Proficiency Test Final Report

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Octagon Measurement Solutions Pvt. Ltd.

PT Division

Accredited Disciplines

Mechanical Calibration | Thermal Calibration | ET Calibration

PT report Number - PTC/MECH/PRVC/FR-001-8

PT Round Code	**PTC/MECH/PRVC/001-8**
Parameter, Range,	**Hydraulic Digital Pressure at 50 bar,100 bar, 125 bar, 150 bar and 175 bar. Operating Range of the pressure gauge 0-200 bar**
Date of Report	15/06/2023
Dates of Measurements	22/12/2022 to 31/05/2023
PT Coordinator(s)	**Bhagyesh Udgirkar** Cell. No.: +91-9099901824/ EMAIL: udgirkar@octagon.co.in; **Vandana Deshmukh** Cell. No.: +91-8329316210/ EMAIL: mr@octagon.co.in

Proficiency Test Description

Clear description of the artifact, standards, items or materials used, including, where appropriate serial numbers and details of sample preparation and homogeneity or stability testing.

Calibration of Digital Hydraulic Pressure Gauge Range 0-200 bar L.C.- 0.01 bar Indicating Device Make – WIKA, Sl. No.- 1A02A8WGY35, ID. No. – OMS-078 measurement points at 50 bar,100 bar, 125 bar, 150 bar and 175 bar.

PT item was manufactured by reputed manufacturer for this study and supplied with an adopter for easy fitting and dismantle activities for participants. All participants were advised to mount the Pressure Gauge with supplied adopter by Octagon, only.

Case	approx. 100 x 150 x 59 mm (3.9 x 5.9 x 2.3 in)
Power Supply	3 x 1.5 V AA alkaline batteries
Ambient Temp.	-10 ... +50 °C
Connection	G 1/2 B
Accuracy	+/- 0.10 % F.S.

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Homogeneity Assessment

In this type of scheme (Sequential Participation Scheme), a single proficiency testing item (Artifact) is circulated successively from one participating laboratory to another, along with suitable Technical Protocol for calibrating the same. This type of PT scheme is used when the test item is non-destructive in nature, or test item is individually produced. The requirement for homogeneity does not apply in such a case.

Stability Assessment

A stability (Drift) assessment of PT item was analyzed with the help of two times calibrations performed at reference laboratory during the PT round. First Calibrations of PT Item was performed before start of the PT round, and last at the end of the round. The final stability study was conducted after completion of PT Round.
The stability of PT Item is used in uncertainty of reference value as given in equation no. 1 & 2.

Subcontracting Activities	❖ PT Items manufacturing ❖ Stability Testing ❖ Determination of Assigned Value from Reference Laboratory ❖ Transportation of PT items ❖ Technical Expertise for planning of PT scheme
Details of the traceability and uncertainty of assigned values	Assigned value is Traceable to National / International Standard through calibration of PT Items at NABL Accredited Calibration Laboratory. Assigned value is average of two calibration results from reference laboratory.

Conduct of Proficiency Test

Objectives	The purpose of the scheme was to demonstrate proficiency in Hydraulic Digital Pressure Gauge up to 200 bar. • To build up mutual confidence among the accredited laboratories providing calibration services with their customers. • To support the labs for improving quality in calibration. • To assist in finding the root cause of methodological problems, which can lead unsatisfactory performance of participating laboratories. • To provide a tool for calibration labs to improve its quality performance in measurements.
Summary of procedures used to design and implement the scheme (which may include reference to a scheme protocol)	**The PT scheme was Quantitative & Sequential** In the current case, measurand was Pressure and proficiency test item was Hydraulic Digital Pressure Gauge up to 200 bar The PT item was circulated within 07 participants in Petal format. The labs were instructed to treat the PT items in the same way as routine laboratory samples.
Procedures Used	The Hydraulic Pressure Gauge up to 200 bar was measured for pressure at 50 bar,100 bar, 125 bar, 150 bar and 175 bar as recommended in **DKD R-6-1 or NABL 129** (with Comparison method).

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Confidentiality	1. All confirmed participants have been communicated their unique Laboratory Code number, which will be used for all further correspondence. The participant laboratory should use the allocated Laboratory code for all correspondence related to this PT Program PTC/MECH/PRVC/001-8. 2. Octagon is committed for maintaining confidentiality at all level, with this unique Laboratory Code. 3. As per the signed contract the participating laboratory also agrees to maintain confidentiality and avoid falsification &collusion.
Performance Evaluation Criteria	
Interpretation of the performance as per ISO 13528:2015	Statistical method used for Performance evaluation of participating laboratories En score with average assigned values of reference laboratory and uncertainty of reference laboratory.
Analysis of PT results	
Summary of procedure used to establish any assigned value. **Summary of procedures used to statistically analyze the data.**	**Evaluation of performance with average Assigned Value of Reference Laboratory.** The assigned value is determined by averaging the results of reference laboratory at two different stages of PT round. En Score is evaluated by considering this assigned value with individual participant results. For evaluation of En score stability assessment factor is considered as one of the uncertainty components.

