

# IN-HOUSE TEST CERTIFICATES

# ARC

# TEST CERTIFICATE

Date : 08.05.2023, 02:45 PM

## ARC INSULATION & INSULATORS PVT LTD RAMDEVPUR

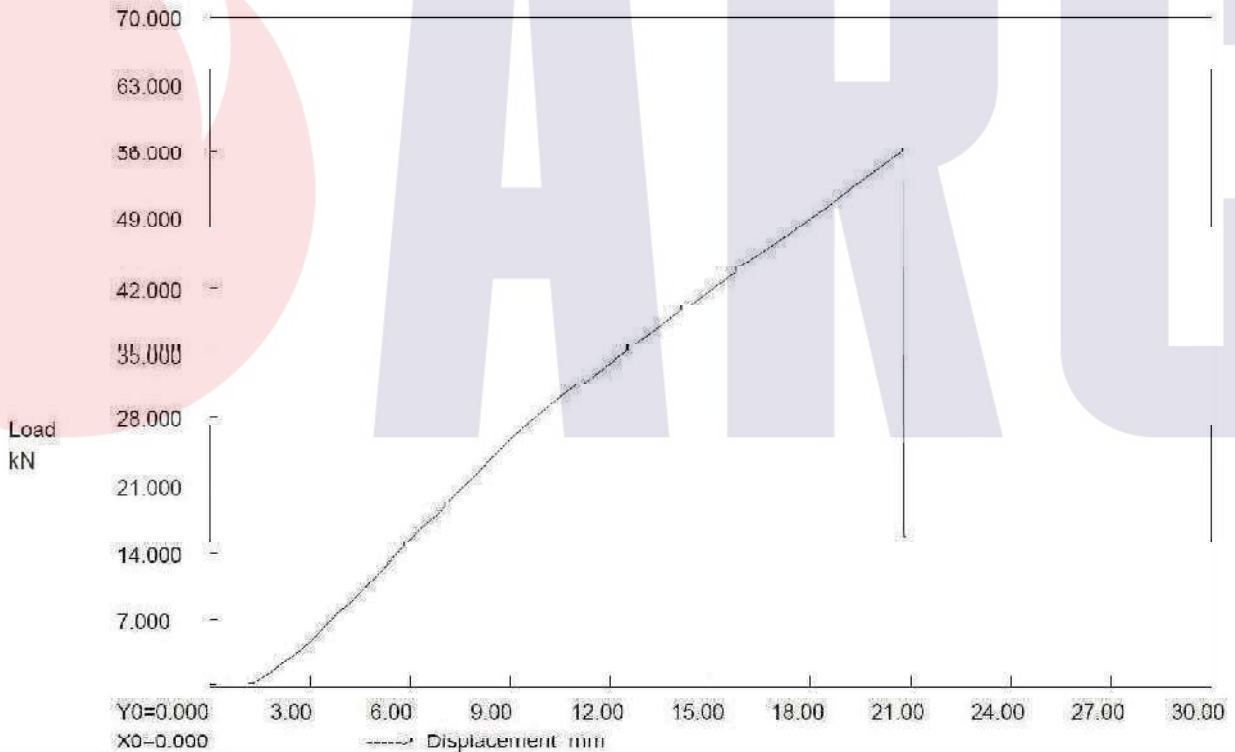
To / Dept. : INHOUSE  
Address : ARC KOLKATA  
sample Identification : GFRP BAR  
Part description :  
Part Number :  
Machine : KRYSTAL Make Universal Testing Machine 1200 kN

**Input Data** File Name : GFRP BAR . Record No. : 5  
Sample Type : Round Solid Bar Area : 44.178 mm<sup>2</sup>  
Diameter : 7.5 mm Final Dia : 7.6 mm  
Ext. Gauge Length: 100 mm Speciman Gauge Length: 37.5 mm  
Final Gauge Length: 37.6 mm

### Results of Tension Test

Maximum Force (Fm) : 56.500 kN Youngs Modulus (E) : 53288.200 MPa  
Disp. at Fm : 20.09 mm  
Max. Disp. : 20.910 mm  
Tensile strength (Rm) : 1278.917 MPa  
Total Elongation at Fm (Agt): More than 2.02 %

