŧ₽∣ <mark>≜</mark> ĭ <sup>™</sup> ĭ⊠ĭ.		
System Configuration and Settings				<u>_   X</u> <u>, ' · · · · <u>, 7 · · · ·</u> <u>^</u></u>
· File Edit Tools View				
CAL Cylinders Serial Numbers Customers Ma	nufacturers Codes Pressure Units			
Select CAL S/N SCC9504-02		Edit Calibration Cylinder	Delete Calibration Cylinder	
	-	Tradit For Min   Tradit	Ere Mary Mary Dame Hal	
Target_Pressure	Pressure_Unit Hold_Time PSI 30	Total_Exp_Min Total 53.7 54.7	Exp_Max Max_Perm_Hole 60	
3360	PSI 30	53.7         54.7           60.1         61.3	60	
- 3695	PSI 30	66.2 67.4	60	
3775	PSI 30	67.6 68.8	60	
4000	PSI 30	71.7 73.1	60	
∾ 5000	PSI 30	80 5 91 3	60	
5833	PSI Delete calibration cylinder	×	00	
6000	PSI Do you want to de	lete calibration cylinder SCC9504-0211A?	60	
7200	PSI ····		60 60	
* 7500	Yes Yes	No	00	
	l de la companya de la compa			
·				
				×
				0
4				* 4 0 7
Page 10 / 10 Defa	ult	150% INSRT STD HY	p *	

# Figure 7: <Delete Calibration Cylinder> button

This is self explanatory. You can delete all calibration cylinder data on the selected cylinder.

#### Figure 8: Cylinder <Serial Numbers> pre-entry method

File			n and Setti View	ngs							<u>-     ×</u>
	vlinders			tomers Manufa	cturers Codes F	ressure Units					
										_	
	Seria	Number	Owner	GasType	Manufacturer	Manufacturer	Date Code	Mutliport MPPos	JacketPos		
<u> </u>	linder I	nforme	ation (Req	uired)	Multiport	Information	(Optional)				 
Cyl	inder S /				Mulitport C	vlinder 🗖					
	stomer s Type	A	quasport	<u> </u>	Mulitport P Jacket Pos		<u>•</u>				
	nufacture	er Lu	uxfer	<u> </u>							
	nu Date										
Co	de	E		•							
K	• 0	•	Add	of							

This screen allows you to enter the test criteria for multiple cylinders, <u>pre-test</u>, for efficient data entry during testing. You can line up cylinders during a downtime, or a shop helper can line them up and input the data at times when the test operator is away from the machine. Then you can load the next cylinder into the jacket, and select the next cylinder serial number on the list, and start the test, instead of searching for the test criteria for the next cylinder while you are testing other cylinders. Pre-test data entry allows you to find 'problem' cylinders that you cannot read the stamping marks, etc... without slowing you down to do it during testing.

It also makes a provision for using the Galiso multiport head to load multiple (up to 4) cylinders into the jacket at the same time. Just switch the hi-pressure hose from one cylinder to the next. Select the correct <Multiport Position> in the program, and start the test.

#### Figure 9: <Customers> screen

	em Configuration ar		_[0]
	Edit Tools View		
CAL Cy	linders Serial Numbe	ers Customers Manufacturers Codes Pressure Units	
	Customer_Code		
•	A1	Aquasport	
	Z1	De Zeeman	
	C1	Cuylaerts	
	T1	Time to Dive	
	H1	Hydrex	
	P1	Punt Alfa	
	Bstn	brandw.St.Niklaas	
	B1	BTV	
	A1	Asahi	
	S1	Scuba	
K	<u>41 ) N</u>	Addof	

You can make a short code for easy test data entry of all your customers. Enter the short code and the program enters that customer in the <Customers> field on the test screen.

#### Figure 10: <Manufacturers> tab

🚟 Sys	stem Configuration and	d Settings				
File	Edit Tools View					
CAL	Cylinders Serial Number:	s Customers Manufaci	urers Codes Pressure Units			
	·					
	Manufacturer_Code	Manufacturer	4	]		
•	L	Luxfer		1		
	м	MCS				
	D	Draeger				
	F	Faber				
	н	Heiser				
	IW	IWKA				
	MN	Mannesmann				
	R	Roth				
	W	Worthington	_			
	0	Onbekend				
-	<u> 4                                    </u>	Add of				

You can make a short code for easy test data entry of all your manufacturers. Enter the short code and the program enters that manufacturer in the <Manufacturers> field on the test screen.

# Figure 11: <Codes> screen

🚟 Syste	em Configu	uration and Sel	ttings							
File	Edit Too	ols View								
CAL Cy	linders Se	erial Numbers C	ustomers Manufa	acturers Codes	Pressure Units					
	Code	Dimension	DOT_Rating	REE_Source	Liner_Type	PT_Target_Pressure	PT_Hold_Time	PT_REE	PT_Fail_Prm	QT_Target_Pressure
	E	4.25x25.75	3AA-2015	C5						3360
	D	4.25x16.75	3AA-2015	C5						3360 -
	В	3.25x13	3AA-2015	C5						3360
	A1	5.25x13.87	3AA-2015	C5						3360
	A2	5.25x14.87	3AA-2015	C5						3360
	A3	6.25x21	34-2015	C5					_	3360
	A4	6.75x18.5	3AA-2015	C5					_	3360
	A5	5.37x37	3AA-2015	C5						3360
	A6	5.75x32	3AA-2015	C5						3360
•		7.05	044-001E	LOT.			1	1	1	
Cod	le	E	PT Target Pro	essure	PSI	💌 QT Target	3360	PSI 💌	Empty Weight M	in 🗌
		4.25x25.75	PT Hold Time	(sec)		QT Hold Time (sec)	30	-	Empty Weight M	ax
		34A-2015	PT REE			QT REE	23.1	-	Full Weight Min	
		C5	PT REE Min			QT REE Min		-	Full Weight Max	
			PT Fail % Perm		_	QT Fail % Prm 10		-	Full weight Max	
Lin	er Type	J	PT Max Prm Hold (sec) 15			QT Max Prm Hold (sec) 15		-	Variable Pressurize Rate Factor	
			PT Total Exp			QT Total Exp Max		-	Variable Rate 15	
			PTTotalExp		_	QT Total Exp Min		-	Factor	1.5
			FIIOGIEXP	min i		u i i otai Expinin	1			
	<b>I I I</b>	► H	Add of							

You can make a short code for easy test data entry of all your cylinder types. Enter the short code and the program enters that cylinder type in the <Cylinder Codes> field on the test screen.

#### Figure 12: <Pressure Units> screen

		Configuration ar		<u>- 🗆 ×</u>
		: Tools View		
CAL	. Cylinde	ers Serial Numbe	ers Customers Manufacturers Codes Pressure Units	
	F	Pressure_Unit	Conversion_Factor	
		PSI	1	
	K	(g/cm2	14.223	
	В	}ar	14.5038	
	M	1Pa	145.0377	
	_			
	_			
		e Units PSI		
9	Conver	sion 1		
			Di of	
			n	

You may select from the pressure units above to display and test with for the <u>test water</u> <u>pressure</u> reading. Another pressure unit may also be created by entering the conversion factor from PSI.

Any changes made to 'Grid Lines', must be saved by going to the <File> menu, and clicking <Save> or <Save As>.

System and configuration settings drop down menus.

Figure 13: <Save> and <Save As> function

	ystem Confic	uration and Se	ttinas								_ 🗆 ×
File	_	ols View									
	Save		stomers Manuf	acturers Codes	Pressure Units						
	Save As										
	Export Code	e Table	DOT_Rating	REE_Source	Liner_Type	PT_Target_Pressure	PT_Hold_Time	PT_REE	PT_Fail_Prm	QT_Target_Pressur	e 🔺
	Export Resu	ılts	3AA-2015	C5						3360	
	Log Off Cur	rent User	3AA-2015	C5						3360	
	Exit		3AA-2015	C5						3360	
	AI	0.20813.07	34A-2015	C5						3360	
	A2	5.25x14.87	3AA-2015	C5						3360	
	A3	6.25x21	3A-2015	C5						3360	
	A4	6.75x18.5	3AA-2015	C5						3360	
	A5	5.37x37	3AA-2015	C5						3360	
	A6	5.75x32	3AA-2015	C5						3360	
•		2.05	244-2015				1	1		2200	Ъ
I	Dimension DOT Rating REESource Liner Type	4.25×25.75 3AA-2015 C5	PT TotalExp PT TotalExp	rm Iold(sec) 15 Max		QT Hold Time (sec) QT REE QT REE Min QT Fail & Prm QT Max Prm Hold (s QT Total Exp Max QT Total Exp Min	23.1	-	Empty Weight Min Full Weight Max Variable Press Variable Rate Factor		

The <Save> function will always save the entire database (all grid/spreadsheet type files) to the <u>default</u> file location. The default file location cannot be changed. Please use the <Save> function after making any changes. This is the testing program database to input the correct data for testing cylinders. It saves the calibration cylinder data, serial number data, customer data, manufacturer data, and cylinder code data.

The <Save As> function enables you to **<u>back-up</u>** the same database set to another file location on your network. Please back-up the database when changes are made.



ile Edit Save	Tools View	stomers Manuf	acturers Codes	Pressure Units						
Save	As			T TOSSAIC OTIKS						
Expor	: Code Table	DOT_Rating	REE_Source	Liner_Type	PT_Target_Pressure	PT_Hold_Time	PT_REE	PT_Fail_Prm	QT_Target_Pressure	
Expor	t Results	3AA-2015	C5						3360	
Log O	ff Current User	3AA-2015	C5						3360	
Exit		3AA-2015	C5						3360	
A	0.20810.07	3AA-2015	C5						3360	
A2	5.25x14.87	3AA-2015	C5						3360	
A3	6.25x21	3A-2015	C5						3360	
A4	6.75x18.5	3AA-2015	C5						3360	
A5	5.37x37	3AA-2015	C5						3360	
AB	5.75x32	3AA-2015	C5						3360	
•	2.05	044-001E	C.F.						0000	
DOT Ra REESou Liner Ty	uce C5	PT REE PT REE Min PT Fail % Pe PT MaxPrml	erm Hold (sec) 15	=	QT REE QT REE Min QT Fail % Prm QT MaxPrm Hold (;	23.1 10 sec) 15		Full Weight Min Full Weight Max <u>Variable Press</u>	urize Rate Factor	
		PT Total Exp			QT Total Exp Max		-	Variable Rate	1.5	
		PT Total Exp			QT Total Exp Min		-	Factor	1.0	
K	<u>∢ 1 ▶ ₩</u>	Add of								

This function is to save and print the cylinder code table for the operator to have a hardcopy handy for ready reference. It is also for anyone who needs to view the table. It may be saved as a text file to use as needed.

Save As         DOT_Rating         REE_Source         Liner Type         PT_Target_Pressure         PT_Hold_Time         PT_REE         PT_Fal_Pm         QT_Target_Pressure           Export Results         3AA-2015         C5         3AA-2015         C5         3360           Log Off Current User Exit         3AA-2015         C5         3360         3360           PT         92/87/30*         3AA-2015         C5         3360           A2         5 25x14.87         3AA-2015         C5         3360           A3         6.25x21         3A-2015         C5         3360           A4         6.75x18.5         3AA-2015         C5         3360           A4         6.75x18.5         3AA-2015         C5         3360           A5         5.37x37         3AA-2015         C5         3360           A6         5.75x32         3AA-2015         C5         3360           A6         5.75x32         3AA-2015         C5         3360           A7         Target Pressure         PSI ♥ QT Target         3360           A6         5.75x32         3AA-2015         C5         90         EmptyWeight Min           Dimension         4.25x25.75         PT Hold Time(	ile Edit To Save	ools View	stomers Manufa	acturers Codes	Pressure Units					
Export Results         34A.2015         C5         Image: C5         S360           Log Off Current User Exit         34A.2015         C5         S360         S360           AA.2015         C5         S4A.2015         C5         S360           AA.2         5.25x14.87         34A.2015         C5         S360           A2         5.25x14.87         34A.2015         C5         S360           A3         6.25x21         34A.2015         C5         S370           A4         6.75x18.5         34A.2015         C5         S380           A4         6.75x18.5         34A.2015         C5         S370           A4         6.75x18.5         34A.2015         C5         S370         S360           A5         5.37x37         34A.2015         C5         S370         S360           A6         5.75x32         34A.2015         C5         S370         S360           A6         5.75x32         34A.2015         C5         S370         S360           Dimension         4.25x25.75         PT Hold Time (sec)         30         Empty Weight Max         Empty Weight Max           REESource         C5         PT REE Min         QT REE         33 <th>Save As</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>	Save As									
Lige Off Current User Exit         MA-2015         C5         Image: Control of Co	Export Code	e Table	DOT_Rating	REE_Source	Liner_Type	PT_Target_Pressure	PT_Hold_Time	PT_REE	PT_Fail_Prm	QT_Target_Pressure
Log Off Current User       3AA-2015       C5       Image: C5 </td <td>Export Resi</td> <td>ults</td> <td>3AA-2015</td> <td>C5</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>3360</td>	Export Resi	ults	3AA-2015	C5						3360
Exit     34A 2015     C5     C5     Add     3360       A1     0.2007.3x07     34A 2015     C5     C5     Add     3360       A2     5.25x14.87     34A 2015     C5     C5     Add     3360       A3     6.25x21     34A 2015     C5     C5     Add     3360       A4     6.75x18.5     34A 2015     C5     C5     Add     3360       A5     5.37x37     34A 2015     C5     C5     Add     3360       A6     5.75x32     34A 2015     C5     C5     Add     Add       Dimension     4.25x25.75     PT Hold Time (sec)     300     PSI V     Empty Weight Max       D0T Rating     34A 2015     PT REE     QT REE     331     Full Weight Max       Liner Type     PT Fail 2 Perm     QT Fail 2 Prm     10       PT Max Prm Hold (sec)     15     QT Max Prm Hold (sec)     15     Variable Pressurize Rate Factor       Yariable Pressurize Rate Factor     QT Total Exp Max     In     In	Log Off Cur	rent User	<sup>2</sup> 3AA-2015	C5						3360
A1       324.2015       C5       3360       3360         A2       5.25x14.87       3A4.2015       C5       1       1       1       3360         A3       6.25x21       3A-2015       C5       1       1       1       3360         A4       6.75x18.5       3A4.2015       C5       1       1       1       3360         A5       5.37x37       3A4.2015       C5       1       1       1       3360         A6       5.75x32       3A4.2015       C5       1       1       1       3360         Code       E       PT Target Pressure       PSI ▼ gT Target       3360       PSI ▼ gt mpt Weight Mn       1         Dimension       4.25x25.75       PT Hold Time (sec)       QT REE       QT REE       23.1       Full Weight Max       1         REE Source       C5       PT REE Min       QT REE       23.1       Full Weight Max       1         Liner Type       PT Fail 2 Perm       QT Max PrmHold [sec)       15       Variable Pressurize Rate Factor         PT TotalExp Max       I5       QT TotalExp Max       I5       Variable Rate Factor			3AA-2015	C5						3360
A3       6.25x21       3A-2015       C5       Image:		3.23813.07	3AA-2015	C5						3360
A4       6.75x18.5       3AA.2015       C5       Image: C5       Image	A2	5.25x14.87	3AA-2015	C5						3360
A5       5.37x37       3AA.2015       C5       Image:	A3	6.25x21	3A-2015	C5						3360
A6       5.75x32       3AA.2015       C5       01       01       3360         A7       3.95       01A.2015       C5       01       01       01       01       0200<	A4	6.75x18.5	3AA-2015	C5						3360
A 2 000       PT Target Pressure       PSI v QT Target       3360       PSI v EmptyWeight Min         Dimension       4.25x25.75       PT Hold Time (sec)       QT Hold Time (sec)       30       EmptyWeight Max         DOT Rating       3AA-2015       PT REE       QT REE       23.1       Full Weight Min         REE Source       C5       PT Fail & Perm       QT Fail & Prm       10         Liner Type       PT Fail & Perm       QT Max Prm Hold (sec)       15       Variable Pressurize Rate Factor         PT TotalExp Max       QT TotalExp Max       QT TotalExp Max       1.5       Factor	A5	5.37x37	3AA-2015	C5						3360
Code       E       PT Target Pressure       PSI v       QT Target       3360       PSI v       EmptyWeight Min       Image: Constraint of the sector of	A6	5.75x32	3AA-2015	C5						3360
Code       E       PT Target Pressure       PSI v gT Target       3360       PSI v Empty Weight Min         Dimension       4.25x25.75       PT Hold Time (sec)       0       Empty Weight Max       Empty Weight Max         DOT Rating       34A-2015       PT REE       QT REE       23.1       Full Weight Max         REE Source       C5       PT REE Min       QT REE Min       Full Weight Max         Liner Type       PT Fail & Perm       QT Fail & Prm       10         PT Max Prm Hold (sec)       15       Variable Pressurize Rate Factor         PT TotalExp Max       QT TotalExp Max       Variable Rate       1.5	1 1.7	7.05	244-201E							2000
	REESource		PT REE Min PT Fail % Pe PT Max Prm H PT Total Exp	lold(sec) 15 Max		QT REE Min QT Fail % Prm QT Max Prm Hold ( QT Total Exp Max	10	-	Full Weight Max <u>Variable Press</u> Variable Rate	surize Rate Factor