Average Assigned Value $x_{pt} = \frac{x_1 + x_2}{2}$ (1)

Uncertainty of reference laboratory

$$U(x_{pt}) = \sqrt{(U)^2 + \left(\frac{a}{\sqrt{3}}\right)^2} \quad (2)$$

Where a= x_{Max}-x_{Min} (Range)

U- Average of two times uncertainties of measurement of reference laboratory

$$En = \frac{x_i - x_{pt}}{\sqrt{U^2(x_i) + U^2(x_{pt})}} \quad (3)$$

Where

x_i – is the result of participant laboratory

x_{pt} – is the Average Assigned value determined by reference laboratory

U_{xi} – is the expanded uncertainty of the participants results x_i

U_{xpt}- is the expanded uncertainty of the assigned values x_{pt}

Acceptance criteria for En Score:

-1 <En < 1 = Successful performance

En ≤ -1 = Unsatisfactory indicate a need to review the uncertainty estimates, or to correct a measurement issue

En≥ 1 = Unsatisfactory indicate a need to review the uncertainty estimates, or to correct a measurement issue.

Tables & Graphs	
Laboratory test results (data)	Participants were requested to perform the Measurements according to the Instructions mentioned in Technical Protocol and to submit their measurement results with uncertainty specified in the result sheet. The results of the individual laboratories were received through duly filled Result Sheet format by email and courier also. See attached **table 1**
Assigned values and summary statistics for test methods/procedures used by other participants (if different methods are used by different participants)	See attached **table 2**
Tables of Data, precision tests, and evaluation data	See attached **table 3 to table 7**
Graphs of data, standard value/uncertainty values, misc. graphs	See attached graphs.

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Results of Participants

Table 1 – Hydraulic Digital Pressure Gauge up to 200 bar.

S No	Lab. Code	Measurement Points in bar	UUC Reading in bar	Uncertainty of measurement in bar	S No	Lab. Code	Measurement Points in bar	UUC Reading in bar	Uncertainty of measurement in bar
1	HP078	50	49.99	0.1784	5	HP106	50	49.99	0.29
		100	99.99	0.1785			100	99.99	0.29
		125	124.99	0.2663			125	124.99	0.29
		150	149.99	0.2664			150	150.01	0.29
		175	174.99	0.2404			175	175.02	0.29
2	HP084	50	49.983	0.044	6	HP108	50	49.99	0.113
		100	100.05	0.14			100	99.99	0.113
		125	125.06	0.14			125	124.97	0.113
		150	150.07	0.14			150	149.97	0.113
		175	175.06	0.14			175	174.96	0.114
3	HP091	50	49.9992	0.0358	7	HP121	50	50.024	0.065
		100	100.0089	0.0407			100	100.016	0.065
		125	125.0195	0.0508			125	125.019	0.065
		150	150.0284	0.0628			150	150.038	0.065
		175	175.0447	0.0729			175	175.049	0.065
4	HP102	50	50.005	0.07					
		100	100.016	0.07					
		125	125.021	0.07					
		150	150.045	0.07					
		175	175.064	0.07					

Table 2: Average Assigned Values of Reference lab for Hydraulic Digital Pressure Indicating Device

X1 (Calibrated on 22/12/2022) and X2 (Calibrated on 31/05/2023)

Sl. No.	Nominal Value (bar)	Measurement Value of Ref. lab X1in (bar)	Measurement Value of Ref. lab X2in (bar)	Average Uncertainty of Ref. Lab (U)	Average Assigned Value (Xpt) in (bar)	Range (Xmax - Xmin)	Uncertainty of Assigned Value U Xpt (bar)
1.	50	50.001	49.997	0.00715	49.9990	0.0040	0.00751
	100	100.004	100.004	0.00965	100.0040	0.0000	0.00965
	125	125.012	125.009	0.0111	125.0105	0.0030	0.01123
	150	150.028	150.024	0.01295	150.0260	0.0040	0.01315
	175	175.037	175.037	0.01440	175.0370	0.0000	0.01440

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Summary of performance:

Table 3: En score for Hydraulic Pressure Gauge at 50 bar

En Score with Average assigned value from Reference Laboratory

En score is evaluated from Pre-Calibration (22/12/2022) and Post Calibration (31/05/2023) results of the PT item.