Graph : Load Vs Displacement



TESTED BY

INSPECTED BY

APPROVED BY

SUBHADIP ROY

MANISH BAJORIA

# TEST CERTIFICATE

Date :

## ARC INSULATION & INSULATORS PVT LTD RAMDEVPUR

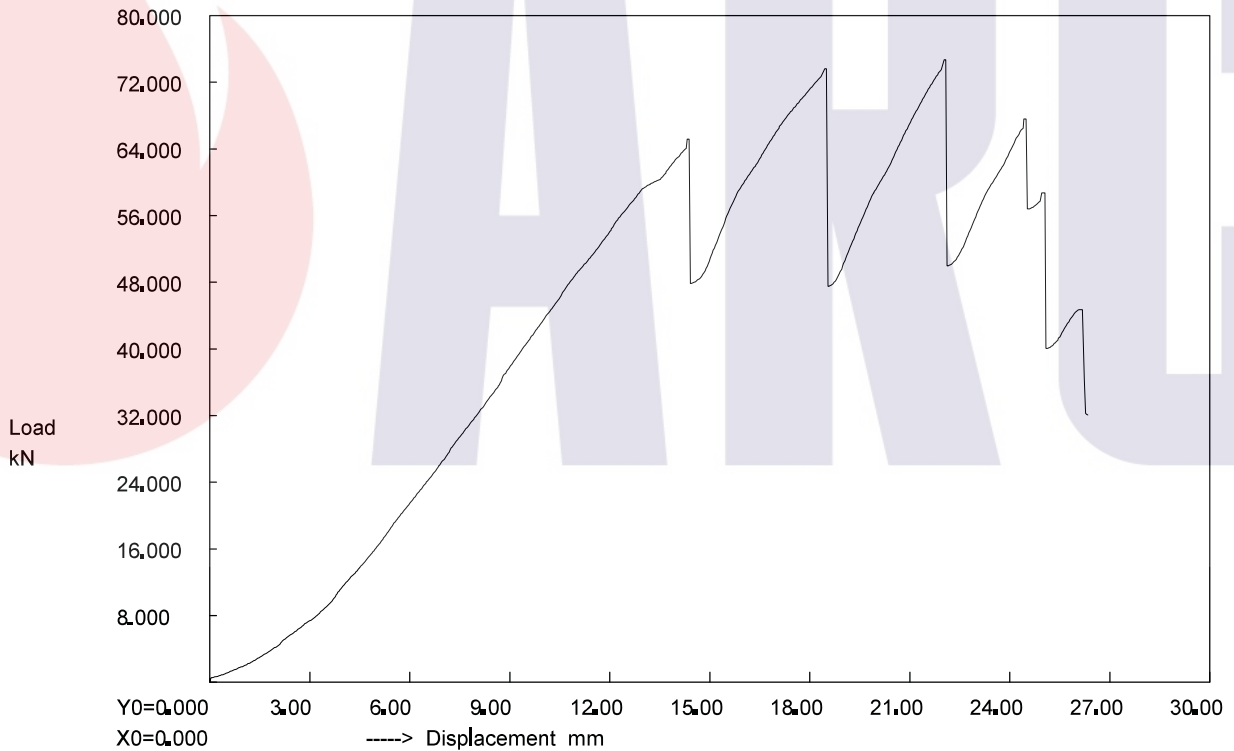
To / Dept. : INHOUSE  
Address : ARC KOLKATA  
sample Identification : GFRP BAR  
Part description :  
Part Number :  
Machine : KRYSTAL Make Universal Testing Machine 1200 kN

**Input Data** File Name : GFRP BAR , Record No. : 11  
Sample Type : Round Solid Bar Area : 67.929 mm<sup>2</sup>  
Diameter : 9.3 mm Final Dia : 9.2 mm  
Ext. Gauge Length: 100 mm Speciman Gauge Length: 46.5 mm  
Final Gauge Length: 46.6 mm

### Results of Tension Test

Maximum Force (Fm) : 74.700 kN Youngs Modulus (E) : 55827.160 MPa  
Disp. at Fm : 22.03 mm  
Max. Disp. : 26.340 mm  
Tensile strength (Rm) : 1099.677 MPa  
Total Elongation at Fm (Agt): More than 2.07 %