#### Figure 15:<Export Results>

This function allows you to back-up the test results file for remote or duplicate storage. Upon execution of exporting the results, it will ask you if you want to remove the results from the current data base. Galiso recommends backing up the results and removing them from the current data base once per month, or periodically at your convenience.

#### Figure 16: <Delete Records>

[ 🚟 System Configuration an	nd Settings		
File Edit Tools View			
CAL C 🗙 Delete Records	omers Manufacturers Codes Pressure Uni	its	
Manufacturer_Code	Manufacturer		
L	Luxfer		
М	MCS		
D	Draeger		
F	Faber		
Н	Heiser		
IW	IWKA		
► MN	Mannesmann		
B	Roth		
W	Worthington		
0	Onbekend	<b>•</b>	
Manu Code MN			
Manufacturer Mannes	mann		
₩ ₹ 7 → →	Add of		

Unused, or unwanted data base items can be deleted here. Simply go to the desired data base (customer, manufacturer, etc...), make the desired record/item selections, and use the <Delete Records> button.

Figure 17: Go to test screens:

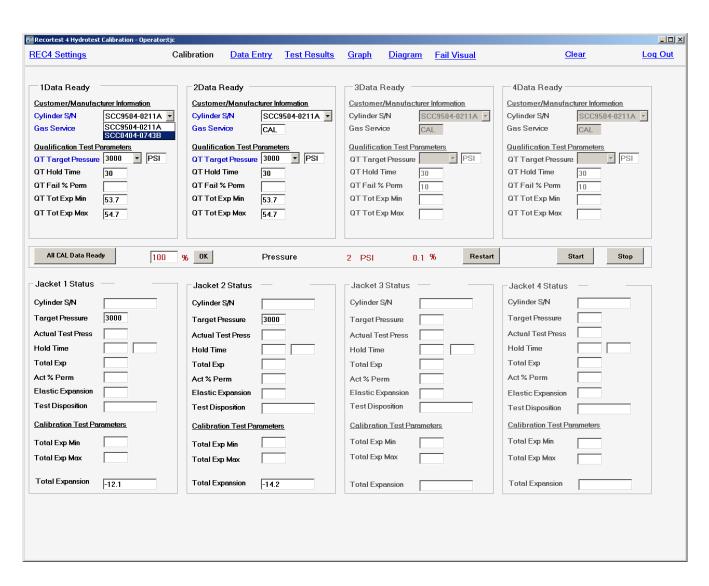
Pie Edt   Cytinder Open Test Forms     Manufactures Code     Manufactures Code     M MCS   D Draeges   F Felse   H Heiser   V WKA   NMN Manufactures   Ontbekend		em Configuration and 9	ettings	
Manufacturer_Code Manufacturer   L Luxfer   M MCS   D Draeger   F Faber   H Heiser   W WKA   MN Mannesmann   R Roh   W Worthington   O Onbekend	File	Edit Tools View		
Manufacturer_Code Manufacturer   L Luxfer   M MCS   D Draeger   F Faber   H Heiser   W WKA   MN Mannesmann   R Roth   W Worthington   D Dnbekend	CAL C	ylinders Open Test Fi	orms Manufacturers Codes Pressure Units	
L Luxfer   M MCS   D Draeger   F Faber   H Heiser   IW IV/KA   MN Mannesmann   R Roth   U Worthington   D Onbekend				
M MCS   D Draeger   F Faber   H Heiser   IW IWKA   MN Mannesmann   R Roth   W Worthington   D Onbekend		Manufacturer_Code	Manufacturer	
D Draeger   F Faber   H Heiser   W IwKA   MN Mannesmann   R Roth   W Worthington   D Onbekend		L	Luxfer	
F Faber   H Heiser   W IVKA   MN Mannesmann   R Roth   W Worthington   O Onbekend		м	MCS	
H Heiser   W Iv/KA   MN Mannesmann   R Roth   W Worthington   D Onbekend		D	Draeger	
W       IWKA         MN       Mannesmann         R       Roth         W       Worthington         D       Onbekend         ManuCode       MN         Manufacturer       Mannesmann		F	Faber	
MN       Mannesmann         R       Roth         W       Worthington         0       Onbekend         ManuCode       MN         Manufacturer       Mannesmann		Н	Heiser	
R Roth   W Worthington   D Onbekend     ManuCode MN   Manufacturer Mannesmann		IW	IWKA	
W     Worthington       D     Onbekend       ManuCode     MN       Manufacturer     Mannesmann	Þ		Mannesmann	
D     Onbekend       ManuCode     MN       Manufacturer     Mannesmann				
ManuCode MN Manufacturer Mannesmann				
Manufacturer		0	Onbekend 🗸	
	<u> </u>	<u>  ∢ 7 ▶ भ</u>	Add of	

To navigate back to the test screens, use the <Tools> menu, and click the <Open Test Forums> button.

	Calibration <u>Data Entry</u> <u>Test Result</u>	<u>is Graph Diagram Fail Visual</u>	<u>Clear</u> Log (
1Data Ready	2Data Ready	3Data Ready	4Data Ready
Customer/Manufacturer Information	Customer/Manufacturer Information	Customer/Manufacturer Information	Customer/Manufacturer Information
Cylinder S/N SCC9504-0211A	Cylinder S/N SCC9504-0211A	Cylinder S/N SCC9504-0211A -	Cylinder S/N SCC9504-0211A 💌
Gas Service CAL	Gas Service CAL	Gas Service CAL	Gas Service CAL
Qualification Test Parameters	Qualification Test Parameters	Qualification Test Parameters	Qualification Test Parameters
QT Target Pressure 3000 V PSI		QT Target Pressure	QT Target Pressure
QT Hold Time 30	QT Hold Time 30	QT Hold Time 30	QT Hold Time 30
QT Fail % Perm	QT Fail % Perm	QT Fail % Perm	QT Fail % Perm 10
QT Tot Exp Min 53.7	QT Tot Exp Min 53.7	QT Tot Exp Min	QT Tot Exp Min
QTTotExpMax 54.7	QT Tot Exp Max 54.7	QT Tot Exp Max	QT Tot Exp Max
I			
All CAL Data Ready	% OK Pressure	2 PSI 0.1 % Restart	Start Stop
Jacket 1 Status Cylinder S/N Target Pressure 3000	Jacket 2 Status Cylinder S/N Target Pressure 3000	Jacket 3 Status Cylinder S/N Target Pressure	Jacket 4 Status Cylinder S/N Target Pressure
Actual Test Press	Actual Test Press	Actual Test Press	Actual Test Press
Hold Time	Hold Time	Hold Time	Hold Time
Total Exp	Total Exp	Total Exp	Total Exp
Act % Perm	Act % Perm	Act % Perm	Act % Perm
Elastic Expansion	Elastic Expansion	Elastic Expansion	Elastic Expansion
Test Disposition	Test Disposition	Test Disposition	Test Disposition
Calibration Test Parameters	Calibration Test Parameters	Calibration Test Parameters	Calibration Test Parameters
Total Exp Min	Total Exp Min	Total Exp Min	Total Exp Min
i utai Exp Milli	Total Exp Max	Total Exp Max	Total Exp Max
Total Exp Max			

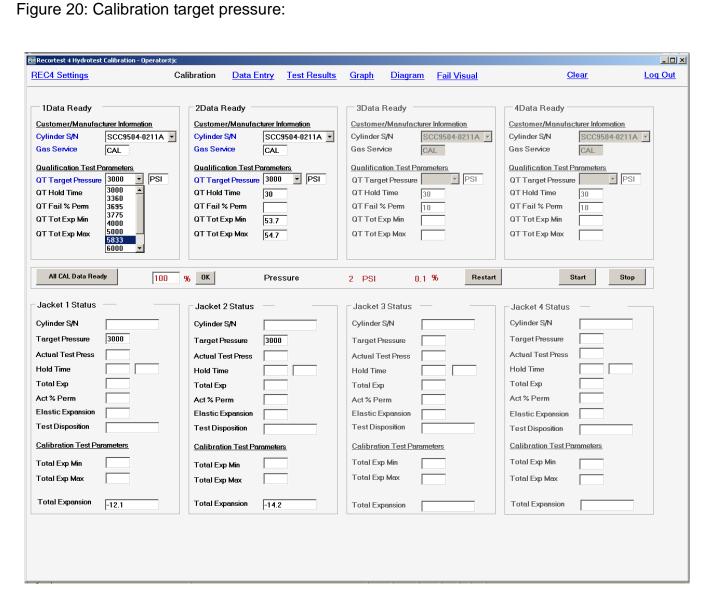
Figure 18: Start-up screen from R4 Settings:

The calibration screen displays when first navigating to the test screens. This is the screen used when performing your daily calibration verification tests. Galiso recommends you adhere to the testing authority calibration verification regulations for the cylinders being tested.



#### Figure 19: Choosing a calibrated cylinder:

Here you may choose the calibrated cylinder for the jacket to be verified.



You can select the pressure for calibration verification. Galiso recommends verifying within 500 PSI of the test pressure for every cylinder to be tested that day.

REC4 Settings	Calibration Data Entry Test Results	<u>Graph Diagram Fail Visual</u>	<u>Clear</u> Loq Ou
IData Ready         Customer/Manufacturer Information         Cylinder S/N       SCC9504-0211A ≤         Gas Service       CAL         Qualification Test Parameters       CAT arget Pressure         QAT Hold Time       SO         QAT Hold Time       SO         QAT Hold Time       SO         QAT Hold Time       SO         QAT Tot Exp Min       53.7         QAT Tot Exp Max       54.7	2Data Ready Customer/Manufacturer Information Cylinder S/N SCC9504-0211A Gas Service CAL Qualification Test Parameters OT Target Pressure 3000 OT Hold Time 30 OT Fail % Perm OT Tot Exp Min 53.7 OT Tot Exp Mex 54.7	3Data Ready         Customer/Manufacturer Information         Cylinder S/N       SCC9504-0211A         Gas Service       CAL         Qualification Test Parameters         QT Target Pressure       PSI         QT Hold Time       30         QT Fail % Perm       10         QT Tot Exp Min       Intervention	4Data Ready <u>Customer/Manufacturer Information</u> Cylinder S/N SCC9504-0211A Gas Service CAL <u>Qualification Test Parameters</u> QT Target Pressure QT Target Pressure QT Fail % Perm 10 QT Tot Exp Min QT Tot Exp Max
All CAL Data Ready 100	% OK Pressure	2 PSI 0.1 % Restart	Start Stop
Jacket 1 Status Cylinder S/N Target Pressure 3000 Actual Test Press Hold Time Total Exp Act % Perm Elastic Expansion Calibration Test Parameters Total Exp Min Total Exp Max Total Expansion -12.1	Jacket 2 Status         Cylinder S/N         Target Pressure         3000         Actual Test Press         Hold Time         Total Exp         Act % Perm         Elastic Expansion         Test Disposition         Calibration Test Parameters         Total Exp Min         Total Exp Max         Total Expansion	Jacket 3 Status         Cylinder S/N         Target Pressure         Actual Test Press         Hold Time         Total Exp         Act % Perm         Elastic Expansion         Test Disposition         Calibration Test Parameters         Total Exp Min         Total Exp Max         Total Expansion	Jacket 4 Status         Cylinder S/N         Target Pressure         Actual Test Press         Hold Time         Total Exp         Act % Perm         Elastic Expansion         Test Disposition         Calibration Test Parameters         Total Exp Min         Total Exp Max         Total Expansion

Figure 21: Other qualification test parameters:

All test parameters for the cal cylinder serial number are entered automatically from the code table data base. You can manually change the parameters in each field before testing if needed. The target pressure can be selected by clicking the <down arrow> as outlined in Green above. The default pressure is already selected to 3000PSI.

