

# CALIBRATION CERTIFICATE

## Centre for Calibration

a unit of

**NAGMAN INSTRUMENTS & ELECTRONICS (P) LTD.**

Block 'B', "Nagman Complex" 27th KM Stone, Chennai - Bangalore NH4,

Nazarathpet (Via), Chembarambakkam, Chennai - 600 123. Tamilnadu.

Phone : 044 - 26811710, 26811731 (Lab), Marketing : 044 - 2681 1776

Fax : 044 - 26811703 E-Mail : cfcchennai@nagman.com, calibration@nagman.com

Site : www.nagman-calibration.com




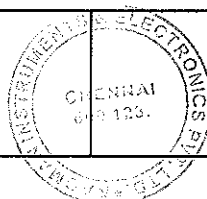
CFC / FT - 01/5.10

C-0162/C-0163/C-0164


<b>Job No: 614</b>	<b>Calibration Certificate No.</b>	<b>2014-15 / CFC / 5629</b>
<b>Customer Name and Address</b>	M/s. EDACI-Empresa De Automatization, Control Industrial, Cnel Lynch 2684-San Justo, Buenos Aires-Argentina.	
<b>Customer Reference</b>	PO No: 1690 Dated: 30.04.2014	
<b>Details of the Instrument</b>		
Description	Hydraulic Dead weight Tester	
Make	Nagman Instruments and Electronics (P) Ltd.	
Model	H6600-DP-700/1	
Serial number	DWT 1405 P0048	
Identification number	-	
Range	1 to 700 bar	
No of weights	14 Nos.	
Weights in bar	5 * 6, 2 * 2, 1 * 1, 0.5 * 1, 0.2 * 2, 0.1 * 1, 0.05 * 1	
Accuracy	±0.025% Rdg	
Equipment received on	30.06.2014	
HP Multiplication factor	20	
Condition of the equipment on receipt	Good	
Calibration procedure number	CFC / WI- M 04	
Date of calibration	30.06.2014	
Date of next calibration suggested	30.06.2015	
<b>Calibration Environments</b>		
Temperature	23°C±2°C	
Relative humidity	35% to 65%	
Acceleration due to Gravity	9.7737452 m/sec <sup>2</sup>	
<b>Master Instrument</b>	<b>Master - 1</b>	<b>Master - 2</b>
Description	Hydraulic Cross Float System	Dead Weight Tester
Make	Pressurements, U.K.	Avic Taiyuan
Type / Model	P7300	BHY 100S
Serial number	H895	505
Report Number	1500159288	RGpc2011-0551
Calibration valid till	09/01/2017	05/09/2014
<b>The Standards used are traceable to National / International Standards</b>		

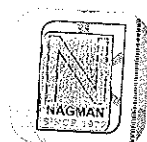
Checked By

  
A. Manivannan  
Team Member



Approved By

  
M. Jagatheeswari  
Team Leader



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### CALIBRATION DATA

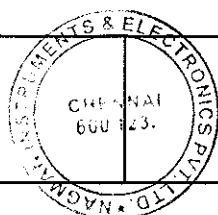
For Low Pressure range ( Increasing )

Nominal Pressure	Test Weights Used	Reference Pressure in bar			Mean	Deviation	Deviation Allowed (±)	Expanded Uncertainty (±)
		1st	2nd	3rd				
bar	bar	Observations			bar	bar	bar	bar
	Carrier(C) = 1							
4.0	C+(2*1)+(1*1)	3.9991	3.9991	3.9991	3.9991	0.0009	0.0010	0.0018
7.0	C+(5*1)+(1*1)	6.9985	6.9985	6.9985	6.9985	0.0015	0.0017	0.0021
10.5	C+(5*1)+(2*2)+(0.5*1)	10.4978	10.4978	10.4978	10.4978	0.0022	0.0026	0.0026
14.0	C+(5*2)+(2*1)+(1*1)	13.9976	13.9976	13.9976	13.9976	0.0024	0.0035	0.0033
17.5	C+(5*3)+(1*1)+(0.5*1)	17.4990	17.4990	17.4990	17.4990	0.0010	0.0044	0.0040
21.0	C+(5*4)	21.0013	21.0013	21.0013	21.0013	-0.0013	0.0053	0.0047
24.5	C+(5*4)+(2*1)+(1*1)+(0.5*1)	24.5036	24.5036	24.5036	24.5036	-0.0036	0.0061	0.0054
28.0	C+(5*5)+(2*1)	28.0047	28.0047	28.0047	28.0047	-0.0047	0.0070	0.0061
31.5	C+(5*6)+(0.5*1)	31.5059	31.5059	31.5059	31.5059	-0.0059	0.0079	0.0068
35.0	C+(5*6)+(2*2)	35.0072	35.0072	35.0072	35.0072	-0.0072	0.0088	0.0075