Graph : Load Vs Displacement



TESTED BY

INSPECTED BY

WITNESSED BY

SUBHADIP ROY

MANISH BAJORIA

# TEST CERTIFICATE

Date : 08.05.2023 , 02:52 PM

## ARC INSULATION & INSULATORS PVT LTD RAMDEVPUR

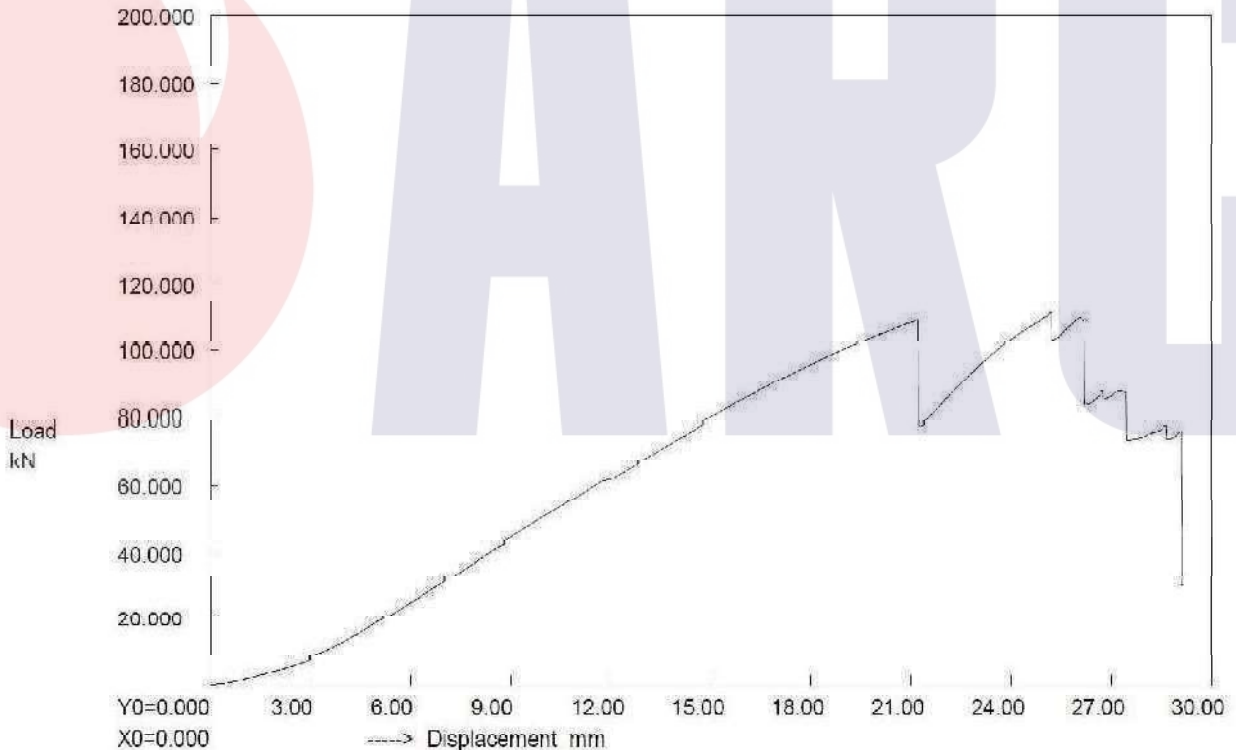
To / Dept. : INHOUSE  
Address : ARC KOLKATA  
sample Identification : GFRP BAR  
Part description :  
Part Number :  
Machine : KRYSTAL Make Universal Testing Machine 1200 kN

**Input Data** File Name : GFRP BAR , Record No. : 9  
Sample Type : Round Solid Bar Area : 103.86 mm<sup>2</sup>  
Diameter : 11.5 mm Final Dia : 11.6mm  
Ext. Gauge Length: 100 mm Speciman Gauge Length: 57.5 mm  
Final Gauge Length: 57.6 mm

### Results of Tension Test

Maximum Force (Fm) : 111.180 kN Youngs Modulus (E) : 52218.480 MPa  
Disp. at Fm : 25.16 mm  
Max. Disp. : 29.160 mm  
Tensile strength (Rm) : 1070.479 MPa  
Total Elongation at Fm (Agt): More than 2.02 %