# Command line options: Figure 22: <All Cal Data Ready> button:

	Calibration Data Entry Test Results	<u>s Graph Diagram Fail Visual</u>	Loq Out
1Data Ready         Customer/Manufacturer Information         Cylinder S/N       SCC9504-0211A         Gas Service       CAL         Qualification Test Parameters         QT Target Pressure       3000 y         QT Hold Time       30	2Data Ready Customer/Manufacturer Information Cylinder S/N SCC9504-0211A Gas Service CAL Qualification Test Parameters OT Target Pressure 3000 OT Hold Time 30	3Data Ready Customer/Manufacturer Information Cylinder S/N SCC9504-0211A × Gas Service CAL Qualification Test Parameters OT Target Pressure × PSI OT Hold Time 30	4Data Ready Customer/Manufacturer Information Cylinder S/N SCC9504-0211A Gas Service CAL Qualification Test Parameters QT Target Pressure PSI QT Hold Time 30
QT Fail % Perm QT Tot Exp Min 53.7 QT Tot Exp Max 54.7	QT Fail % Perm QT Tot Exp Min 53.7 QT Tot Exp Max 54.7	QT Fail % Perm 10 QT Tot Exp Min QT Tot Exp Mex	QT Fail % Perm 10 QT Tot Exp Min QT Tot Exp Max
All CAL Data Ready 100	% OK Pressure	2 PSI 0.1 % Restart	Jacket 4 Status
Cylinder S/N 3000 Target Pressure 3000 Actual Test Press Hold Time Total Exp Act % Perm	Cylinder S/N     3000       Target Pressure     3000       Actual Test Press     1       Hold Time     1       Total Exp     1       Act % Perm     1	Cylinder S/N       Target Pressure       Actual Test Press       Hold Time       Total Exp       Act % Perm       Elastic Expansion	Sacker + Status       Cylinder S/N       Target Pressure       Actual Test Press       Hold Time       Total Exp       Act % Perm       Elastic Expansion
Elastic Expansion	Elastic Expansion		Eldotte Expansion

You must inform the testing program that all of the test data is entered correctly. If both jackets have cal cylinders in place, and are testing the same pressure, you may use this button. The <1 Data Ready> and <2 Data Ready> text lines will turn Blue on <u>both</u> jackets when the program accepts the inputted data.

#### Figure 23: Single Jacket Data Ready:

		<u>Graph Diagram Fail Visual</u>	Clear Log Out
1Data Ready       Customer/Manufacturer Information       Cylinder S/N       SCC9504-0211A       Gas Service	2Data Ready <u>Customer/Manufacturer Information</u> Cylinder S/N SCC9504-0211A Gas Service CAL	3Data Ready <u>Customer/Manufacturer Information</u> Cylinder S/N SCC9504-0211A Gas Service CAL	4Data Ready <u>Customer/Manufacturer Information</u> Cylinder S/N SCC9504-0211A Gas Service CAL
Qualification Test Parameters       QT Target Pressure     3000 ¥       QT Hold Time     30       QT Fail % Perm     30       QT Tot Exp Min     53.7       QT Tot Exp Max     54.7	Qualification Test ParametersQT Target Pressure3000 •PSIQT Hold Time30QT Fail % Perm0QT Tot Exp Min53.7QT Tot Exp Max54.7	Qualification Test Parameters.       QT Target Pressure       QT Hold Time       30       QT Fail % Perm       10       QT Tot Exp Max	Qualification Test Parameters       QT Target Pressure       QT Hold Time       30       QT Fail % Perm       10       QT Tot Exp Max
All CAL Data Ready	% OK Pressure	2 PSI 0.1 % Restart	Start Stop
Jacket 1 Status Cylinder S/N Target Pressure 3000 Actual Test Press Hold Time Total Exp Act % Perm Elastic Expansion Test Disposition Calibration Test Parameters Total Exp Min	Jacket 2 Status         Cylinder S/N         Target Pressure         3000         Actual Test Press         Hold Time         Total Exp         Act % Perm         Elastic Expansion         Test Disposition         Calibration Test Parameters         Total Exp	Jacket 3 Status         Cylinder S/N         Target Pressure         Actual Test Press         Hold Time         Total Exp         Act % Perm         Elastic Expansion         Test Disposition         Calibration Test Parameters         Total Exp	Jacket 4 Status         Cylinder S/N         Target Pressure         Actual Test Press         Hold Time         Total Exp         Act % Perm         Elastic Expansion         Test Disposition         Calibration Test Parameters         Total Exp Min
Total Exp Max Total Expansion -12.1	Total Exp Max Total Expansion -14.3	Total Exp Max	Total Exp Max

If only one jacket is ready for calibration verification, you may select only that jacket by clicking on the <1 Data Ready> or <2 Data Ready> <u>lines of text</u> (the text lines are also buttons) <u>individually</u>. The text will turn Blue, on the jacket to be tested.

EC4 Settings	Calibration Data Entry Test Results	<u>s Graph Diagram Fail Visual</u>	<u>Clear</u> Loq Ou
1Data Ready         Customer/Manufacturer Information         Cylinder S/N       SCC9504-0211A         Gas Service       CAL         Qualification Test Parameters         QT Target Pressure       3000 y         QT Hold Time       30         QT Fail % Perm       93.7         QT Tot Exp Min       53.7         QT Tot Exp Max       54.7	2Data Ready Customer/Manufacturer Information Cylinder S/N SCC9504-0211A Gas Service CAL Qualification Test Parameters OT Target Pressue 3000 OT Hold Time 30 OT Fail % Perm OT Tot Exp Min 53.7 OT Tot Exp Max 54.7	3Data Ready         Customer/Manufacturer Information         Cylinder S/N       SCC9504-0211A y         Gas Service       CAL         Qualification Test Parameters         OT Target Pressure       PSI         OT Hold Time       30         OT Fail % Perm       10         OT Tot Exp Min	4Data Ready         Customer/Manufacturer Information         Cylinder S/N       SCC9504-0211A Y         Gas Service       CAL         Qualification Test Parameters         QT Target Pressure       Y         PSI         QT Hold Time       30         QT Tot Exp Min         QT Tot Exp Max
All CAL Data Ready	% OK Pressure	2 PSI 0.1 % Restart	Start Stop
Jacket 1 Status	Jacket 2 Status         Cylinder S/N         Target Pressure         3000         Actual Test Press         Hold Time         Total Exp         Act % Perm         Elastic Expansion         Test Disposition         Calibration Test Parameters         Total Exp Min         Total Exp Max         Total Exp Max	Jacket 3 Status         Cylinder S/N         Target Pressure         Actual Test Press         Hold Time         Total Exp         Act % Perm         Elastic Expansion         Test Disposition         Calibration Test Parameters         Total Exp Min         Total Exp Max	Jacket 4 Status         Cylinder S/N         Target Pressure         Actual Test Press         Hold Time         Total Exp         Act % Perm         Elastic Expansion         Test Disposition         Calibration Test Parameters         Total Exp Max         Total Exp Max

Figure 24: Calibration target cut-off percentage:

The actual pressure attained can be increased by adjusting the percentage. For example, if it is imperative that the test pressure is maintained throughout the test, you need to increase the pressure attained (target pressure). During the pressure hold time, the pressure will drop. The amount of drop is determined by many factors such as rate of pressurization, cylinder elasticity, etc... Of course, the test should be performed with minimal drop. However, some drop will occur. For example, you can adjust the percentage to 100.2% so the pressure will not drop below test pressure during the test.

Figure 25: Actual pressure and target percentage displays:

🚟 Recortest 4 Hydrotes	t Calibration - Operator:tjc								
REC4 Settings	Ca	libration <mark>Data E</mark>	ntry <u>Test Results</u>	<u>Graph Diag</u> r	<u>ram</u> <u>Fail Vis</u> u	ual	Clea	<u>r Lo</u>	q Out
1Data Ready <u>Customer/Manufac</u> Cylinder S/N     Gas Service <u>Qualification Test F</u> QT Target Pressure     QT Hold Time     QT Fail % Perm     QT Tot Exp Min     QT Tot Exp Min	Cturer Information SCC9504-0211A CAL	2Data Ready — Customer/Manufac Cylinder S/N Gas Service Qualification Test F QT Target Pressure QT Hold Time QT Hold Time QT Fail % Perm QT Tot Exp Min QT Tot Exp Max	turer Information SCC9504-0211A CAL Parameters	3Data Ready <u>Customer/Manufe</u> Cylinder S/N Gas Service <u>Qualification Test</u> QT Target Pressu QT Hold Time QT Fail % Perm QT Tot Exp Min QT Tot Exp Max	acturer Information SCC9504-021 CAL Parameters		4Data Ready <u>Customer/Manufactur</u> Cylinder S/N <u>S</u> Gas Service <u>C</u> <u>Qualification Test Para</u> QT Target Pressure	er Information SCC9504-0211A Y SAL meters Y PSI 0	
All CAL Data Rea	idy 100 9	<mark>ж</mark> ок	Pressure	2 PSI	0.1 %	Restart	Star	t Stop	
Jacket 1 Status Cylinder S/N		– Jacket 2 Status Cylinder S/N		– Jacket 3 Status Cylinder S/N	;	_	Jacket 4 Status – Cylinder S/N		
Target Pressure	3000	Target Pressure	3000	Target Pressure			Target Pressure		
Actual Test Press		Actual Test Press		Actual Test Press			Actual Test Press		
Hold Time		Hold Time		Hold Time			Hold Time		
Total Exp		Total Exp		Total Exp			Total Exp		
Act % Perm		Act % Perm		Act % Perm			Act % Perm		
Elastic Expansion		Elastic Expansion		Elastic Expansion			Elastic Expansion		
Test Disposition		Test Disposition		Test Disposition			Test Disposition		
Calibration Test Pa	arameters	Calibration Test Pa	rameters	Calibration Test F	arameters		Calibration Test Paran	neters_	
Total Exp Min		Total Exp Min		Total Exp Min			Total Exp Min		
Total Exp Max		Total Exp Max		Total Exp Max			Total Exp Max		
Total Expansion	-12.2	Total Expansion	-14.4	Total Expansion			Total Expansion		

The actual pressure and the percentage of target pressure are dynamically displayed on the command line in RED text at all times.

EC4 Settings	Calibration Data Entry Test Results	<u>Graph Diagram Fail Visual</u>	<u>Clear</u> <u>Loq O</u>
1Data Ready	2Data Ready	3Data Ready	4Data Ready
Customer/Manufacturer Information	Customer/Manufacturer Information	Customer/Manufacturer Information	Customer/Manufacturer Information
Cylinder S/N SCC9504-0211A	Cylinder S/N SCC9504-0211A -	Cylinder S/N SCC9504-0211A -	Cylinder S/N SCC9504-0211A -
Gas Service CAL	Gas Service CAL	Gas Service CAL	Gas Service CAL
Qualification Test Parameters	Qualification Test Parameters	Qualification Test Parameters	Qualification Test Parameters
QT Target Pressure 3000 🗾 PSI	QT Target Pressure 3000 - PSI	QT Target Pressure PSI	QT Target Pressure PSI
QT Hold Time 30	QT Hold Time 30	QT Hold Time 30	QT Hold Time 30
QT Fail % Perm	QT Fail % Perm	QT Fail % Perm 10	QT Fail % Perm 10
QT Tot Exp Min 53.7	QT Tot Exp Min 53.7	QT Tot Exp Min	QT Tot Exp Min
QT Tot Exp Max 54.7	QT Tot Exp Max 54.7	QT Tot Exp Max	QT Tot Exp Max
·			
All CAL Data Ready 100	% OK Pressure	2 PSI 0.1 % Restart	Start Stop
Cylinder S/N     3000       Farget Pressure     3000       Actual Test Press	Cylinder S/N	Target Pressure         Actual Test Press         Hold Time         Total Exp         Act % Perm         Elastic Expansion         Test Disposition         Calibration Test Parameters         Total Exp Max	Target Pressure         Actual Test Press         Hold Time         Total Exp         Act % Perm         Elastic Expansion         Test Disposition         Calibration Test Parameters         Total Exp Min         Total Exp Max
Total Expansion -12.2	Total Expansion -14.4	Total Expansion	Total Expansion

Figure 26: <Restart>; <Start> and <Stop> buttons:

Click the <Start> button to start a test when the <Data Ready> buttons are Blue in color. This button starts the pressurization process.

Click the <Stop> button to abort the same test. This button stops the pressurization process and bleeds the pressure. It also records the abort in the test results.

Click the <Restart> button to retest a failed or aborted test. If, for any reason, the calibrated cylinder fails the test, you can immediately run another calibration test. The operator should determine another test should pass before performing the retest.

## Figure 27: Menu Line:

REC4 Settings Ca	libration <u>Data Entry</u> <u>Test Results</u>	<u>Graph Diagram Fail Visual</u>	<u>Clear</u> <u>Loq Out</u>
1Data Ready         Customer/Manufacturer Information         Cylinder S/N       SCC9504-0211A Y         Gas Service       CAL         Qualification Test Parameters         OT Target Pressure       3000 Y         OT Hold Time       30         OT Fail % Perm         OT Tot Exp Min       53.7         OT Tot Exp Max       54.7	2Data Ready <u>Customer/Manufacturer Information</u> Cylinder S/N SCC9504-0211A ▼ Gas Service CAL <u>Qualification Test Parameters</u> <u>OT Target Pressure</u> 3000 ▼ PSI <u>QT Hold Time</u> 30 <u>QT Fail % Perm</u> <u>QT Tot Exp Min</u> 53.7 <u>QT Tot Exp Max</u> 54.7	3Data Ready         Customer/Manufacturer Information         Cylinder S/N       SCC9504-0211A Y         Gas Service       CAL         Qualification Test Parameters         QT Target Pressure       Y         PSI         QT Hold Time       30         QT Tail % Perm       10         QT Tot Exp Min       QT Tot Exp Max	4Data Ready         Customer/Manufacturer Information         Cylinder S/N       SCC9504-0211A y         Gas Service       CAL         Qualification Test Parameters         QT Target Pressure       y         PSI         QT Hold Time       30         QT Tot Exp Min         QT Tot Exp Mex
	% DK Pressure	2 PSI 0.1 % Restart	Start Stop
Jacket 1 Status       Cylinder S/N       Target Pressure       3000       Actual Test Press       Hold Time       Total Exp       Act % Perm       Elastic Expansion       Test Disposition       Calibration Test Parameters       Total Exp Min       Total Exp Max       Total Expansion	Jacket 2 Status         Cylinder S/N         Target Pressure         3000         Actual Test Press         Hold Time         Total Exp         Act % Perm         Elastic Expansion         Test Disposition         Calibration Test Parameters         Total Exp Min         Total Exp Max         Total Expansion	Jacket 3 Status         Cylinder S/N         Target Pressure         Actual Test Press         Hold Time         Total Exp         Act % Perm         Elastic Expansion         Test Disposition         Calibration Test Parameters         Total Exp Min         Total Exp Max         Total Expansion	Jacket 4 Status Cylinder S/N Target Pressure Actual Test Press Hold Time Total Exp Act % Perm Elastic Expansion Test Disposition Calibration Test Parameters Total Exp Min Total Exp Max Total Expansion

The menu line is outlined above in Green. Each item on this line will be explained further, later in the manual.