Assigned Value (Xpt) = 49.9990bar

Uncertainty of Assigned Value U (Xpt) = 0.00751 bar

S-Satisfactory & U- Unsatisfactory

Lab. Code	Measurement Value in bar	Uncertainty in bar	En score	Performance S/U
HP078	49.99	0.1784	-0.05	S
HP084	49.983	0.044	-0.36	S
HP091	49.9992	0.0358	0.01	S
HP102	50.005	0.07	0.09	S
HP106	49.99	0.29	-0.03	S
HP108	49.99	0.113	-0.08	S
HP121	50.024	0.065	0.38	S

Refer the graphs on next page

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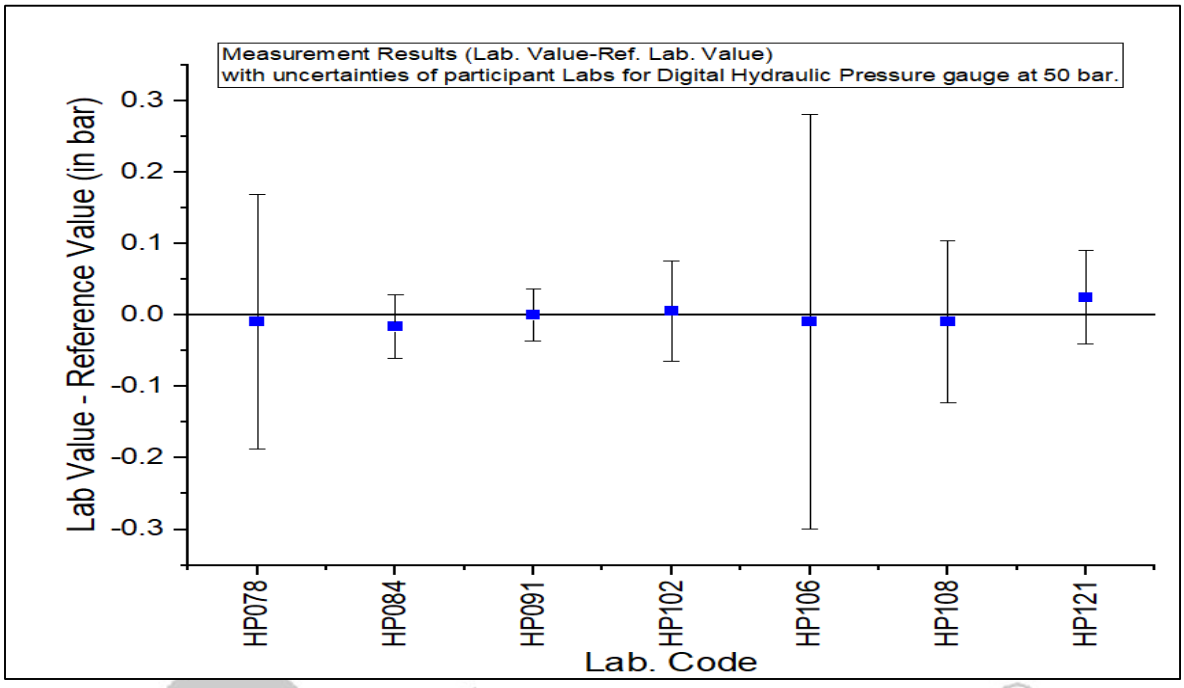

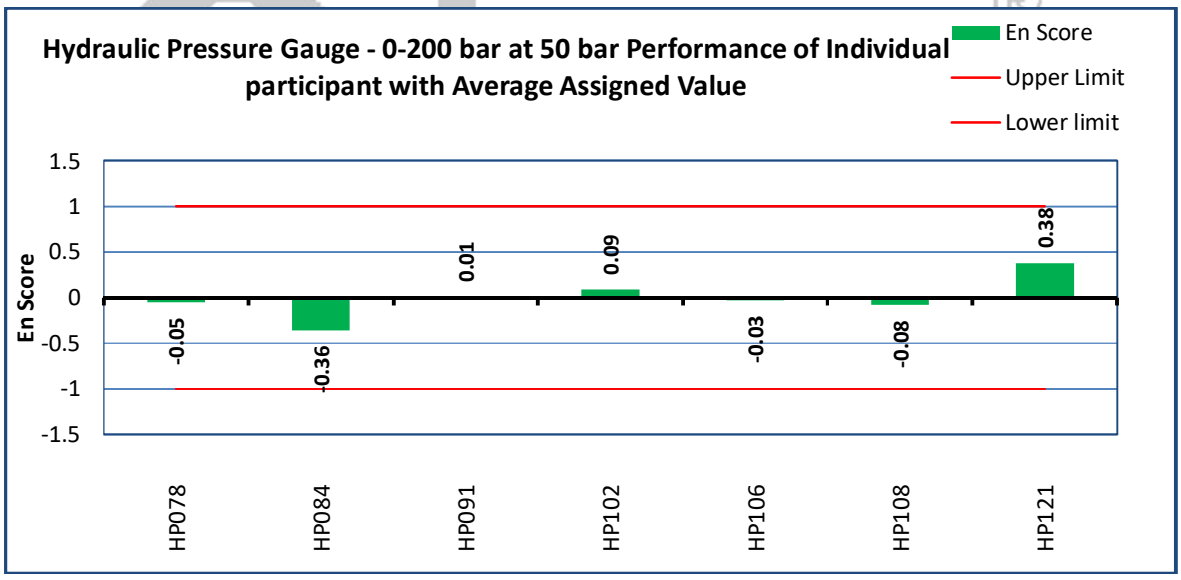

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Table 4: En score for Hydraulic Pressure Gauge at 100 bar
En Score with Average assigned value from Reference Laboratory
Assigned Value (Xpt) = 100.0040 bar
Uncertainty of Assigned Value U (Xpt) = 0.00965 bar