### Graph : Load Vs Displacement



TESTED BY

INSPECTED BY

APPROVED BY

SUBHADIP ROY

MANISH BAJORIA



# KrystalMet Software for Material Testing - KRYSTAL -

## Batch Details

Client... INHOUSE

Batch... GFRP BAR 10 MM

Operator... S. ROY

Date of Test... 30 June 2023 : 18:31

## Sample Details

Test Type... Shear

Material... GFRP

Sample No... 4

Specimen... Rod

Sensor... Encoder

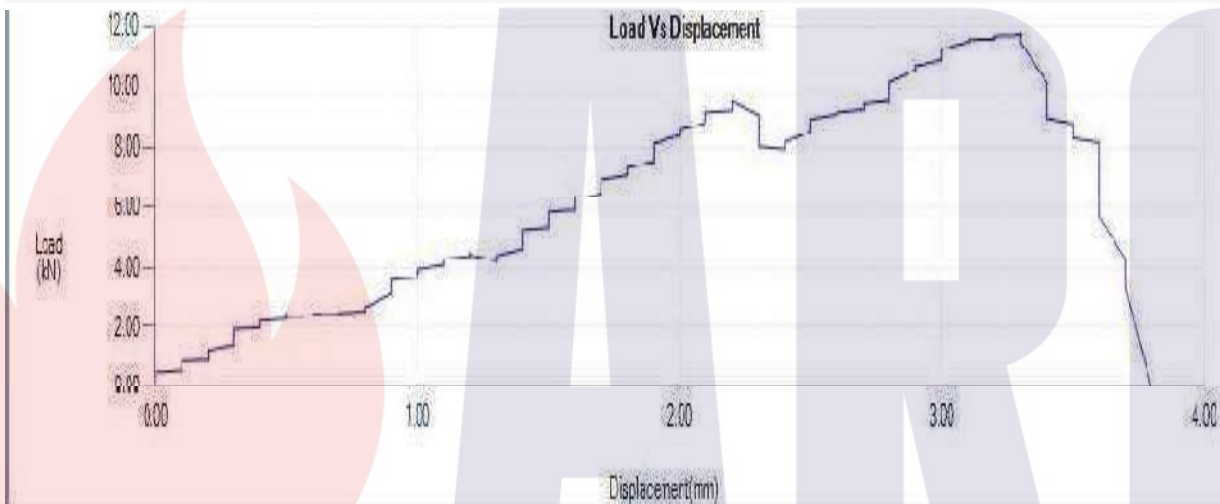
## Test Parameters

Diameter... 9.3 mm

Shear Type... Single

Area of C/S... 67.929 mm<sup>2</sup>

## Load Vs Displacement



## Test Results

Max. Force (Fm)... **11.82 kN**  
Displacement at Fm... **3.3 mm**  
Maximum Displacement... **4.9 mm**  
Shear Strength... **174.005 MPa**