– Recortest 4 Hydrotest Data Entry - Operator:tjc						
	libration Data Entry Te	st Results Graph Diagram Fa	il Visual Clear			
<u></u>	-		STRAITURE CONTRACTOR			
1Data Ready         Customer/Manufacturer Information         Cylinder S/N       234         Multiport Pos         Manufacturer       Luxfer         Manufacturer Date       0799         Customer       NA         Gas Service       02         Cylinder Properties       02         Cylinder Code       M         E.E. Source       9         Pretest Parameters       PSI         PT Hold Time       30         Qualification Test Parameters       QT Target Press         QT Fail R.E.E.       01         QT Fail R.E.E.       01         Visual Eddy       ×         Allow Plus / Star       /         Var Press Rate       1.5         Test Remark	2Data Ready Customer/Manufacturer Inform Cylinder S/N · Multiport Pos Manufacturer IWKA Weigecturer Date Customer Gas Service Add/Edit Cylinder Propertie Cylinder Propertie Cylinder Size Cylinder DOT Rating Manufac R.E.E. Source Pretest Parameter PT Target Press PT Hold Time Gas Service Cylinder Traget Press Othold Time Multipo	ation Customer/Manufacturer Infor Cylinder S/N + Multiport Pos Manufacturer Date Customer Customer Customer Manufacturer Date Customer C	4Data Ready         mation       Customer/Manufacturer Information         Y       Cylinder S/N       Y         Multipot Pos       Y         Manufacturer       IWKA         Manufacturer       IWKA         Gas Service       Customer         Cylinder Properties       Cylinder Size         Cylinder Size       4.25x25.75         DOT Rating       3AA-2015         R.E.E. Source       CS         PSI       PT Target Press         PSI       PT Target Press         Qualification Test Parameters       PSI         QT Target Press       3360         QT Fail R.E.E.       23.1         QT Fail R.E.E.       23.1         QT Fail R.E.E.       23.1         QT Fail R.E.E.       23.1         QT Fail % Perm       10         Yisual Eddy       Y         Allow Plus / Star       /			
		Cancel				
All Data Ready 100 % 0K Restart Stop						
Jacket 1 Status	Jacket 2 Status	Jacket 3 Status	Jacket 4 Status			
Cylinder S/N	Cylinder S/N	Cylinder S/N	Cylinder S/N			
Total Expansion -12.2	Total Expansion -14.5	Total Expansion	Total Expansion			
Test Disposition	Test Disposition	Test Disposition	Test Disposition			
Retest Options						
Aborted Test (pressure during aborted test did not exceed 90% of target pressure)     None     None						

Figure 28: <Data Entry> screen; Add/Edit Cylinders window:

The <Data Entry> screen is where the recorded cylinder tests are performed.

By pressing the <+> button outlined in Green above, you can enter the data for multiple cylinders that are ready for testing. You can input the data for each cylinder in the same order the cylinders are physically lined up in the shop. This allows the data entry task to be performed first, so you can concentrate only on testing later. Throughput is decreased when you have to stop testing to remove paint, etc... in order to visually see the parameters on the cylinder to be requalified. This option allows you to uncover hard to read serial numbers, dates, etc..., and overcome those obstacles before testing, so your testing time is maximized and cylinder throughput can be increased.

The Multiport Cylinder checkbox, and the MP (multiport) Position field are for use with the Galiso multiport cylinder head which holds up to 4 - 6" diameter cylinders. You can input positions 1 through 4 for the corresponding cylinder to head location. Then, only moving the hose between positions is necessary to test all 4 cylinders without removing the test head.

Of course, all test parameters can be inputted manually during testing too.

<Cylinder Serial Number> entry field: The S/N must be entered here for pre-test data entry. Upon the successful start of a test, the S/N and cylinder information is removed from this database.

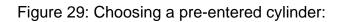
<Manufacturer>, <Customer>, and <Cylinder Code> fields: These 3 field entries use the respective database tables to accept the information. They must be chosen from the existing table. If they do not exist in the database, you must go to the R4 Settings program and input the new addition. You can code them for shortcut keystrokes. You can also create an 'N/A' for cases where the information does not apply.

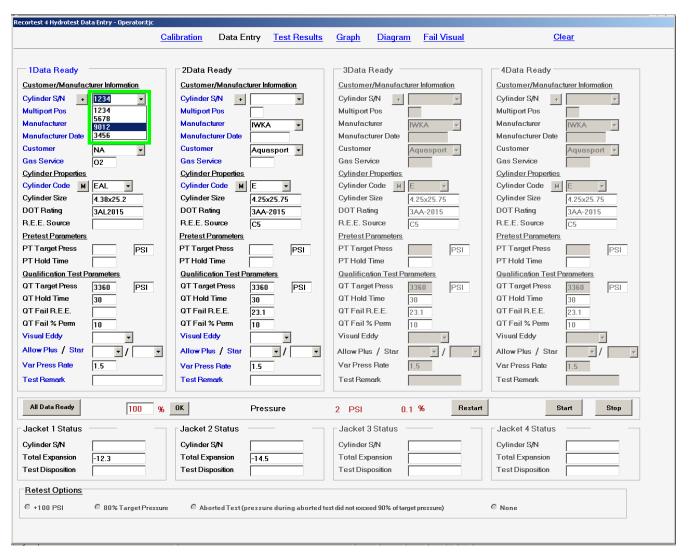
<Manufacturer Date> field: This is a manually inputted item. The field accepts 2 date formats.

- 1. MMYY No spaces or punctuation.
- 2. MMYYYY No spaces or punctuation.

<Gas Service> field: This is a manually inputted item. It accepts any input up to 4 digits.

Click <Save> to complete the data entry. The cylinder information can be changed at any time, and click <Save> again to save the change(s). Click <Add> to add another cylinder to the order of test list. The cylinders will come up automatically in the same order entered. You can also open the list and choose one out of order if needed.





As stated above, you can choose a cylinder out of order here.

# Cylinder properties: Figure 30: <Set Manual Code> window:

Recortest 4 Hydrotest Data Entry - Operator:tjc					
Ca	libration Data Entry <u>Test Results</u>	<u>Graph Diagram Fail Visual</u>	Clear		
			211.36		
1Data Ready	2Data Ready	3Data Ready	4Data Ready		
Customer/Manufacturer Information	Customer/Manufacturer Information	Customer/Manufacturer Information	Customer/Manufacturer Information		
	Cylinder S/N + V	Cylinder S/N _+ Multiport Pos	Cylinder S/N + /		
· · ·					
Manufacturer Luxfer  Manufacturer Date 0799	Manufacturer IWKA  Manufacturer Date	Manufacturer Date	Manufacturer Date		
6133					
Customer NA  Gas Service 02	Customer Aquasport -	Customer Aquasport -	Customer Aquasport -		
Cylinder Properties	Cylinder P 🔀 Set Manual Code		Cylinder Properties		
Cylinder Code M V V	Cylinder C	<b>_</b>	Cylinder Code M E		
Cylinder Size	Cylinder S Cylinder Properties	5x25.75	Cylinder Size 4.25x25.75		
DOT Rating NA	DOT Ratin Cylinder Size 9x51	A-2015	DOT Rating 3AA-2015		
R.E.E. Source NA	R.E.E. Sou DOT Rating 3AA-600		R.E.E. Source C5		
Pretest Parameters	Pretest Pa R.E.E. Source NA		Pretest Parameters		
PT Target Press PSI	PT Target Pretest Parameters	PSI	PT Target Press PSI		
PT Hold Time	PT Hold Ti PT Target Press	PSI	PT Hold Time		
Qualification Test Parameters	Qualificati PT Hold Time	eters.	Qualification Test Parameters		
QT Target Press 7000 PSI	QTTaget Qualification Test Parameters	j0 PSI	QT Target Press 3360 PSI		
QT Hold Time 30	QT Hold CT Target Press 10000	PSI 🗸	QT Hold Time 30		
QT Fail R.E.E. 145	QT Fail R. QT Hold Time 30	1	QT Fail R.E.E. 23.1		
QT Fail % Perm 10	QT Fail % QT Fail R.E.E. NA		QT Fail % Perm 10		
Visual Eddy	Visual Edd QT Fail % Perm 10 /	<b>*</b>	Visual Eddy		
Allow Plus / Star	Allow Plus Max Perm Hold 15	× / ×	Allow Plus / Star /		
Var Press Rate 1.5	Var Press Rate 1.5		Var Press Rate 1.5		
Test Remark	Test Rema		Test Remark		
	Save to All Save t	to Jkt Cancel			
All Data Ready 100 %	OK	// Kestart	Start Stop		
Jacket 1 Status	Jacket 2 Status	Jacket 3 Status	Jacket 4 Status		
Cylinder S/N	Cylinder S/N	Cylinder S/N	Cylinder S/N		
Total Expansion -12.3	Total Expansion -14.5	Total Expansion	Total Expansion		
TestDisposition	TestDisposition	Test Disposition	Test Disposition		
Retest Options					
+100 PSI     108 80% Target Pressure     108 Aborted Test (pressure during aborted test did not exceed 90% of target pressure)     100 None     100 PSI     100 PSI					
gerifoodalo					

The cylinder properties can be entered automatically by choosing the code from the code table in the <R4 Settings> program. They can also be entered manually by clicking the <M> button as shown in Green above.

<Cylinder Size> field: This is for the physical dimensions of the cylinder. The field will accept any text inputted. You may specify inches, millimeters, etc...

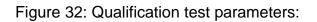
<DOT Rating> field: This is to manually input the DOT rating of the cylinder. It accepts any text inputted.

<REE Source> field: If an REE (Reject Elastic Expansion) is used for test criteria, this field is to enter where the REE figure originated from, i.e. manufacturer name, exemption, etc...

## Figure 31: Pretest parameters:

Recortest 4 Hydrotest Data Entry - Operator:tjc			
Ca	alibration Data Entry <u>Test Results</u>	<u>Graph Diagram Fail Visual</u>	Clear
1Data Ready	2Data Ready	3Data Ready	4Data Ready
Customer/Manufacturer Information	Customer/Manufacturer Information	Customer/Manufacturer Information	Customer/Manufacturer Information
Cylinder S/N + 1234			
Multiport Pos 1	Cylinder S/N +  Multiport Pos	Cylinder S/N _+ Multiport Pos	Cylinder S/N + V
		Manufacturer IWKA	
Manufacturer Luxfer  Manufacturer Date 0799	Manufacturer IWKA  Manufacturer Date	Manufacturer Date	Manufacturer IWKA
Customer NA V	Customer Aquasport -	Customer Aquasport	Customer Aquasport -
Gas Service 02	Gas Service	Gas Service	Gas Service
Cylinder Properties	Cylinder Properties	Cylinder Properties	Cylinder Properties
Cylinder Code M M V	Cylinder Code M E -	Cylinder Code M E -	Cylinder Code M E V
Cylinder Size 9X51	Cylinder Size 4.25x25.75	Cylinder Size 4.25x25.75	Cylinder Size 4.25x25.75
DOT Rating 3AA-6000	DOT Rating 3AA-2015	DOT Rating 3AA-2015	DOT Rating 3AA-2015
R.E.E. Source NA	R.E.E. Source C5	R.E.E. Source C5	R.E.E. Source C5
Pretest Parameters	Pretest Parameters	Pretest Parameters	Pretest Parameters
PT Target Press 8000 PSI	PT Target Press PSI	PT Target Press PSI	PT Target Press PSI
PT Hold Time 15	PT Hold Time	PT Hold Time	PT Hold Time
Qualification Test Parameters	Qualification Test Parameters	Qualification Test Parameters	Qualification Test Parameters
QT Target Press 10000 PSI	QT Target Press 3360 PSI	QT Target Press 3360 PSI	QT Target Press 3360 PSI
QT Hold Time 30	QT Hold Time 30	QT Hold Time 30	QT Hold Time 30
QT Fail R.E.E. 0	QT Fail R.E.E. 23.1	QT Fail R.E.E. 23.1	QT Fail R.E.E. 23.1
QT Fail % Perm 10	QT Fail % Perm 10	QT Fail % Perm 10	QT Fail % Perm 10
Visual Eddy	Visual Eddy	Visual Eddy	Visual Eddy
Allow Plus / Star 🗸 / 💌	Allow Plus / Star 🔹 / 💌	Allow Plus / Star /	Allow Plus / Star /
Var Press Rate 1.5	Var Press Rate 1.5	Var Press Rate 1.5	Var Press Rate 1.5
Test Remark	Test Remark	Test Remark	Test Remark
All Data Ready 100 %	OK Pressure	2 PSI 0.1 % Restart	Start Stop
Jacket 1 Status	Jacket 2 Status	Jacket 3 Status	Jacket 4 Status
Cylinder S/N	Cylinder S/N	Cylinder S/N	Cylinder S/N
Total Expansion -12.5	Total Expansion -14.6	Total Expansion	Total Expansion
TestDisposition	Test Disposition	Test Disposition	TestDisposition
Retest Options			
C +100 PSI C 80% Target Pressure	Aborted Test (pressure during aborted test	st did not exceed 90% of target pressure)	© None

You can enter parameters of target pressure and hold time for a complete test, prior to the actual qualification test. Some cylinders require a 'pretest' in order to get a more accurate qualification test. All pretests performed on DOT cylinders must be below 90% of test pressure, or it is a qualification test attempt that must report the results and be dispositioned accordingly. If it is a newly manufactured cylinder, then the 'pretest' is used for autofrettage purposes. The pretest parameters can be entered into the cylinder code table, or manually in the 'Data Entry' screen. You can also perform a pretest on a calibrated cylinder to condition it for the calibration verification test. The qualification test will start automatically, directly after the pretest results are recorded.