The measurement confidence level is 95.45% , with Coverage Factor k = 2.11

Note: Calibration of Dead Weight Tester was carried out taking the "g" at nagman and are given corrected to standard G = 9.80665 m/s<sup>2</sup>. To obtain the exact pressure multiply the measured pressure by the term(g-local/G-standard)

Checked By  
*AM*  
A. Manivannan  
Team Member



Approved By  
*MJ*  
M. Jagatheeswari  
Team Leader



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### CALIBRATION DATA

For Low Pressure range ( Decreasing )

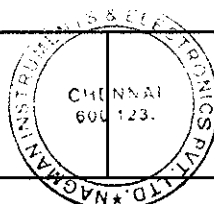
Nominal Pressure bar	Test Weights Used bar	Reference Pressure in bar			Mean bar	Deviation bar	Deviation Allowed (±) bar	Expanded Uncertainty (±) bar
		1st	2nd	3rd				
	Carrier(C) = 1							
35.0	C+(5*6)+(2*2)	35.0072	35.0072	35.0072	35.0072	-0.0072	0.0088	0.0075
31.5	C+(5*6)+(0.5*1)	31.5059	31.5059	31.5059	31.5059	-0.0059	0.0079	0.0068
28.0	C+(5*5)+(2*1)	28.0047	28.0047	28.0047	28.0047	-0.0047	0.0070	0.0061
24.5	C+(5*4)+(2*1)+(1*1)+(0.5*1)	24.5036	24.5036	24.5036	24.5036	-0.0036	0.0061	0.0054
21.0	C+(5*4)	21.0013	21.0013	21.0013	21.0013	-0.0013	0.0053	0.0047
17.5	C+(5*3)+(1*1)+(0.5*1)	17.4990	17.4990	17.4990	17.4990	0.0010	0.0044	0.0040
14.0	C+(5*2)+(2*1)+(1*1)	13.9976	13.9976	13.9976	13.9976	0.0024	0.0035	0.0033
10.5	C+(5*1)+(2*2)+(0.5*1)	10.4978	10.4978	10.4978	10.4978	0.0022	0.0026	0.0026
7.0	C+(5*1)+(1*1)	6.9985	6.9985	6.9985	6.9985	0.0015	0.0017	0.0021
4.0	C+(2*1)+(1*1)	3.9991	3.9991	3.9991	3.9991	0.0009	0.0010	0.0018

The measurement confidence level is 95.45% , with Coverage Factor k = 2.11

Note: Calibration of Dead Weight Tester was carried out taking the "g" at nagman and are given corrected to standard G = 9.80665 m/s<sup>2</sup>. To obtain the exact pressure multiply the measured pressure by the term (g-local/G-standard)