S-Satisfactory & U- Unsatisfactory

Lab. Code	Measurement Value in bar	Uncertainty in bar	En score	Performance S/U
HP078	99.99	0.1785	-0.08	S
HP084	100.05	0.14	0.33	S
HP091	100.0089	0.0407	0.12	S
HP102	100.016	0.07	0.17	S
HP106	99.99	0.29	-0.05	S
HP108	99.99	0.113	-0.12	S
HP121	100.016	0.065	0.18	S

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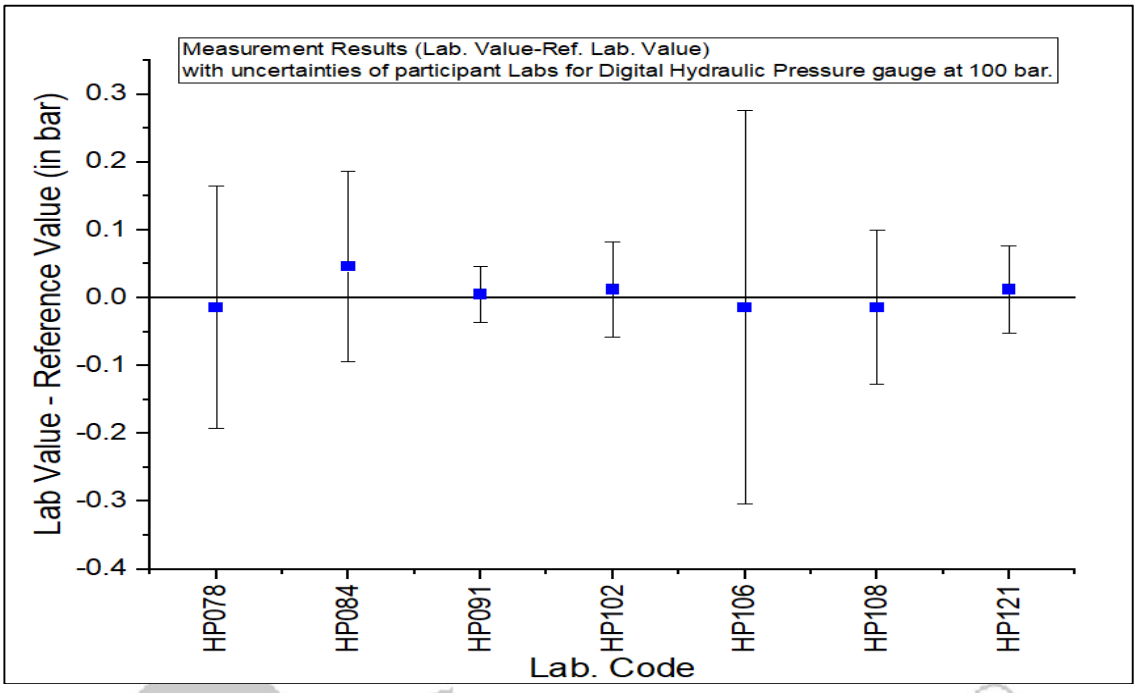