	Calibration Data Entry <u>Test Results</u>	<u>Graph Diagram Fail Visual</u>	<u>Clear</u>
1Data Ready	2Data Ready	3Data Ready	4Data Ready
Customer/Manufacturer Information	Customer/Manufacturer Information	Customer/Manufacturer Information	Customer/Manufacturer Information
Cylinder S/N + 1234 -	Cylinder S/N +	Cylinder S/N +	Cylinder S/N +
Multiport Pos 1	Multiport Pos	Multiport Pos	Multiport Pos
Manufacturer Luxfer -	Manufacturer IWKA -	Manufacturer IWKA -	Manufacturer
Manufacturer Date 0799	Manufacturer Date	Manufacturer Date	Manufacturer Date
Customer NA -	Customer Aquasport -	Customer Aquasport -	Customer Aquasport -
Gas Service 02	Gas Service	Gas Service	Gas Service
Cylinder Properties	Cylinder Properties	Cylinder Properties	Cylinder Properties
Cylinder Code M M 🔹	Cylinder Code M E	Cylinder Code M E	Cylinder Code M E
Cylinder Size 9X51	Cylinder Size 4.25x25.75	Cylinder Size 4.25x25.75	Cylinder Size 4.25x25.75
DOT Rating 3AA-6000	DOT Rating 3AA-2015	DOT Rating 3AA-2015	DOT Rating 3AA-2015
R.E.E. Source NA	R.E.E. Source C5	R.E.E. Source C5	R.E.E. Source C5
Pretest Parameters	Pretest Parameters	Pretest Parameters	Pretest Parameters
PT Target Press 8000 PSI	PT Target Press PSI	PT Target Press PSI	PT Target Press PSI
PT Hold Time 15	PT Hold Time	PT Hold Time	PT Hold Time
Qualification Test Parameters	Qualification Test Parameters	Qualification Test Parameters	Qualification Test Parameters
QT Target Press 10000 PSI	QT Target Press 3360 PSI	QT Target Press 3360 PSI	QT Target Press 3360 PSI
QT Hold Time 30	QT Hold Time 30	QT Hold Time 30	QT Hold Time 30
QT Fail R.E.E.	QT Fail R.E.E. 23.1	QT Fail R.E.E. 23.1	QT Fail R.E.E. 23.1
QT Fail % Perm 10	QT Fail % Perm 10	QT Fail % Perm 10	QT Fail % Perm 10
Visual Eddy Pass •	Visual Eddy	Visual Eddy	Visual Eddy
Allow Plus / Star No 💌 / No 💌	Allow Plus / Star	Allow Plus / Star	Allow Plus / Star
Var Press Rate 1.5	Var Press Rate 1.5	Var Press Rate 1.5	Var Press Rate 1.5
Test Remark 80% & 100% Test	Test Remark	Test Remark	Test Remark
All Data Ready 100 9	5 OK Pressure	2 PSI 0.1 % Restart	Start Stop
Jacket 1 Status — —	Jacket 2 Status	Jacket 3 Status	Jacket 4 Status
Cylinder S/N	Cylinder S/N	Cylinder S/N	Cylinder S/N
Total Expansion -12.5	Total Expansion -14.6	Total Expansion	Total Expansion
Test Disposition	Test Disposition	Test Disposition	Test Disposition
Retest Options			
C +100 PSI C 80% Target Pressu	re C Aborted Test (pressure during aborted te		C None

The qualification test parameters are automatically entered by the cylinder code table. They can also be entered manually in the <Set Manual Code> window. The fields can also be changed manually on the <Data Entry> screen.

The <Visual Eddy>, Pass or Fail selections allow you to document the visual inspection in more detail if needed.

The <Allow Plus / Star> fields allow you to use those functions for US DOT testing.

The <Variable Pressurize Rate> field allows you to adjust the pump speed faster or slower.

The <Test Remark> field allows you to put a short reminder note of the test if needed.

cortest 4 Hydrotest Data Entry - Operator:tjc			
	Calibration Data Entry <u>Test Results</u>	<u>Graph Diagram Fail Visual</u>	Clear
1Data Ready         Customer/Manufacturer Information         Cylinder S/N       ▼         Multiport Pos       ▼         Manufacturer       Luxfer       ▼         Gas Service       ■       ▼         Cylinder Properties       Cylinder Size       4.36x25.2         DOT Rating       3AL2015       R.E.E. Source         Pretest Parameters       PS1         PT Target Press       PS1         PT Hold Time       30         Qualification Test Parameters       PS1         QT Hold Time       30         QT Hold Time       10         Visuel Eddy       ▼	2Data Ready         Customer/Manufacturer Information         Cylinder S/N         Multiport Pos         Manufacturer         MCS         Manufacturer Date         Customer         NA         Gas Service         Cylinder Properties         Cylinder Code         MEAL         Cylinder Size         Al8x25.2         DOT Rating         3AL2015         R.E.E. Source         Pretest Parameters         PT Target Press         PSI         PT Hold Time         Qualification Test Parameters         QT Target Press         QIT Hold Time         30         QIT Fail R.E.E.         QIT Fail % Perm         Visual Eddy	3Data Ready         Customer/Manufacturer Information         Cylinder S/N →         Multiport Pos         Manufacturer Date         Customer         Manufacturer Date         Customer         Aquasport ▼         Gas Service         Cylinder Properties         Cylinder Code         E         Cylinder Size         4.25x25.75         DOT Rating         3AA-2015         R.E.E. Source         C5         Pretest Parameters         PT Target Press         PSI         PT Hold Time         Qualification Test Parameters         QT Target Press         Q360         QT Fail R.E.E.         Q3.1         Q1 Teail % Perm         10         Visual Eddy	4Data Ready         Customer/Manufacturer Information         Cylinder S/N       *         Multiport Pos       *         Manufacturer       IWKA         Manufacturer Date       *         Customer       Aquasport *         Gas Service       *         Cylinder Properties       *         Cylinder Properties       *         Cylinder Size       4.25x25.75         DOT Rating       3AA-2015         R.E.E. Source       C5         Pretest Parameters       PSI         PT Hold Time       306         Qualification Test Parameters       PSI         QT Target Press       3360         QT Thold Time       30         QT Fail R.E.E.       23.1         QT Fail % Perm       10         Visuel Eddy       *
Allow Plus / Star No Var Press Rate 1.5	Allow Plus / Star No Var Press Rate 1.5	Allow Plus / Star / · / · · / · · · / · · · · · · · · ·	Allow Plus / Star Var Press Rate 1.5
Test Remark	Test Remark	Test Remark	Test Remark
All Data Ready 100 9	6 OK Pressure	1 PSi 0 % Restart	Start Stop
Jacket 1 Status 124.78- Cylinder S/N 1234 Total Expansion 0.3 Test Disposition PPNNP	Jacket 2 Status     124.78       Cylinder S/N     E52634       Total Expansion     0.3       Test Disposition     PPNNP	Jacket 3 Status       Cylinder S/N       Total Expansion       Test Disposition	Jacket 4 Status Cylinder S/N Total Expansion Test Disposition
Retest Options       +100 PSI     © 80% Target Pressi	re C Aborted Test (pressure during aborted te	st did not exceed 90% of target pressure)	© None
one	Done		

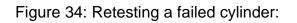
Figure 33: <Data Entry> screen command line and jacket status information:

The <All Data Ready> button is to make the data ready on all jackets at the same time. This is so the testing program knows the data is ready for testing. Before starting a test, be sure the cylinder is in the jacket, and the high and low pressure hoses are attached.

The <% Target Pressure> field text is in Red letters. Here you can enter in a % value of the target pressure and click the <OK> button to finalize the entry. The system will stop pressurizing at that pressure. Less than 100% of target pressure, and you can restart the pump by entering in another value greater than the current value. At pressures greater than 100% target pressure, the test will start the hold time.

The actual pressure and percent of target pressure are dynamically displayed in Red letters on the command line.

The <Start> button starts the test. The <Stop> button aborts the test. It will stop pressurizing and bleed off the pressure.



<u>Calibration</u> Data Entry <u>Test Results</u>	<u>s Graph Diagram Fail Visual</u>	Clear
		<u>Ciedi</u>
1Data Ready 2Data Ready	3Data Ready	4Data Ready
ustomer/Manufacturer Information Customer/Manufacturer Information	Customer/Manufacturer Information	Customer/Manufacturer Information
vlinder S/N +  Cylinder S/N +	Cylinder S/N +	Cylinder S/N +
ultiport Pos Multiport Pos	Multiport Pos	Multiport Pos
anufacturer MCS - Manufacturer Luxfer -	Manufacturer IWKA -	Manufacturer
anufacturer Date Manufacturer Date	Manufacturer Date	Manufacturer Date
ustomer NA	Customer Aquasport -	Customer Aquasport -
as Service Gas Service	Gas Service	Gas Service
Vlinder Properties Cylinder Properties	Cylinder Properties	Cylinder Properties
vlinder Code M M 💌 Cylinder Code M M 💌	Cylinder Code M E	Cylinder Code M E
vlinder Size 4.38x25.2 Cylinder Size 4.38x25.2	Cylinder Size 4.25x25.75	Cylinder Size 4.25x25.75
OT Rating 3AL2015 DOT Rating 3AL2015	DOT Rating 3AA-2015	DOT Rating 3AA-2015
E.E. Source Lux R.E.E. Source Lux	R.E.E. Source C5	R.E.E. Source C5
retest Parameters	Pretest Parameters	Pretest Parameters
T Target Press PSI PT Target Press PSI	PT Target Press PSI	PT Target Press PSI
T Hold Time PT Hold Time	PT Hold Time	PT Hold Time
ualification Test Parameters Qualification Test Parameters	Qualification Test Parameters	Qualification Test Parameters
T Target Press 3360 PSI QT Target Press 3360 PSI	QT Target Press 3360 PSI	QT Target Press 3360 PSI
T Hold Time 30 QT Hold Time 30	QT Hold Time 30	QT Hold Time 30
TFail R.E.E	QT Fail R.E.E. 23.1	QT Fail R.E.E. 23.1
T Fail % Perm 10 QT Fail % Perm 10	QT Fail % Perm 10	QT Fail % Perm 10
sual Eddy Visual Eddy Visual Eddy	Visual Eddy	Visual Eddy
low Plus / Star No V / No V Allow Plus / Star No V / No V	Allow Plus / Star 💽 / 💽	Allow Plus / Star 💽 / 💽
ar Press Rate 1.5 Var Press Rate 1.5	Var Press Rate 1.5	Var Press Rate 1.5
est Remark Test Remark	Test Remark	Test Remark
All Data Ready 100 % OK Pressure	3467 PSI 100.2 % Restart	Start Stop
acket 1 Status 43.95 Jacket 2 Status 43.95	Jacket 3 Status	Jacket 4 Status
vlinder S/N 5678 Cylinder S/N E45839	Cylinder S/N	Cylinder S/N
otal Expansion 61.1 Total Expansion 64.9	Total Expansion	Total Expansion
est Disposition Test Disposition	Test Disposition	Test Disposition
tetest Options		
+100 PSI 🛛 80% Target Pressure 🖉 Aborted Test (pressure during aborted	I test did not exceed 90% of target pressure)	© None
Iding Pressure Holding Pressure		

In the example above, the <Restart> button has been clicked. But, before clicking it, you must choose a <Retest Option> from the selections shown.

The <+100PSI> option will retest the cylinder at 100PSI over test pressure. This is a US DOT requirement to retest a failed cylinder test. Before selecting this option, you must be confident that it will pass the next test. In other words, you need to remedy the problem that made it fail the first time, such as a machine problem, or operator error, etc... Operator errors such as setting the <Var Press Rate> too high, can pressurize the cylinder too fast and cause it to continue expanding after reaching the target pressure. This can result in an unstable test that fails.

The <80% Target Pressure> option will take the cylinder to 80% target pressure and perform the test at that pressure. This is good for ensuring the test machine is operational, and the cylinder is not at fault before performing a retest for qualification. If it passes the 80% test, then you can be more confident it will pass a +100 PSI test. However, to perform a +100PSI test after

the 80% test, you must manually input the test parameters again, and manually input the target pressure to 100PSI over test pressure to pass the cylinder to US DOT regulation.