Checked By

*A. Manivannan*  
A. Manivannan  
Team Member



Approved By

*M. Jagatheeswari*  
M. Jagatheeswari  
Team Leader



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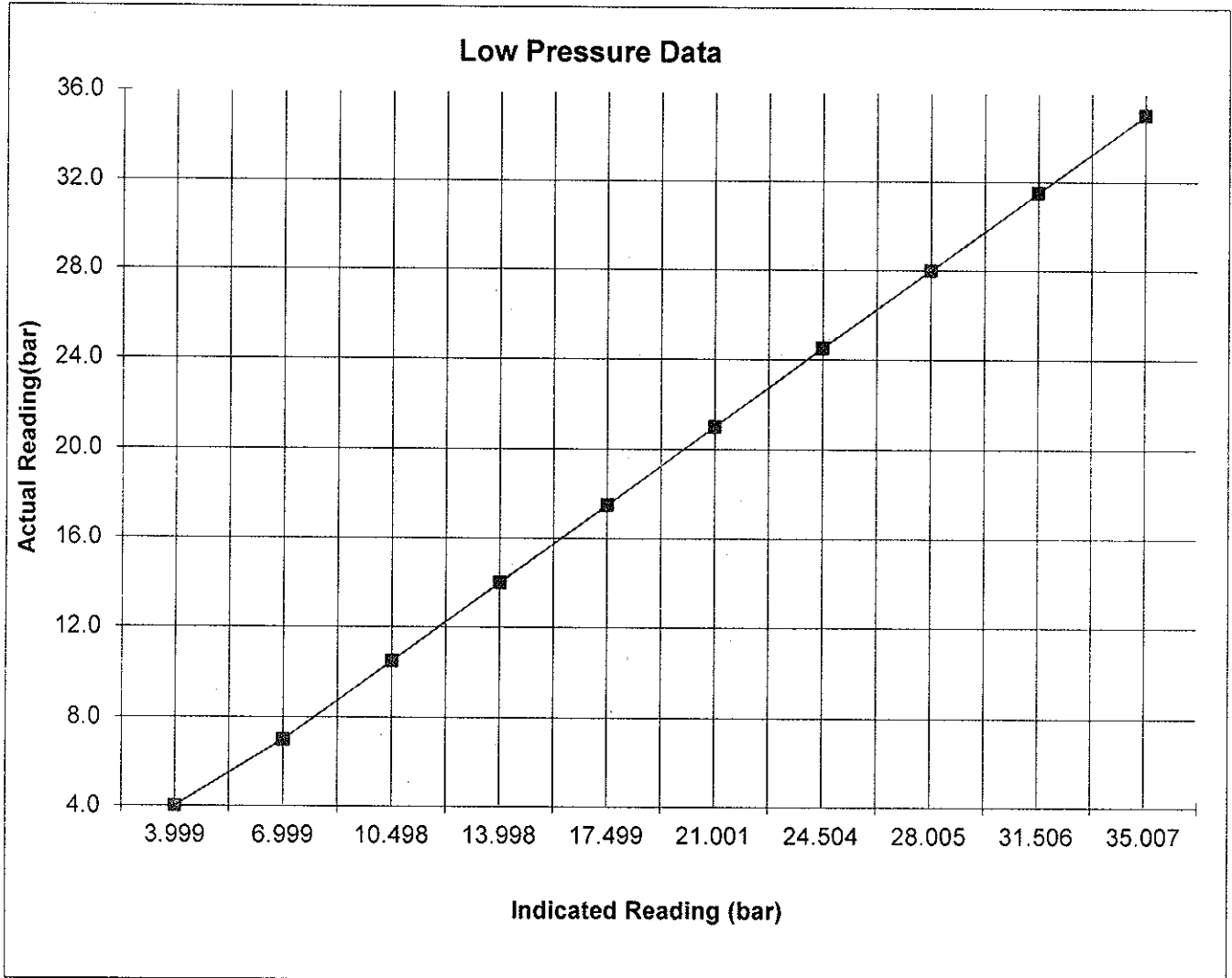
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Certificate No

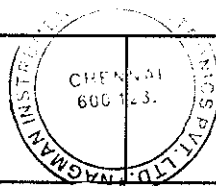
2014-15 / CFC / 5629

### CALIBRATION DATA CHART



Checked By

*A. Manivannan*  
A. Manivannan  
Team Member



Approved By

*M. Jagatheeswari*  
M. Jagatheeswari  
Team Leader



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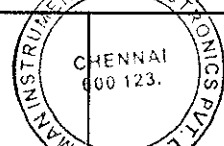