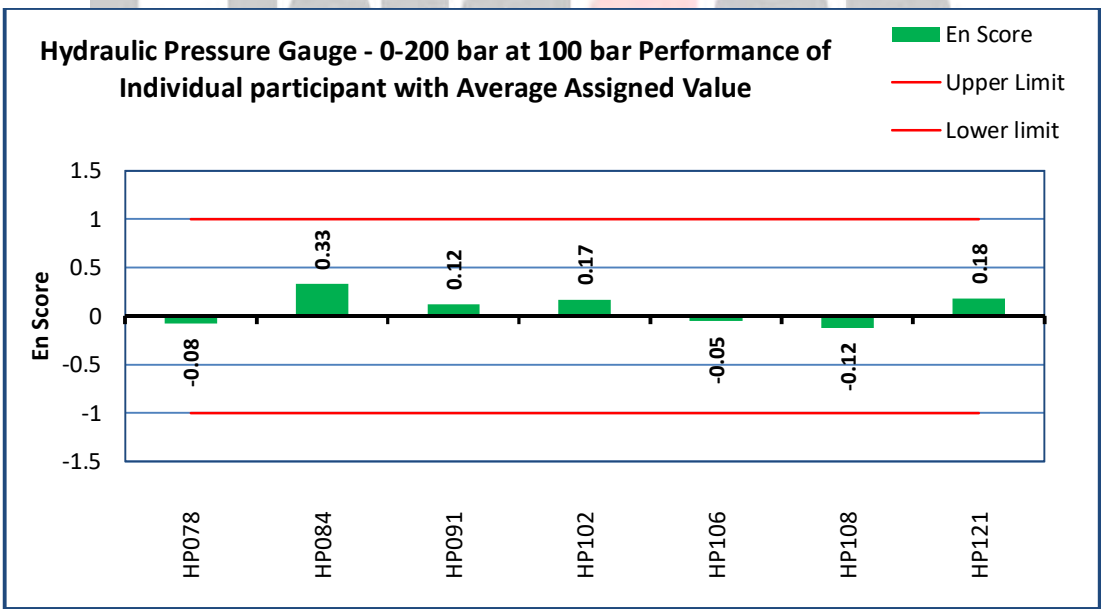

Table 5: En score for Hydraulic Pressure Gauge at 125 bar
En Score with Average assigned value from Reference Laboratory
Assigned Value (Xpt) =125.0105 bar
Uncertainty of Assigned Value U (Xpt) = 0.01123bar

S-Satisfactory & U- Unsatisfactory

Lab. Code	Measurement Value in bar	Uncertainty in bar	En score	Performance S/U
HP078	124.99	0.2663	**-0.08**	S
HP084	125.06	0.14	**0.35**	S
HP091	125.0195	0.0508	**0.17**	S
HP102	125.021	0.07	**0.15**	S
HP106	124.99	0.29	**-0.07**	S
HP108	124.97	0.113	**-0.36**	S
HP121	125.019	0.065	**0.13**	S

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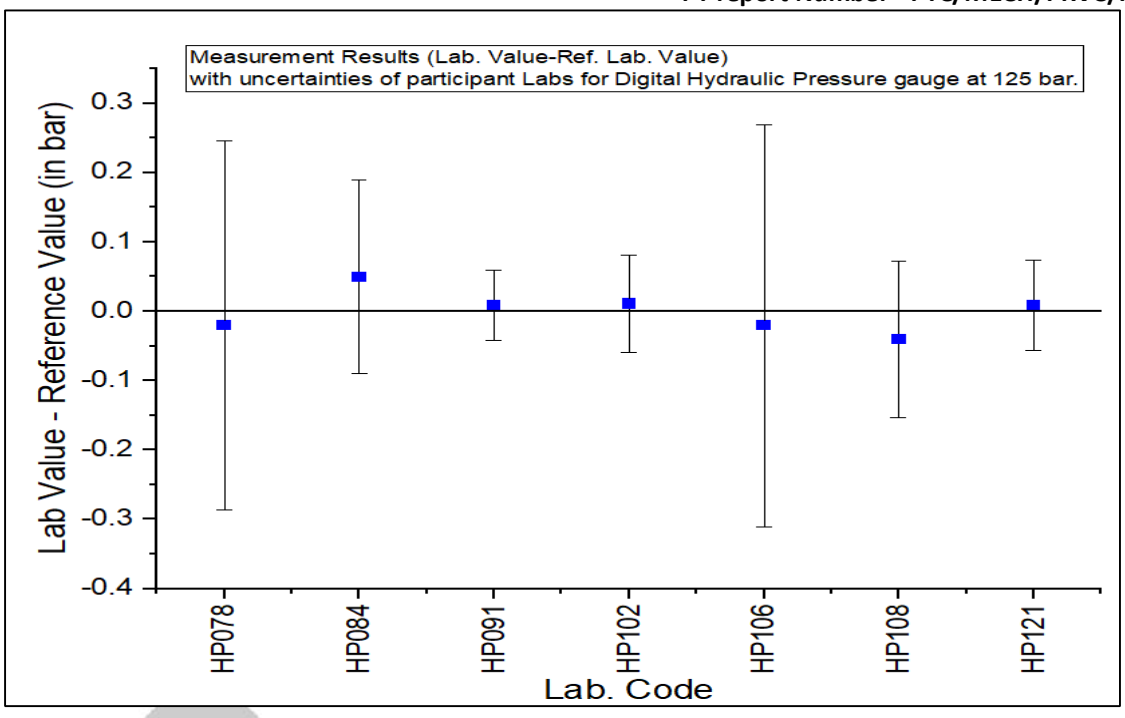