The <Aborted Test> option can only be used if the test was aborted before the pressure achieved 90% of test pressure. The retest is then performed at the normal test pressure. Any test that achieves more than 90% and less than 100% (or does not hold 100%+) is a <u>failed</u> test result that requires documenting.

cortest 4 Hydrotest Data Entry - Operator:tjc			
	Calibration Data Entry <u>Test Results</u>	<u>Graph Diagram Fail Visual</u>	<u>Clear</u>
1Data Ready	2Data Ready	3Data Ready	4Data Ready
Customer/Manufacturer Information	Customer/Manufacturer Information	Customer/Manufacturer Information	Customer/Manufacturer Information
Cylinder S/N +	Cylinder S/N +	Cylinder S/N +	Cylinder S/N +
Multiport Pos	Multiport Pos	Multiport Pos	Multiport Pos
Manufacturer MCS -	Manufacturer Luxfer -	Manufacturer	Manufacturer
Manufacturer Date	Manufacturer Date	Manufacturer Date	Manufacturer Date
Customer NA V	Customer NA -	Customer Aquasport -	Customer Aquasport -
Gas Service	Gas Service	Gas Service	Gas Service
Cylinder Properties	Cylinder Properties	Cylinder Properties	Cylinder Properties
Cylinder Code M M 🗸	Cylinder Code M M 💌	Cylinder Code M E	Cylinder Code M E
Cylinder Size 4.38x25.2	Cylinder Size 4.38x25.2	Cylinder Size 4.25x25.75	Cylinder Size 4.25x25.75
DOT Rating 3AL2015	DOT Rating 3AL2015	DOT Rating 3AA-2015	DOT Rating 3AA-2015
R.E.E. Source Lux	R.E.E. Source Lux	R.E.E. Source C5	R.E.E. Source C5
Pretest Parameters	Pretest Parameters	Pretest Parameters	Pretest Parameters
PT Target Press PSI	PT Target Press PSI	PT Target Press PSI	PT Target Press PSI
PT Hold Time	PT Hold Time	PT Hold Time	PT Hold Time
Qualification Test Parameters	Qualification Test Parameters	Qualification Test Parameters	Qualification Test Parameters
DT Target Press 3360 PSI	QT Target Press 3360 PSI	QT Target Press 3360 PSI	QT Target Press 3360 PSI
QT Hold Time 30	QT Hold Time 30	QT Hold Time 30	QT Hold Time 30
TFail R.E.E2	QT Fail R.E.E2	QT Fail R.E.E. 23.1	QT Fail R.E.E. 23.1
TFail%Perm 10	QT Fail % Perm 10	QT Fail % Perm 10	QT Fail % Perm 10
/isual Eddy 🔹	Visual Eddy 🔹	Visual Eddy	Visual Eddy
Allow Plus / Star No 🗸 / No 🔻	Allow Plus / Star No 🗸 / No 💌	Allow Plus / Star 💽 / 💌	Allow Plus / Star
Ar Press Rate 1.5	Var Press Rate 1.5	Var Press Rate 1.5	Var Press Rate 1.5
Fest Remark	Test Remark	Test Remark	Test Remark
All Data Ready 100 %	OK Pressure	1 PSI 0 % Restart	Start Stop
Jacket 1 Status 89.3	Jacket 2 Status 89.3	Jacket 3 Status	Jacket 4 Status
Sylinder S/N 5678	Cylinder S/N E45839	Cylinder S/N	Cylinder S/N
Total Expansion 0	Total Expansion 0	Total Expansion	Total Expansion
Test Disposition PPFNP	Test Disposition PPFNP	Test Disposition	Test Disposition
Retest Options			
🗘 +100 PSI 👘 80% Target Pressu	re C Aborted Test (pressure during aborted te	st did not exceed 90% of target pressure)	© None

Figure 35: Failed tests:

Upon the event of a failed test, the jacket status text will change color. Yellow = failed REE. Red = failed % permanent expansion.

<Test Disposition> field: The letters in the disposition will also change color according to pass = green; fail = red for % perm and yellow for REE; abort = yellow; or black = not applicable. The disposition codes key is printed on the report form.

Test status display line. This is on the very bottom of each screen in Red letters.

## Figure 36: Disposition codes key:

Disposition Codes Key		
Code Has Five Letters:	Letter Code:	Examples:
1 <sup>st</sup> Letter: Visual Test	P= Passed	PPPNP - Passed Visual, Passed % Perm, Passed REE, Total
2 <sup>nd</sup> Letter: % Perm Exp Test	F= Failed	Exp Not Applicable, Passed Proof Pressure
3 <sup>rd</sup> Letter: REE Test	N=Not Applicable	PFFNP - Passed Visual, Failed % Perm, Failed REE, Total
4 <sup>th</sup> Letter: Total Exp Test	A=Aborted	Exp Not Applicable, Passed Proof Pressure
5 <sup>th</sup> Letter: Proof Pressure Test		

## Figure 37: <Test Results> screen:

lydi	rotest Results	<u>i</u>										
	Index 🔺	Test Number	Test Time	Test Date	Serial Number	Cylinder Size	Cylinder Service	Manufacturer	Rating	PT Target Pressure	PT Start Pressure	PT End Pressure
	1576	2	9:21	5/16/2007	E52634	4.38x25.2	02	MCS	3AL2015			
	1577	3	9:58	5/16/2007	5678	4.38x25.2	02	MCS	3AL2015			
	1578	4	9:58	5/16/2007	E45839	4.38x25.2	02	Luxfer	3AL2015			
	1579	5	10:01	5/16/2007	5678	4.38x25.2	02	MCS	3AL2015			
	1580	6	10:01	5/16/2007	E45839	4.38x25.2	02	Luxfer	3AL2015			
	1581	7	10:06		9012	4.38x25.2	02	Luxfer	3AL2015			
۰.	1582	8	10:06	5/16/2007	E45839	4.38x25.2	02	Luxfer	3AL2015			
Test	t Number (by day	) 8		TestDate	5/16/200	7 12:0	Test Time	10:06		Operator	tjc	
Cust	omer/Manufact	urer Information										
Cylir	nder S/N	E45839		Manufacturer	Luxfer	_	Manufacturer	Date 0704		Customer	NA	
Gas	Service	02			,						,	
Cylin	nder Properties											
	nder Code	м	_	Cylinder Size	4.38x25.2	2	DOT Rating	3AL20	15	R.E.E. Source	Lux	
Prete	est Information	,			,			,			,	
рт т	arget Pressure		PSI	PT Actual Pressur	e	PSI	PT Hold Time	,				
РТ Е	Elastic Exp			PT % Perm Exp			PT Permane	entExp	_	PT Total I	Exp 🗌	
рт т	Test Disposition		]									
Qual	lification Test In	formation										
тт	arget Pressure	3360	PSI	QT Actual Pressur	e 3387	PSI	QT Hold Time	30				
QT F	Fail R.E.E.	65		QT Elastic Exp	63.4		QT Fail % Pe	rm 10		QT % Perm Exp	0	
ат ғ	Permanent Exp	0		QT Total Exp	63.4		QT Tot Exp N	Ain 0.0		QT Tot Exp Max	0.0	
TΤΩ	Fest Disposition	PPPNP		Plus Star			Visual Eddy					
Fest	<u>t Remark (45 ch</u>	aracters maxim	<u>um)</u>									
								nable Edit			Save	Cancel

All of the test results are displayed here. Some fields can be edited to correct data entry mistakes on the part of the operator, or to add comments, etc... Click the <Enable Edit> box to view and edit those fields.

Figure 38: <Create Report> criteria options:

😁 Select Report Criteria					<u>- 0 ×</u>
📢 May, 2007 🕨			May, 2007		
Sun Mon Tue Wed Thu         Fri         Sat           29         30         1         2         3         4         5           6         7         8         9         10         11         12           13         14         15         (15)         17         18         19           20         21         22         23         24         25         26           27         28         29         30         31         1         2           3         4         5         6         7         8         9		Sun Mon 29 30 6 7 13 14 20 21 27 28 3 4	Tue Wed Thu           1         2         3           8         9         10           15         (15)         17           22         23         24           29         30         31           5         6         7	Fri         Sat           4         5           11         12           18         19           25         26           1         2           8         9	
C) Today: 5/16/2007	_		lay: 5/16/200	07	
Start Date		End Date			1
5/16/2007		5/16/20	07	Ŧ	1
Serial Number Customer					
Disposition Criteria	7				
<ul> <li>All Tests</li> </ul>					
C Failed Tests					
Fail % Perm					
Fail REE					
Aborted Tests					
Failed Visual Tests					
C Passed Tests					
	OK				

The reports can be sorted and created using the criteria shown above.

## Figure 39: Report form:

_	<b>/linder R</b> T/TC Registr		cation Rep	<u>ort</u>		22 Po	<b>so, inc</b> nderosa Ct. ose , CO	81401					
	de Has Five L tter Code: P= erator Signatu	ire:			rm Exp Test, 3rd Lett Example: PPPNPF Date Signed.					_		Test roof Pre	ssure
			-	-	re made under my :					-			
#	Test Date Test Time	Operator	Serial Cyl Owner	Size Service	Cyl MFG. MFG. Date	REE Source	Rating Unit	Specified Actual	Test Time	Total Elastic	Perm Percen	+* ¥E	Disposition Remark
1	5/16/200 9:21	tjc	1234 NA	4.38×25.2 02	Luxfer 0799		3AL2015 PSI	3360 3387	30	60.0 59.6	0.4 0.7	Pass	PPNNP 80% & 100% Te
2	5/16/200	tjc	E52634	4.38×25.2	MCS		3AL2015	3360	30	63.7	0.4		PPNNP
3	9:21 5/16/200	tjc	NA 5678	02 4.38×25.2	0703 MCS	.2	PSI 3AL2015	3387 3360	30	63.3 59.6	0.6		PPFNP
4	9:58 5/16/200	tjc	NA E45839	02 4.38×25.2	0700 Luxfer	Lux	PSI 3AL2015	3378 3360	30	59.6 63.3	0.0	Pass	PPFNP
	9:58		NA	02	0704	Lux	PSI	3378		63.3	0.0	Pass	
5	5/16/200 10:01	tje	5678 NA	4.38x25.2 02	MCS 0700	.2 Lux	3AI 2015 PSI	3460 3465	30	61.1 61.1	0.0 0.0	Pass	PPFNP Retest at +100
6	5/16/200	tjc	E45839	4.38×25.2	Luxfer	.2	3AL2015	3460	30	64.9	0.0		PPFNP
7	10:01 5/16/200	tjc	NA 9012	02 4.38×25.2	0704 Luxfer	Lux 65	PSI 3AL2015	3465 3360	30	64.9 59.8	0.0	Pass	Retest at +100 PPPNP
8	10:06 5/16/200	tic	NA E45839	02 4.38×25.2	0701 Luxfer	Lux 65	PSI 3AL2015	3387 3360	30	59.8 63.4	0.0		PPPNP
°	10:06	yc.	NA	02	0704	Lux	PSI	3387	30	63.4	0.0		PPPNP
Τ	tData∉s): S/14	5 <i>2</i> 2007 -			5/16/2007								Page 1 of 1

The standard report form displays the items shown above.

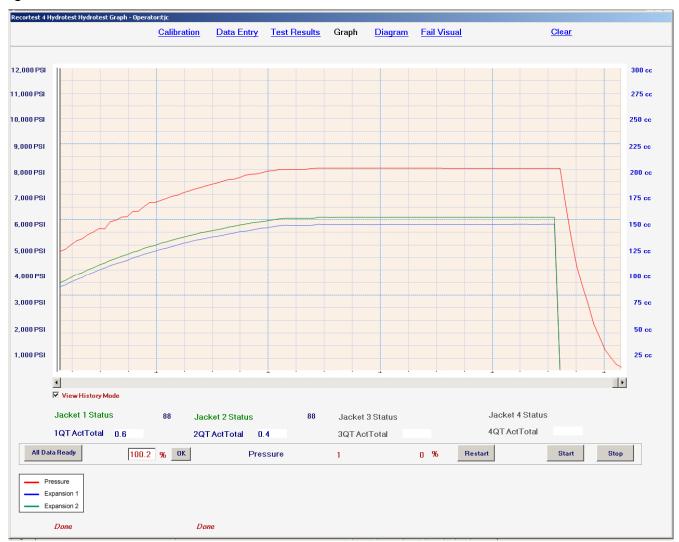
Cylinder Requalification F	Report Galiso.Inc 22 Ponderosa Ct			
It Letters         St Letters:         St Letters:	xport Report Save jr:   Recortest 4 Hydrostatic Testing Software v. 2   My Recent Documents  My Documents  My Computer  My Network Places  File game: DayReport  Save as Upp: Cystal Reports ["tpt]  Octeat Recorts ["tpt]  Octeat Recorts ["tpt]  Octeat Recorts ["tpt]  Octeat Recorts ["tpt]  Netrosoft Excel ["tst]  Microsoft Vord ["doc)  Rich Test Format ["ttt]	, P.	Pressure Test assed Proof Pre s. Permen +* Percen VE 0.4 0.7 Pass 0.7 Pass 0.0 Pass	SSURE Disposition Remark PPINNP 80% & 100% Te PPINP PPFNP PPFNP Retest at +100 PPFNP Retest at +100 PPFNP PPENP PPENP PPENP PPENP PPENP PPENP PPENP PPENP
Test Dab(s): 5/16/2007 -	5/16/2007 10:16:53AM			Page 1 of 1

The reports can be exported for further customizing, and or saved for back-up in the file formats shown above.



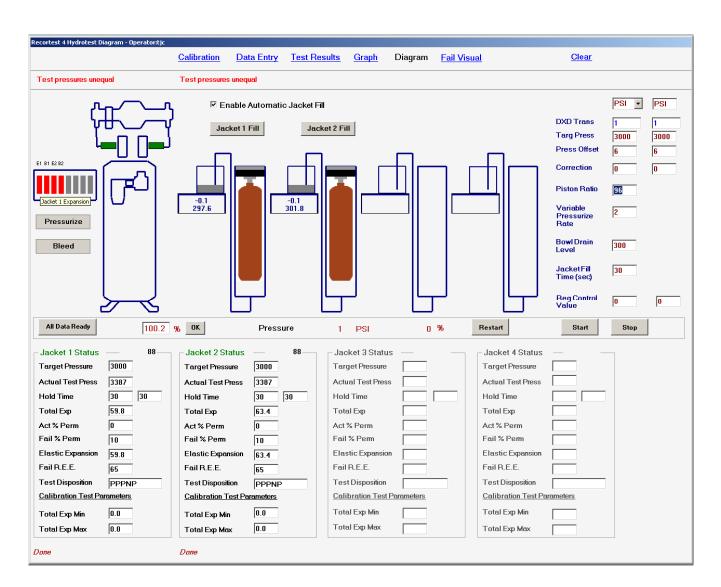
## Figure 41: <Graph> Screen:

Shown above are the graphed curves of the pressure, and cylinder expansions. 2 cylinders are shown to be pressurizing at the same time. The scale of the graph can be changed for different viewing if needed.



## Figure 42: Pressure Bleed:

The <Graph> screen continuously moves on a timeline to show the release or 'bleed' of pressure. You can click on the <View History Mode> check box to view up to 15 minutes previously.



## Figure 43: <Diagram> screen:

After starting a test from the 'Data Entry' screen, you can switch to the diagram screen to view the progression of the test in more detail. You can also start a test from the 'Diagram' screen.

The red text toward the top is the error message line. Click on the '<u>Clear</u>' text (upper right corner of screen) to clear the message out of memory. This enables another message to appear if and when another error occurs. It displays operator and system errors.

The 'Diagram' screen is mainly for learning and troubleshooting. Here, you can set the various control parameters to test the cylinder more precisely if needed. To learn those parameters, you may need to experiment with changing them to see the effect they have on the test. For example: Test a cylinder at 80% test pressure. If it does not pass the test (% Perm, or REE), then you may need to do a full pretest on that type of cylinder, before doing a 100% pressure test. Pretests can be used to exercise the cylinder before the qualification test, so the next test is more stable. There are simply many things you can learn about the cylinder type, by

using the diagram screen.