### Calibration data

For High Pressure range ( Increasing )

Nominal Pressure	Test Weights Used	Reference Pressure in bar			Mean	Deviation	Deviation Allowed (±)	Expanded Uncertainty (±)
		1st	2nd	3rd				
bar	bar	Observations			bar	bar	bar	bar
	Carrier(C) = 10							
70	C+(40*1)+(20*1)	70.008	70.008	70.008	70.008	-0.008	0.018	0.020
140	C+(100*1)+(20*1)+(10*1)	140.016	140.016	140.016	140.016	-0.016	0.035	0.032
210	C+(100*2)	210.025	210.025	210.025	210.025	-0.025	0.053	0.045
280	C+(100*2)+(40*1)+(20*1)+(10*1)	280.032	280.032	280.032	280.032	-0.032	0.070	0.059
350	C+(100*3)+(40*1)	350.026	350.026	350.026	350.026	-0.026	0.088	0.073
420	C+(100*4)+(10*1)	420.021	420.021	420.021	420.021	-0.021	0.105	0.087
490	C+(100*4)+(40*2)	490.008	490.008	490.008	490.008	-0.008	0.123	0.101
560	C+(100*5)+(40*1)+(10*1)	559.987	559.987	559.987	559.987	0.013	0.140	0.115
630	C+(100*6)+(20*1)	629.977	629.977	629.977	629.977	0.023	0.157	0.129
700	C+(100*6)+(40*2)+(10*1)	699.965	699.965	699.965	699.965	0.035	0.175	0.143

The measurement confidence level is 95.45% , with Coverage Factor k = 2

Note: Calibration of Dead Weight Tester was carried out taking the "g" at nagman and are given corrected to standard G = 9.80665 m/s<sup>2</sup>. To obtain the exact pressure multiply the measured pressure by the term (g-local/G-standard)

Checked By  A. Mahivannan Team Member		Approved By  M. Jagatheeswari Team Leader
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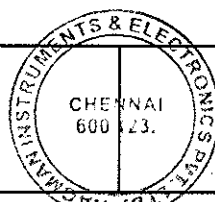
For High Pressure range ( Decreasing )

Nominal Pressure	Test Weights Used	Reference Pressure in bar			Mean	Deviation	Deviation Allowed (±)	Expanded Uncertainty (±)
bar	bar	Observations			bar	bar	bar	bar
	Carrier(C) = 10	1st	2nd	3rd				
700	C+(100*6)+(40*2)+(10*1)	699.965	699.965	699.965	699.965	0.035	0.175	0.143
630	C+(100*6)+(20*1)	629.977	629.977	629.977	629.977	0.023	0.157	0.129
560	C+(100*5)+(40*1)+(10*1)	559.987	559.987	559.987	559.987	0.013	0.140	0.115
490	C+(100*4)+(40*2)	490.008	490.008	490.008	490.008	-0.008	0.123	0.101
420	C+(100*4)+(10*1)	420.021	420.021	420.021	420.021	-0.021	0.105	0.087
350	C+(100*3)+(40*1)	350.026	350.026	350.026	350.026	-0.026	0.088	0.073
280	C+(100*2)+(40*1)+(20*1)+(10*1)	280.032	280.032	280.032	280.032	-0.032	0.070	0.059
210	C+(100*2)	210.025	210.025	210.025	210.025	-0.025	0.053	0.045
140	C+(100*1)+(20*1)+(10*1)	140.016	140.016	140.016	140.016	-0.016	0.035	0.032
70	C+(40*1)+(20*1)	70.008	70.008	70.008	70.008	-0.008	0.018	0.020

The measurement confidence level is 95.45% , with Coverage Factor k = 2

Note: Calibration of Dead Weight Tester was carried out taking the "g" at nagman and are given corrected to standard G = 9.80665 m/s<sup>2</sup>. To obtain the exact pressure multiply the measured pressure by the term (g-local/G-standard)