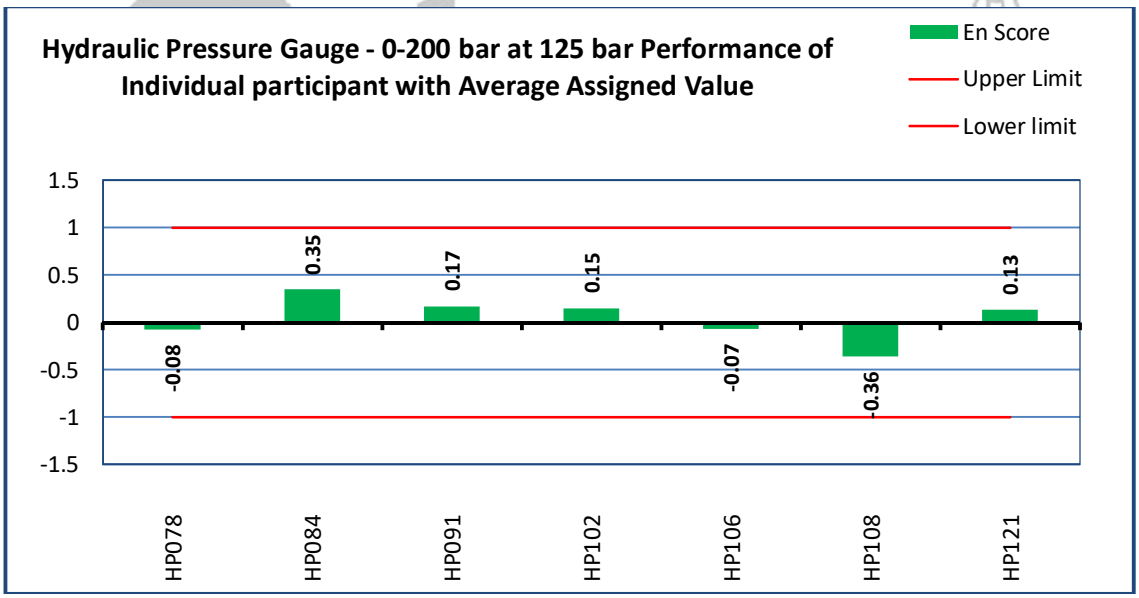

Table 6: En score for Hydraulic Pressure Gauge at 150 bar
En Score with Average assigned value from Reference Laboratory
Assigned Value (Xpt) = 150.0260 bar
Uncertainty of Assigned Value U(Xpt) = 0.01315bar

S-Satisfactory & U- Unsatisfactory

Lab. Code	Measurement Value in bar	Uncertainty in bar	En score	Performance S/U
HP078	149.99	0.2664	**-0.13**	S
HP084	150.07	0.14	**0.31**	S
HP091	150.0284	0.0628	**0.04**	S
HP102	150.045	0.07	**0.27**	S
HP106	150.01	0.29	**-0.06**	S
HP108	149.97	0.113	**-0.49**	S
HP121	150.038	0.065	**0.18**	S

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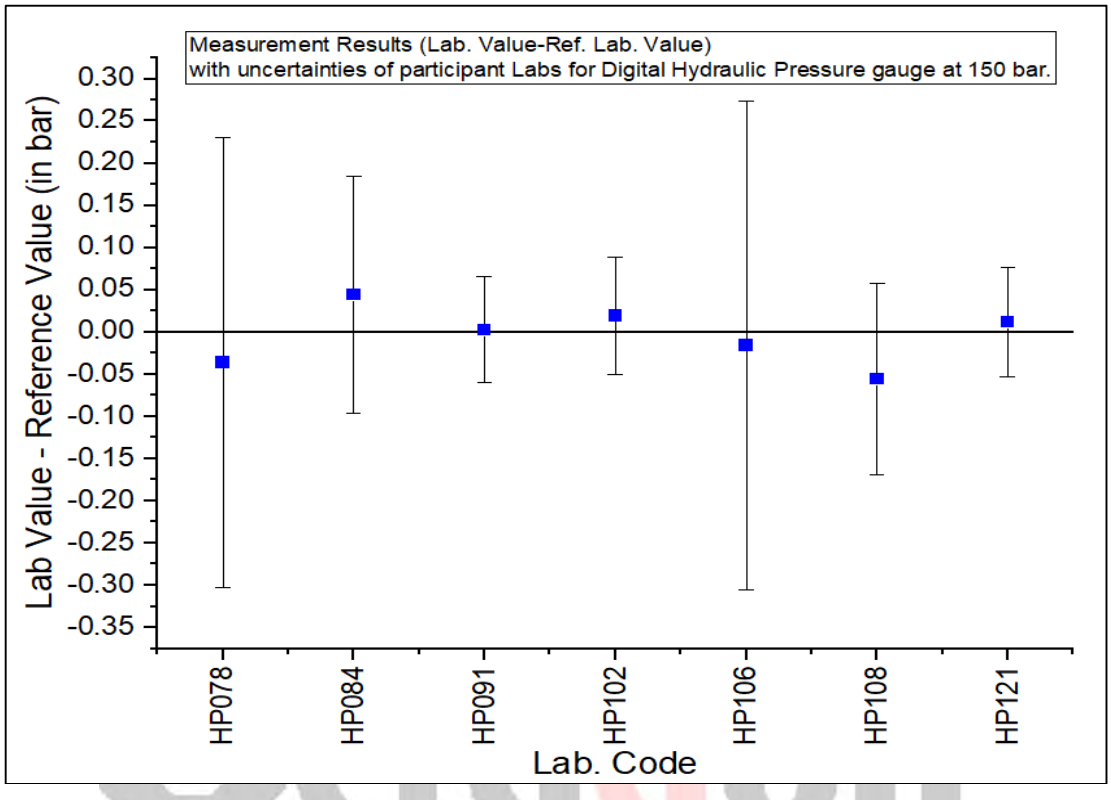