You can run troubleshooting tests that are not documented. You can also use the screen to pressurize the calibration cylinder to exercise it before the calibration test. You can manually operate the test by opening each expansion valve, and clicking on the <Pressurize> button. To release the pressure, click the <Bleed> button.

To learn the control parameters, use the calibration cylinder or a shop cylinder that stays in the shop. The adjustable fields should be set correctly before the start of the test, but can be adjusted dynamically during a test. Here is an explanation of the different fields on the screen:

<PSI> field: Displays the current unit of measure. It is also adjustable to Bar, MPa, KG/CM<sup>2</sup>, or PSI.

DXD Trans: Displays the current pressure. This field is not adjustable.

<Target Press>: Displays the current target pressure. It can be manually adjusted too.

<Press Offset>: Adjusts to make the pressure start from zero.

<Correction>: This can be adjusted <u>up</u> in value to theoretically increase the target by that amount.

<Piston Ratio>: For higher targets, start with the adjustment higher. To re-adjust during a test, <u>decrease</u> the value for <u>more pressure</u>.

Variable Pressurize Rate>: Adjustable from .1 - 5. It allows you to give time if needed, for the cylinder to expand during the pressurization which gives a more stable test during the 30 second hold time.

<Bowl Drain Level>: The program will achieve this amount of water in the bowl before starting a documented test. You can adjust it for more stability, or for the amount of expansion you are measuring, etc... It is basically an operator preference, but Galiso like to put it between 150 – 250.

<Jacket Fill Time>: This value is in seconds. The adjustment will fill the jacket for that amount of time, starting from when the head safety switch is disengaged to remove the tested cylinder.

Reg Control Value: Displays the amount of PSI the regulator is allowing to flow through. It is not adjustable.

Figure 44: <Fail Visual> screen:

You can document a failed cylinder due to failing the visual inspection. Your customer can clearly see the reason for the failure. Many known reasons are listed for you to check if it failed for that reason. Otherwise, you can enter the reason in the comments, along with any other comment you desire.

## Figure 45: Error messages:

EC4 Settings	Ca	libration <mark>Data E</mark>	Entry Test Results	<u>Graph</u> <u>Diagra</u>	<u>ım</u> <u>Fail Visual</u>	Clear	Log Out
Fest pressures unequ	al	Test pressures une	qual				
1Data Ready		2Data Ready		3Data Ready		4Data Ready	
Customer/Manufactu	irer Information	Customer/Manufa	cturer Information	Customer/Manufac	cturer Information	Customer/Manufacturer Information	
Cylinder S/N	SCC9504-0211A 🔽	Cylinder S/N	SCC9504-0211A 🔻	Cylinder S/N	SCC9504-0211A 💌	Cylinder S/N SCC9504-021	1A 🔽
Gas Service	CAL	Gas Service	CAL	Gas Service	CAL	Gas Service CAL	
Qualification Test Pa	rameters	Qualification Test F		Qualification Test P	arameters	Qualification Test Parameters	
QT Target Pressure	3695 💽 🎔 SI	QT Target Pressure	3000 🔽 🌮 SI	QT Target Pressure	PSI	QT Target Pressure	SI
QT Hold Time	30	QT Hold Time	30	QT Hold Time	30	QT Hold Time 30	
QT Fail % Perm		QT Fail % Perm		QT Fail % Perm	10	QT Fail % Perm 10	
	66.2	QT Tot Exp Min	53.7	QT Tot Exp Min		QT Tot Exp Min	
QT TotExp Max	67.4	QT Tot Exp Max	54.7	QT Tot Exp Max		QT Tot Exp Max	
All CAL Data Ready	100.2	% OK	Pressure	1 PSI	0 % Restart	Start	op
Jacket 1 Status –	- 88	□ Jacket 2 Status		– Jacket 3 Status		⊤ Jacket 4 Status —	
	2212			Cylinder S/N		Cylinder S/N	-
	9012	Cylinder S/N	E45839				
	3000	Target Pressure	3000	Target Pressure		Target Pressure	
	3387	Actual Test Press	3387	Actual Test Press		Actual Test Press	_
	30 30	Hold Time	30 30	Hold Time		Hold Time	
	59.8	Total Exp	63.4	Total Exp		Total Exp	
	0	Act % Perm	0	Act % Perm		Act % Perm	
	59.8	Elastic Expansion	63.4	Elastic Expansion		Elastic Expansion	
Test Disposition	PPPNP	Test Disposition	PPPNP	Test Disposition		Test Disposition	
Calibration Test Para	meters_	Calibration Test Pa	<u>arameters</u>	Calibration Test Pa	rameters	Calibration Test Parameters	
Total Exp Min	0.0	Total Exp Min	0.0	Total Exp Min		Total Exp Min	
Total Exp Max	0.0	Total Exp Max	0.0	Total Exp Max		Total Exp Max	
Total Expansion	0	Total Expansion	-0.1	Total Expansion		Total Expansion	

Error messages are shown in red text above the corresponding jacket that the error is affecting, if it is jacket specific. Jacket specific errors will overwrite non-jacket specific errors. So, if there are both errors present, you may not see the non-jacket specific error.

In the example above, note the red colored blurb next to the field that is incorrectly entered. In this case, one or the other must be changed to match each other. Since both jackets will pressurize simultaneously (if 'Data Ready' light is on for both), then both test pressures must be equal.

## Section 2: Quick Start and Reference Guide

## REC 4 Steel Jacket Quick Start and Reference Guide

#### Powering on the system:

- 1. Ensure the air and water are off, and that the battery back-up supply is on.
- 2. Turn on the PC, and type in the username and password.
- 3. Open the testing program by clicking on the Galiso test software icon on the desktop.
- 4. Turn on the air supply to the test system first, and then the water and you should now be ready for testing. The reason the air is turned on first, is to get air to all air operated valves so they are properly working before water is applied.
- 5. If you get a PLC Bowl Communication failure, then check the scales and turn them on. When that error occurs, always check the scale power first.

#### Powering off the system:

- 1. Turn off the water supply to the test system first, and then turn off the air supply.
- 2. Close the test software program.
- 3. Close any other open programs, and <Shut-Down> the PC.
- 4. You may leave the scales on.

# **Reference Guide For Common Occurrences:** Please refer to the operations manual for more detailed descriptions.

- 1. Software is not responding properly:
  - a) Close the program completely, and open it up again. If that doesn't fix it, close down all programs, and reboot the PC.
  - b) Cycle the power on the PLC by removing the PLC power connector on the back of the PLC. Wait 10 seconds, and reconnect it. The PLC can run out of memory if it is run for too long without cycling the power. This should be performed once a week at a minimum.
- 2. **PC <> PLC COM FAILURE:** check the power to the PLC to be on, and ensure that the red EMO button is in the 'OUT' position.
- 3. Pump won't pressurize:
  - a) Open the manual override ball valve on the pump air supply line located on the tubing between the automatic E/P regulator, and the water pump.
  - b) Cycle the power to the PLC by removing the PLC power connector on the back of the PLC. Wait 10 seconds, and reconnect it. Try cylinder testing again. You may also need to exit the test program, and re-open it. Ensure that the 'Power' and 'Run' green lights are on, on the WinPLC Module. This is the module with the single ethernet cable hooked to it in the PLC.
- 4. **Bleed activation does not work:** Open the manual override bleed valve on the RSP bleed line. Sometimes a person will close the valve and forget to open it back up.
- 5. Cylinder test result fails <u>negative</u> expansion mostly on cylinders 10L or less: The proper adjustments should be documented so the operator can set them for testing small cylinders. More accurate adjustments may be needed for 3.5 L and smaller cylinders. You may also find that some cylinders larger than 10L will benefit by giving a faster test result, with the proper adjustments described below. These will also help the test to not fail '% Perm'. You can do the initial set-up tests at 80% of test pressure. Any test under 90% is not considered a valid test that requires a written

result, so it is safe to do set-up tests at 80%. Be careful to not allow the pressure to exceed 90% during your set-up tests unless it is on a shop 'test set-up' cylinder that is not in service.

- a) <u>Control the temperature:</u> Negative expansion bowl readings are always partly due to a temperature problem of some kind. The room temperature, the full cylinder (water) temperature, the full jacket temp, and the pump test water temp must all be the same. If you are having problems with small cylinders, make all of these temps the same (+/-4°F) and 99% of the problems will go away. Use a mixing valve on the water filter assembly to mix hot and cold water to match room temperature, or better yet, use water from a water storage tank in the same room. Make all other items the same temperature as the room. i.e. test jacket water, test pumping water, and cylinder fill water. Air cannot be moving around the jacket outer steel. Insulate the jackets. Do not blow AC on or near the jackets. All AC ducting must be diverted away from the jacket area. Do not blow large fans on or near the jackets.
- b) <u>Control the rate of pressurization</u>: This needs to be a very slow steady increase to the target. The rate of increase should be about 500 PSI every 3 seconds. Use the ball valve on the electronic regulator to restrict the air flow to the pump to control the rate of pressurization. You may also change the 'Reg Cont Corr' value on the diagram screen. A good range to stay in is 200 300. Going up in value will increase the rate of pressurization. You may also change the 'Piston Ratio' value. Going down in value number will increase rate of pressurization. The pump is rated at 100:1 piston ratio. Normally it should not be necessary to go below 98 or above 102.

Another way is to decrease the piston ratio value to 95, and manually restrict the air feed to the pump with the ball valve between E/P reg and pump. Set this where it works, and leave it for all small cylinder testing.

- c) <u>Control the rate of depressurization or 'Bleed':</u> Use the manual bleed restrictor valve attached to the air operated bleed valve on the RSP. More bleed restriction will affect the bowl cc's to go less into negative expansion. Less bleed restriction (faster bleed flow) will allow the bowl cc's to go further into negative expansion. There is a point where too much adjustment either way, can greatly affect the bowl reading either way to not make sense and confuse the operator. Make small adjustments to determine the proper setting.
- 6. Low Bowl Level: The program automatically adds water, and sets the bowl to zero. It also gets the air out of the line by adding water to the minimum bowl level adjustment in the diagram screen. The program limits the water level in the scale so that water cannot overflow and damage the scale during normal use. Care must also be taken to not allow the water level to fall below the end of the expansion probe. This will cause air to get into the expansion line, so be sure to keep the water level above the end of the probe during manual testing in the diagram screen.
- 'Restart' Button: Automatically restarts a test at <u>80%</u> target pressure. If the full target pressure is desired, click the 'Restart' button, and then click the 80% button. This will uncheck the 80% feature, and run a full target pressure test.
- 8. **'+100PSI' Retest:** If you choose to retest a failed cylinder at 100PSI over the rated target pressure, then you must click on the '+100PSI' button, and click the 'Restart' button. The software will only allow 1 "retest" at +100PSI over the rated target pressure for that cylinder serial number. The +100PSI text will turn red after the start of the test. It is best

to run a failed cylinder at 80% test pressure first, for an equipment check. After passing at 80%, then test at 100 PSI, or 10% over test pressure, whichever is less.

9. Fail To Reach Target Pressure: Galiso has overcome this problem that can sometimes happen when the variables (such as incoming air supply, water pressure, and pump stroke position) keep the pump from attaining target pressure. If the pump stalls below the target for 6 seconds, it will bleed for 2 seconds, and start pumping again to achieve the target. It should achieve the target the second time, and start the 30 second timer at that point.

## Section 3: Principles and Structure

#### Principles and Structure with Component Function Detail of the Recortest 4 Water Jacket Test Console

The water jacket cylinder test system mainly consists of the following components:

- 1. Pressure system
- 2. Expansion system
- 3. Water filtering system
- 4. Software control interface

#### Basic overview of the water jacket test system components:

- 1. <u>Pressure system:</u> This system contains the water pump with high pressure valve, bleed valve, high pressure tubing with fittings, test heads, and calibrated cylinders. Its main function is to pressurize the cylinders for hydrostatic testing.
  - a) Water pump: It is an air driven, 100:1 ratio, dual action intensifier pump. 1 PSI of air to the pump, = 100PSI of water pressure in the pressure line. Those are the design figures in the theoretical world/best case scenario. There are 4 check valves on the pump: 1 for low pressure water inlet, and 1 for high pressure water outlet for each of the 2 pump pistons. There is a reservoir support package to provide more air volume to feed the pump drive.
  - b) High pressure and bleed valves: Upon initial start of cylinder pressurization, the bleed valve closes (electro-pneumatic control valve light on). Upon achieving the target pressure, during the hold time, the pressure valve also closes (electro-pneumatic control valve light on). To bleed off the test pressure, both valves open (lights off).
  - c) **High pressure tubing, fittings, test head stems, & quick couplers:** Stainless tube with compression fittings to the stainless test heads, and master gauge locations. A quick coupler is utilized for the master gauge connection.
  - d) Calibrated cylinder: The final piece of the pressure system. Verifies predetermined pressure to expansion measurements to ensure the system is in calibration before testing production cylinders.
- 2. <u>Expansion system</u>: This system contains the water jacket (1 for each cylinder to test), test head to jacket seal boot, expansion tubing, expansion weigh scale, and weigh bowl.
  - a) **Water Jacket:** Must be full of water, and sealed with the test head and cylinder in place. Made of steel. Has an 8" glass pressure relief port (burst disc) in the event of a loss of cylinder integrity under pressure.
  - b) **Test head to jacket seal boot:** Seals the head to the jacket with air applied to the air fitting.
  - c) **Expansion tubing:** Blue colored flexible nylon tubing, connected via push in style fittings. The tube carries the expansion water from the jacket, to the stainless weigh bowl probe, which is the last extension of the expansion tube. The probe typically sits at a level within ¼" of the bottom of the weigh bowl. An air free siphon must be established between jacket and weigh bowl for the system to properly function.

- d) Expansion weigh scale: The scale measures the weight in grams. 1 gram of weight = 1cc of water. The scale must simply be powered on, and the control software does the tare and measure functions. <u>Do not</u> manually 'zero' the scale with the scale 'zero' button.
- e) Weigh bowl: The weigh bowl holds enough water to enable a stable measurement of the cylinder expansion. It is a simple plastic bowl, with a metal drain stick, should the level accidentally overflow.

3. <u>Test water cartridge filtering:</u> There is one large cartridge filter for incoming facility water. This filter needs changed once per year.

4. <u>Software control interface:</u> Controls the test parameters for all testing. Measures the test information and calculates pass or fail. There are 2 programs that effect water jacket system testing control. One is the Rec4 Settings program, and the other is the main testing interface. In the Rec4 Settings program, you can input many of the test parameters such as cylinder code information. Sends test result files to the network location of your choice, and to the machine PC local hard drive.