Checked By  
*Manivannan*  
Manivannan  
Team Member



Approved By  
*M. Jagatheeswari*  
M. Jagatheeswari  
Team Leader



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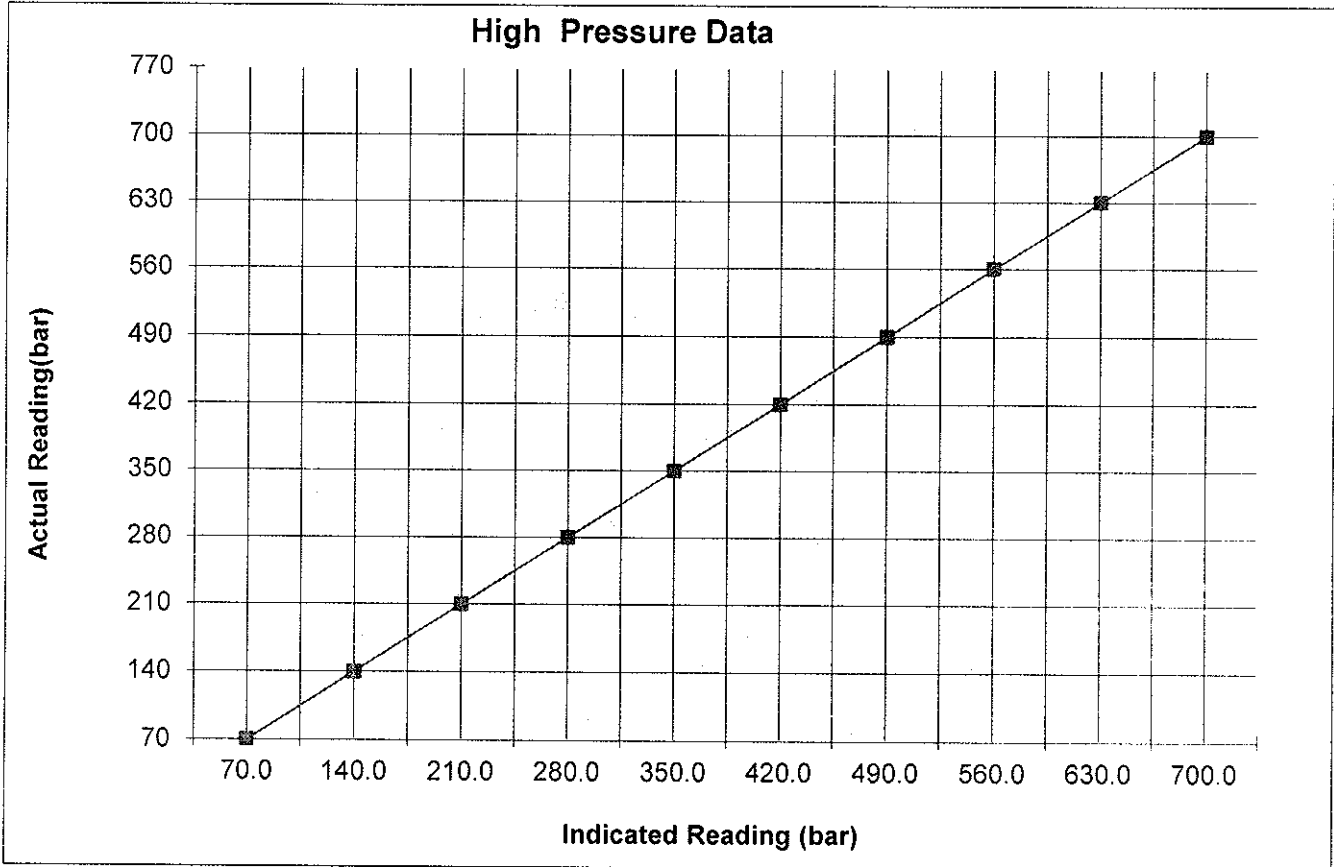
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C-0162/C-0163/C-0164

<b>Certificate No</b>	<b>2014-15 / CFC / 5629</b>
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### CALIBRATION DATA CHART