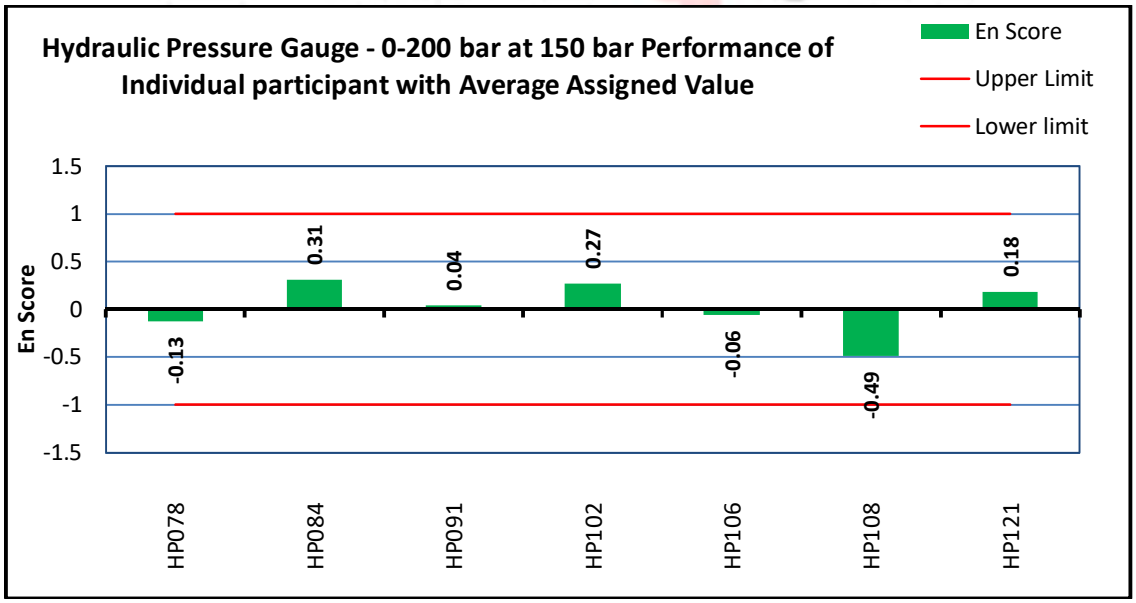

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Table 7: En score for Hydraulic Pressure Gauge at 175 bar
En Score with Average assigned value from Reference Laboratory
Assigned Value (Xpt) = 175.0370 bar
Uncertainty of Assigned Value U(Xpt) = 0.01440 bar

S-Satisfactory & U- Unsatisfactory

Lab. Code	Measurement Value in bar	Uncertainty in bar	En score	Performance S/U
HP078	174.99	0.2404	-0.20	S
HP084	175.06	0.14	0.16	S
HP091	175.0447	0.0729	0.10	S
HP102	175.064	0.07	0.38	S
HP106	175.02	0.29	-0.06	S
HP108	174.96	0.114	-0.67	S
HP121	175.049	0.065	0.18	S

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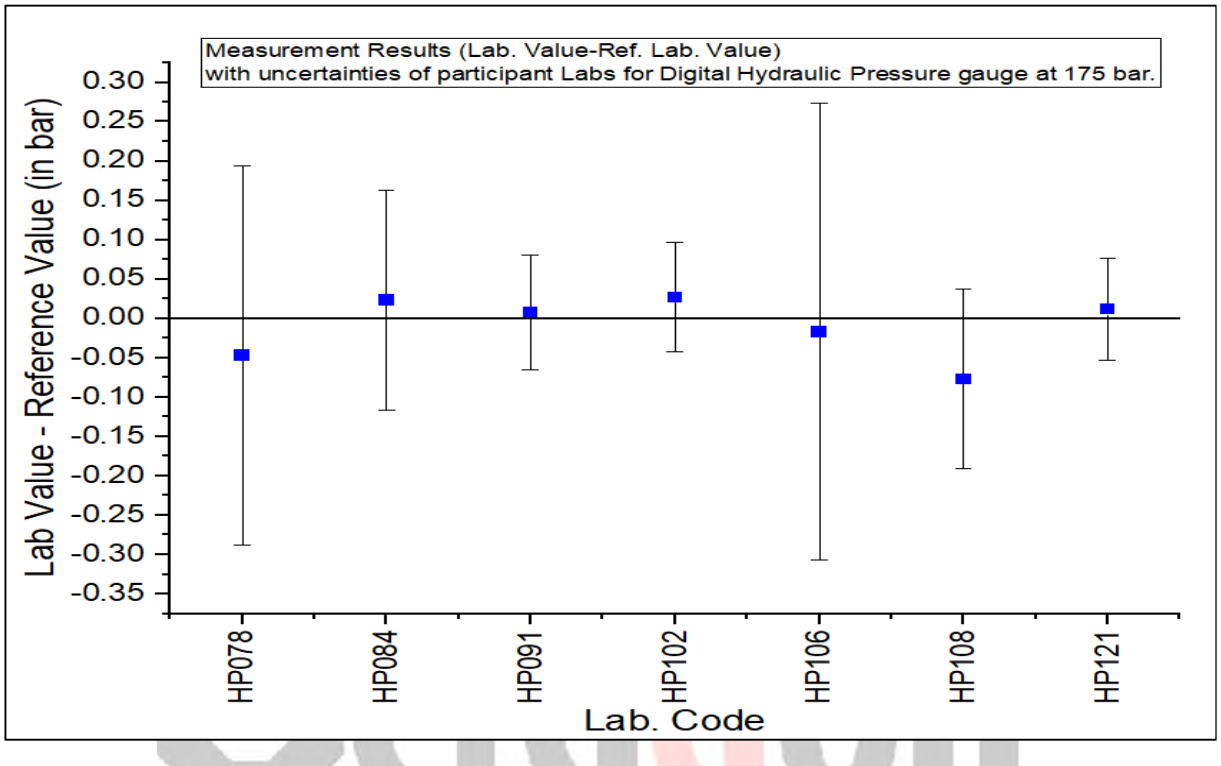