#### Section 4: Instrument Detail

#### Instrument Detail Operations and Technologies for the Rec4 Cylinder Water Jacket Test System

#### 1. Water Jacket Testing:

#### a) Pressure system:

1) Water pump: A minimum of 100PSI of facility shop air is required to properly operate and control the pump functions. It is an air driven, 100:1 ratio, dual action intensifier pump. 1 PSI of air to the pump, = 100PSI of water pressure. This ratio is a hardware constant value. However, the pump piston ratio value can be changed in the control interface to achieve cylinder test target pressure more efficiently. There are 4 check valves 1 for low pressure water inlet, and 1 for high pressure water outlet for each of the 2 pump pistons. There is a reservoir support package to provide more air volume to feed the pump drive. To operate the pump, open the ball valve (adjacent to the automatic regulator) to a sufficient amount for attaining the desired cylinder test pressure. Faster pumping and test times can be achieved by opening the valve more than what is required to achieve test pressure. Galiso controls the rate of pressurization with several software parameters. These are adjustable in the diagram screen. You can also adjust the rate value, and the piston ratio value for more accurate pressure points. Each pump varies slightly in its operation. This variance may require slightly different settings. The cylinder also has many features that require certain changes in the test parameter values in order to achieve test pressure.

A) **High pressure and bleed valves:** Upon initial start of cylinder pressurization, the bleed valve closes (electro-pneumatic control valve light on). Upon achieving the target pressure, the pressure valve also closes (electro-pneumatic control valve light on). To bleed off the test pressure, both valves open (lights off). Watch the control valve lights on the SMC electro pneumatic valves for correct valve signal operation. Watch the valve stem movement to ensure the valve is properly moving with signal. This observation (as is with all test function observations) will help you understand what is happening and when. This will help you choose the correct course of action for later maintenance and troubleshooting.

B) **Manual pressure regulator:** Adjust this to 115PSI control air pressure as displayed on the digital pressure switch. It will go down as cylinders are pressurized, according to the volume of air supplied by the facility compressor. It should not drop below 70PSI.

C) Automatic pressure regulator: Receives signal from control software, to provide adequate air volume to the pump for pressurizing. There is a regulator correction value in the control software if a change is needed to achieve test pressure more efficiently. Normally, this value should not be changed after installation, except for extreme volume and elasticity differences in the cylinders being tested, compared to the cylinders the settings were adjusted with.

D) Pump air exhaust: The pump must have an open exhaust line,

similar to the tail pipe of an automobile. This should remain open. Galiso equips the reservoir support package with a 1" exhaust tube, to be extended and routed by the customer to their exhaust dump location. If you must, it is permissible to place a muffler at the end of the exhaust tube. Preferably at least 5 meters of exhaust tube should be in front of the muffler.

E) **Reservoir safety valve:** The RSP has a 150PSI safety valve. Please keep incoming air pressure at 130 or less.

F) **Reservoir relief valve:** This is a manually operated valve for fast air evacuation from the tank. It will relieve the air in the tank, and shut-off incoming air simultaneously.

- 2) High pressure tubing, fittings, test heads, & quick couplers: Stainless tube with compression fittings to the stainless test heads, and master gauge locations. Quick couplers are utilized for the master gauge connection. The fittings must not be over-tightened. Care must be made during maintenance to ensure fittings are not damaged during reassembly. The coupler seals require periodic replacement.
- 3) Calibrated cylinders: There is 1 for each jacket. The correct cylinder serial number must be placed in the correct jacket for proper calibration. Each cylinder has a predetermined, calibrated point list to show the nominal expansion cc at the given pressure point. To properly calibrate, a pre-pressurization should be done on the cylinders, immediately before the qualification calibration test is done. Do not allow more than 10 seconds to expire between the pre-test bleed to zero PSI, and qualification calibration test. Generally, the next pressurization should be started as soon as the bleed pressure from the previous test comes to zero. With time, the parameters of the pre-test may need changed to better accommodate exercising the cylinder as it gets older. Again, the pre-test is basically to exercise the cylinders so they will expand and contract properly for the calibration verification test.

A) **Adapter usage:** It is important to not remove and reinstall the test adapters for daily calibration verification tests. Leave the adapters on the calibrated cylinders. The cylinders should not be dried, and should be set aside with water still in them, ready for the next day's calibration test. If water stagnation is a concern, you may drain and dry them every 2 months.

#### b) Expansion system:

- Water jackets: Upon pressurization, the cylinder physically expands, pushing water from the sealed jacket, through the expansion line, and to the weigh bowl on the scale for measuring in cc (cubic centimeter). The amount of water pushed to the bowl is measured under pressure, and then the amount is also measured after the pressure is released, and the cylinder stabilizes. This method of measurement accurately displays the integrity of the pressure vessel or cylinder as the case may be.
- 2) Test head: This unit is what seals the test head to the jacket. It is to be kept clean and free of dirt or water slime. The main seal is the head boot that encircles the top inside perimeter of the jacket. Keep the boot rubber clean, and do not allow rust barnacles to build up on it.

- 3) Expansion tubing: Flexible nylon tubing, connected via push in style fittings. The nylon tube must not have any kinks or blockages in it. The tube carries the expansion water from the jacket, to the stainless weigh bowl probe, which is the last extension of the expansion tube. The probe typically sits at a level within ¼" of the bottom of the weigh bowl. An air free siphon must be established between jacket and weigh bowl for the system to properly function.
- 4) Expansion weigh scale: The scale measures the weight in grams. 1 gram of weight = 1cc of water. The scale must simply be powered on, and the control software does the tare and measure functions. Scales should be kept level by adjusting the feet so the air bubble stays centered in the circle. Do not allow the scale to be immersed in or covered with water.
- 5) **Weigh bowl:** The bowl is a 1000cc bowl. It is sufficient in size to test up to 800cc expansion cylinders.
- c) Test water cartridge filtering: The inlet water is filtered down to 5µm.

## d) Software control interface:

1) There are 2 programs essential to performing tests on the water jacket system.

A) **Rec4 Settings program:** This program allows for test parameters to be set according to the cylinders being tested. Please read the Rec4 Settings manual for complete training on its functions.

B) **Rec4 Testing Software:** This program is the user interface to control the machine. Please read its manual for complete operations instructions.

e) Data storage and analysis: Galiso saves all of the raw test data in text (.csv) files. One set of all test data is saved to the machine PC hard drive. Another set is saved remotely to a LAN file location chosen by the customer in the Rec4 Settings program. The remote file may also be another drive on the machine PC, such as a CD write drive, or a removable drive, etc....

#### Section 5: Installation and General Maintenance

#### Installation and General Hardware Maintenance of the Rec4 Water Jacket Cylinder Test System

#### 1. Water Jacket System:

## a) Pressure system:

#### 1. Water pump:

- A) Change the inlet water supply filter to the pressure pump at least once per year.
- B) Ensure pump exhaust pipe is kept clear and unobstructed at all times. Check the end of the pipe at least once per month to ensure pump exhaust is freely escaping out of the end of the pipe. If you use a muffler, check it to ensure it is not clogged.
- C) Pressure and bleed valves: Check for leaks once per month or if leak is suspected. If valve is leaking through the weep hole, tighten the large nut 1/8 of a turn. <u>Do not over-tighten!</u> Remove the lock ring with allen wrench and discard. Carefully tighten the nut, and get a feel for its tightness. The valve pintel tightens against graphite packing rings. These rings can break very easily if over-tightened. Try 1/8<sup>th</sup> of a turn to see if leak stops. Try another 1/8 of a turn if leak does not stop. Ensure the SMC electro-pneumatic pressure and bleed control valve lights are functioning at least once per month. Upon initial start of cylinder pressurization, the bleed valve closes (electro-pneumatic control valve light on). Upon achieving the target pressure, the pressure valve also closes (electro-pneumatic control valve light on). To bleed off the test pressure, both valves open (lights off). Observe the valve movement itself to ensure a clean crisp on and off/in and out movement of the valve hardware.
- D) Keep the RSP and pump assemblies clean, and free of excessive shop dust.
- 2. **Hi Pressure Tubing:** Keep all fittings tight, and visually check for leaks once per month.

Quick couplers: Upon the event of a quick coupler leak, replace the coupler if the machine needs to test cylinders immediately. The old coupler housing is probably still good. Replace the seals in it, and put it back in the rotation of used replacement parts. If new seals don't work to fix the leak on the old coupler, then discard the coupler. Changing the seals on the old coupler is much easier to do when it is not connected. Then, you can change them on a workbench at a more convenient time, or with a more convenient laborer.

## 3. Calibrated cylinders:

Neck threads: Do not remove the test adapters from the calibrated cylinders unless it is absolutely necessary. Frequent removal and reinstallation of the test adapters will wear out the threads, and void the warranty of the cylinders. Galiso does not warranty excessively worn cylinder neck threads.

## b) Expansion system:

## 1. Water jacket:

A) **Head seal to jacket:** Keep the head seal boot clean. Keep the jacket clean, and do not polish the top area where the head seal engages. That area should be about 80grit rough.

B) **Burst disc port:** The glass should be kept clean. Do not allow rust to build up around the rubber seal.

## 2. Expansion tubing and fittings:

- A) Tube condition: Do not allow the tubing to become clogged, compressed, kinked or deteriorated. Tubing must look to be perfectly intact. Replace tubing if it becomes worn or damaged. Purge all air from the lines. Check for leaks once a month, or if leak is suspected. If leak is found, cut the worn tube end off, and reinstall new end of tube into fitting. If that does not fix the leak, replace the tube and the fitting.
- B) Placement: If you replace tubing, keep its length to a minimum. Point the tubing in the direction of destination. Do not make full circle loops with the tubing. Circle loops will develop air pockets that grow larger the more testing is done. Keep the expansion probe from touching the bowl sides or bottom.
- C) **Fitting operation:** The fittings are a press and fit type. To install the tubing, simply push it into the fitting all the way. To remove the tubing, use a ½" wrench or equivalent, place it around the tube, and over the flange, and depress the tube flange with the wrench, while pulling out the tube. You can use your fingers to depress the flange, but some places may require a wrench to assist in pushing the flange down.
- D) **Purging air from the lines:** The entire expansion line from jacket to bowl must not have any air in it.
  - 1. Insert the calibrated cylinder into the jacket, and seal the test head with the blue low pressure hose.
  - Fill the bowl with water. Go to about 800 on the cc lines on the bowl itself. To do this, you must click on the bowl fill valve button on the diagram screen as shown below as B1 = bowl #1, and B2 = bowl #2.
  - 3. Disconnect the blue low pressure hose on the test head, and move the head safety bar away from the head safety switch.
  - 4. Watch the bowl level go down, and click the bowl fill button when the level is between 200 and 250. You can go lower or higher, but this is a good working level. Just make sure the level never goes below the end of the probe. If it does, then purge the line again.

## 3. Expansion weigh scale and bowl:

- A) Powering on: Carefully lift the weigh bowl off of the scale platform (leave the expansion probe intact) and press the on button. Wait for scale to register 0.0, and carefully replace the bowl onto the scale platform. <u>Be sure the bowl and overflow stick do not touch anything</u>, including the expansion probe, and scale mounting bracket. <u>Be sure the bowl is on the scale platform as much as possible, without touching</u> <u>anything else</u>, including expansion probe. Ensure the Galiso signal wire connection is in place at the rear of the scale.
- B) **Taring:** There is no need to tare the scale, as the Galiso program performs that function automatically. Please do not tare the scale.

#### Section 6: Hardware Diagnostics and Troubleshooting

#### Hardware General Diagnostics and Troubleshooting of the Recortest 4 Water Jacket Cylinder Test System

#### **General Troubleshooting Guidelines:**

Study what is happening, and when. Gather clear and precise information before calling Galiso Customer Service. 1-800-854-3789 or 970-249-0233.

Keep all schematics and drawings accessible so Galiso Customer Service can use them to help you fix the machine. Please study the drawings and become familiar with them.

#### 1. Water Jacket System:

#### a) Pressure system:

#### 1) Hi pressure pump:

A. If loss of line pressure is experienced, and there is no leak anywhere in the lines, then fix according to the instruction in the 'Installation and General Maintenance' manual.

B. Rebuild or replace the outlet check valves on the pump. The pressure could be going back into the pump through a check valve that is not functioning properly.

- 2) Negative Expansion: If negative expansion occurs during water jacket test, slow down the bleed speed with the manual bleed valve. Turn it off, and then back it off about 1/16<sup>th</sup> of a turn. That will keep the cylinder from bleeding down the pressure too fast, and going negative on the expansion scale.
- 3) **Pressure rise during hold:** If expansion cc reading increases during the pressure hold time of the water jacket test, then it is highly likely that there is a test connection leak. The test connection is sealed by the speed seal connection from head to cylinder.
- 4) Pressure loss: A loss of pressure during the hold time, and after the pressure stabilizes, greater than 1PSI per every 2 seconds, is probably an external leak somewhere in the pressure line system. This is usually visible, so look for the leak. You need to give the pressure time to stabilize after pressurizing, before being concerned about a pressure leak, unless it cannot stabilize due to a large leak. It is also caused by a very rapid pressurization on a more elastic cylinder. The cylinder pressurizes very fast, and then expands during the hold time. The expansion allows the cc's to drop rapidly during hold. In such cases, slow down the rate of pressurization so all expansion takes place during pressurization.
- 5) **Pump pressure or bleed valve leaking through weep hole:** Fix according to instruction in the 'Installation and General Maintenance' manual.
- 6) Calibrated cylinders: You must pressurize the calibrated cylinders manually in the diagram screen to the pressure to calibrate or more (not to exceed 7800PSI), 2 to 3 times to exercise the cylinders so they will meet the points, and come back to zero expansion correctly during the

calibration test. You can pressurize using the 'Pressurize' button on the on the diagram screen. Hold it for at least 20 seconds, and bleed using the 'Bleed' button on the diagram screen.

- b) Expansion system:
  - 1) **Water jacket:** The bowl level should stabilize within 10 seconds after the expansion valve opens.
  - 2) Expansion weigh scale: If the expansion does not go high enough compared to other cylinder tests, then the placement of the bowl on the scale is suspected to be the problem first. Check the bowl placement according the 'Installation and General Maintenance' manual. Do the same if the expansion does not come to zero/shows to much permanent expansion. Check the bowl placement.