**Remarks :-**

1. The above UUC was calibrated at Lab
2. UUC is defined as Unit Under Calibration.
3. The measurement confidence level is 95.45%
4. The Calibration Certificate shall not be reproduced except in full without written approval of CFC.
5. The above Expanded Uncertainty includes Repeatability, Linearity & Uncertainty of Measurement.
6. The above instrument has been calibrated using cross floating technique.
7. The above results relate only to the items calibrated

Checked By  A. Manivannan Team Member		Approved By  M. Jagatheeswari Team Leader
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### CALIBRATION DATA

#### 1. Effective Area of the Piston

##### A. Low Piston

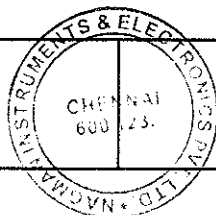
Standard Pressure Value (bar)	Force N	Effective Area (mm <sup>2</sup> )
3.999	32.1136	80.3030
10.498	84.3688	80.3678
13.998	112.5075	80.3761
17.499	140.6454	80.3735
21.001	168.7809	80.3669
24.504	196.9211	80.3641
28.005	225.0568	80.3639
31.506	253.1948	80.3642
35.007	281.3323	80.3641

##### B. High Piston

Standard Pressure Value (bar)	Force N	Effective Area (mm <sup>2</sup> )
70.008	28.0718	4.0098
140.016	56.1408	4.0096
210.025	84.2071	4.0094
280.032	112.2778	4.0095
350.026	140.3438	4.0095
420.021	168.4123	4.0096
490.008	196.4835	4.0098
559.987	224.5491	4.0099
629.977	252.6180	4.0100
699.965	280.6859	4.0100

Checked By

*A. Manivannan*  
A. Manivannan  
Team Member



Approved By

*M. Jagatheeswari*  
M. Jagatheeswari  
Team Leader





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**Remarks:**

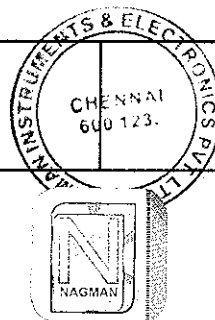
1. The Piston-Cylinder assembly effective area has been calibrated at various pressures. With the piston vertically mounted balancing at its mid operating position and rotating freely in a clockwise direction as seen from above. All data is given with reference to the bottom face of the piston. The values for the effective load take into account acceleration due to gravity, buoyancy in air and surface tension.
2. Effective area @ zero pressures ( A<sub>0</sub> ) = 80.3391 mm<sup>2</sup> ± 0.0132 mm<sup>2</sup> - (Low Piston)  
Effective area @ zero pressures ( A<sub>0</sub> ) = 4.0094 mm<sup>2</sup> ± 0.0001 mm<sup>2</sup> - (High Piston)
3. Deformation coefficient ( d ) = 0.000131 Per N/mm<sup>2</sup> (Low Piston)  
Deformation coefficient ( d ) = 0.000002 Per N/mm<sup>2</sup> (High Piston)
4. Rotation Time Observed is 6 minutes  
Fall Rate Observed is 1 mm/min
5. Free Rotation Time of the piston :

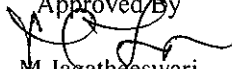
Upper limit of the Measuring Range (Mpa)	Free rotation time for accuracy class (min)					
	0.005	0.01	0.02	0.05	0.1	0.2
from 0.1 to 6 included	4	4	3	2	2	2
from 6 to 500 included	6	6	5	3	3	3

**6. Rate of fall of piston**

Pressure medium in clearance	Upper limit of the measuring range (Mpa)	Max piston fall rate (mm/min) for accuracy class					
		0.005	0.01	0.02	0.05	0.1	0.2
gas	0.1 to 1 included	1	1	1	2	2	-
gas	more than 1	2	2	2	3	3	-
liquid	0.6 to 6 included	0.4	0.4	0.4	1	2	3
liquid	from 6 to 500 included	1.5	1.5	1.5	1.5	3	3

Checked By  
  
A. Manivannan  
Team Member



Approved By  
  
M. Jagatheeswari  
Team Leader