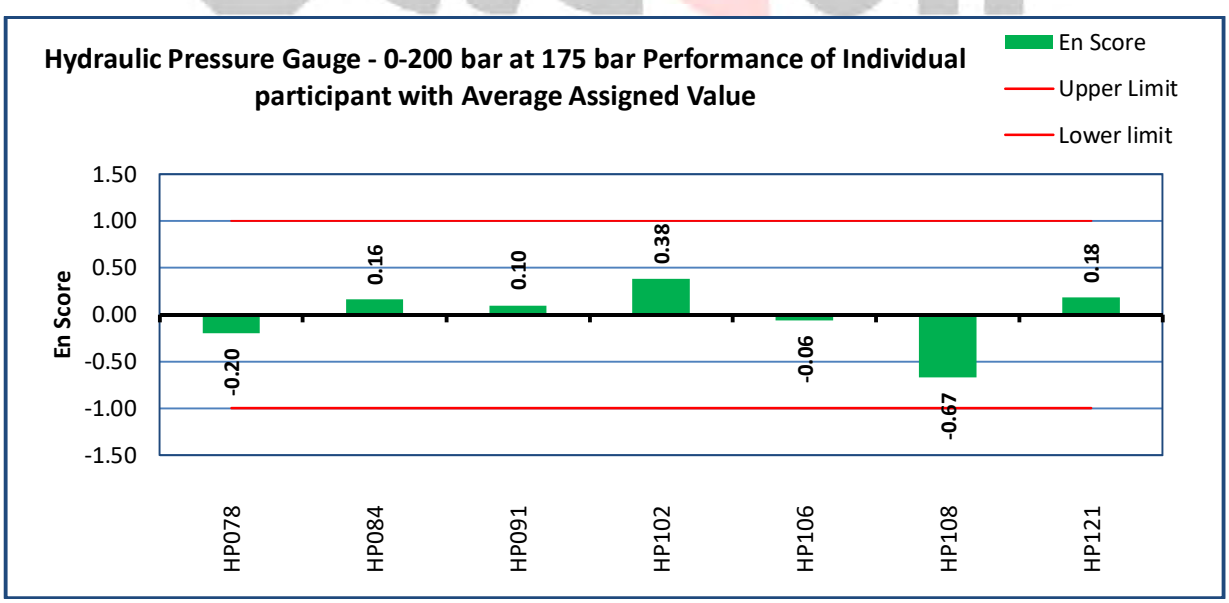

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Conclusions - Comments on participants' performance by the provider and technical advisers

In this proficiency testing program seven (07) laboratories have participated for the comparison of Hydraulic Pressure Gauge up to 200 bar.
Tables and graphs show the tabular and graphical summary of measurement results, Uncertainties of Measurement and En scores.

Statistical Analysis for Evaluation of performance of participant laboratories:
En score for each participant is evaluated based on Reference value as given by reference laboratory (Assigned value as average of two times measurement value of ref. lab) and uncertainty of reference lab as per Tables 3 to 7.
In the present comparison, it was observed that out of Seven (07) participating laboratories, all Seven participating laboratories with Lab Code numbers HP078, HP084, HP091, HP102, HP106, HP108 & HP121 are showing En ≤ ±1 for all points and their performance is satisfactory.

This also reflects that the labs are maintaining unbroken chain of traceability and the calibration is trustful for pressure gauge.
This report will provide evidence to the lab to maintain the quality assurance in terms of satisfactory participation in proficiency testing as per calibration requirement in the ISO/IEC 17025:2017.

The PT report has been completed on the comparison for Hydraulic Pressure Gauge up to 200 bar and may be submitted to NABL for its proper execution.

Advice, where appropriate, on the interpretation of the statistical analysis	--

Prepared By **Authorized By**

Octagon Measurement Solutions Pvt. Ltd.

Technical Manager **Quality Manager**

----------**End of Report**----------

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