Remarks : **Sample Accepted**

Tested By

Verified By

Authorised By

Tested On: ARC INSULATION & INSULATORS PVT.LTD.,UTK-60E, Sr. No.2010-1020

KrystalMet:V4R7 - Software for Material Testing - © KRYSTAL





# KrystalMet Software for Material Testing - KRYSTAL -

## Batch Details

Client... INHOUSE

Batch... GFRP BAR 10 MM

Operator... S. ROY

Date of Test... 17 May 2023 : 19:21

## Sample Details

Test Type... Shear

Material... GFRP

Sample No... 2

Specimen... Rod

Sensor... Encoder

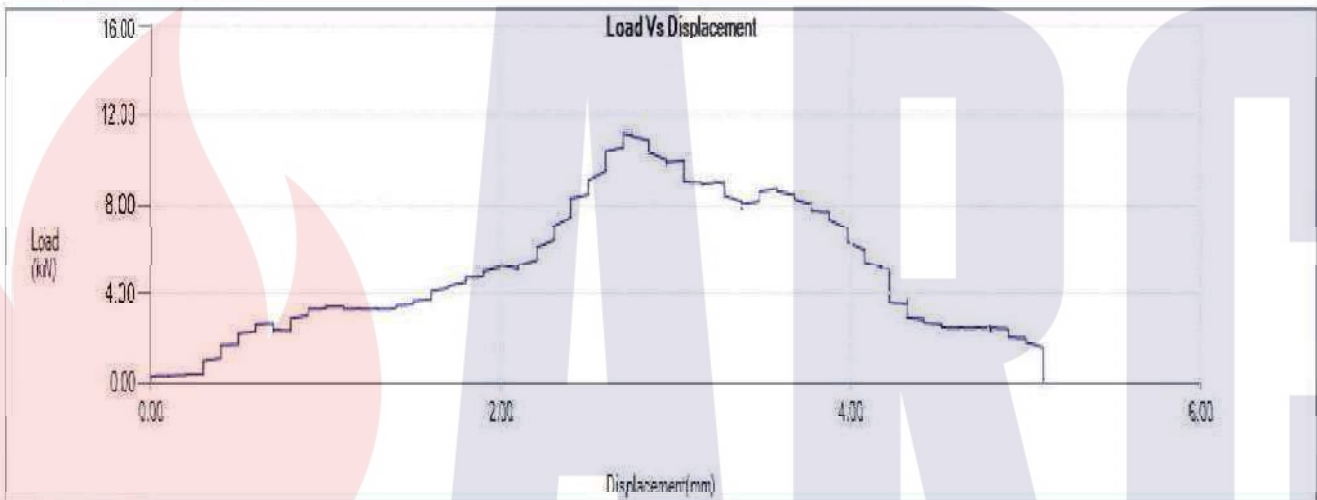
## Test Parameters

Diameter... 9.3 mm

Shear Type... Single

Area of C/S... 67.929 mm<sup>2</sup>

## Load Vs Displacement



## Test Results

Max. Force (F<sub>m</sub>)... **11.44 kN**  
Displacement at F<sub>m</sub>... **2.8 mm**  
Maximum Displacement... **5.1 mm**  
Shear Strength... **168.411 MPa**

## Remarks :

Tested By

Verified By

Authorised By



DATE OF TESTING	24/03/2022
FIBER TYPE	ECR GLASS
FIBER BINDING MATERIAL	VINYLE ESTER RESIN
VOLUME OF RATIO OF FIBER	80%
PRE-CONDITIONING TEMP. & HUMIDITY	23°C & 50% HUMIDITY
TEST TEMP & HUMIDITY	23°C & 50% HUMIDITY
DIAMETER	32 MM

### 1. Glass Content Test

Glass content calculate of GFRP bar from the following equation

$$\frac{100 (W3 - W1)}{(W2 - W1)}$$

Where,

W1 = Mass of the Crucible (Before Burning) = 54.32 gram

W2 = Mass of the Sample + Crucible (Before Burning) = 107.39 gram

W3 = Mass of the Glass + Crucible (After Burning) = 96.84 gram

$$\text{Glass Content \%} = \frac{100 (96.84 - 54.32)}{(107.39 - 54.32)} = 80.12\%$$

### 2. Resin Content

Resin Content Calculate of GFRP bar from the following equation

$$\frac{100 (W2 - W3)}{(W2 - W1)}$$

Where,

W1 = Mass of the Crucible Before Burning = 54.32 gram

W2 = Mass of the Sample + Crucible = 107.39 gram

W3 = Mass of the Glass After Burning + Crucible = 96.84 gram

$$\text{Resin Content \%} = \frac{100 (107.39 - 96.84)}{(107.39 - 54.32)} = 19.87\%$$




Tested By

Approved By

# TEST CERTIFICATE

Date : 25-11-2023 , 12:58 PM

## ARC INSULATION & INSULATORS PVT LTD RAMDEVPUR

INV NO.: 134/23-24

To / Dept. : INHOUSE (TATA PROJECTS LTD)

Report No.: ARC/QC/23-24/JOB-89/108

Address : ARC KOLKATA

sample Identification : GFRP BAR

Part description : BATCH 241123R16

Part Number :

Machine : KRYSTAL Make Universal Testing Machine 1200 kN

**Input Data** File Name : GFRP BAR , Record No. : 7  
Sample Type : Round Solid Bar Area : 201.062 mm<sup>2</sup>  
Diameter : 16 mm Final Dia : 15.9 mm  
Gauge Length : 80 mm Final Gauge Length: 80.1 mm

### Results of Tension Test

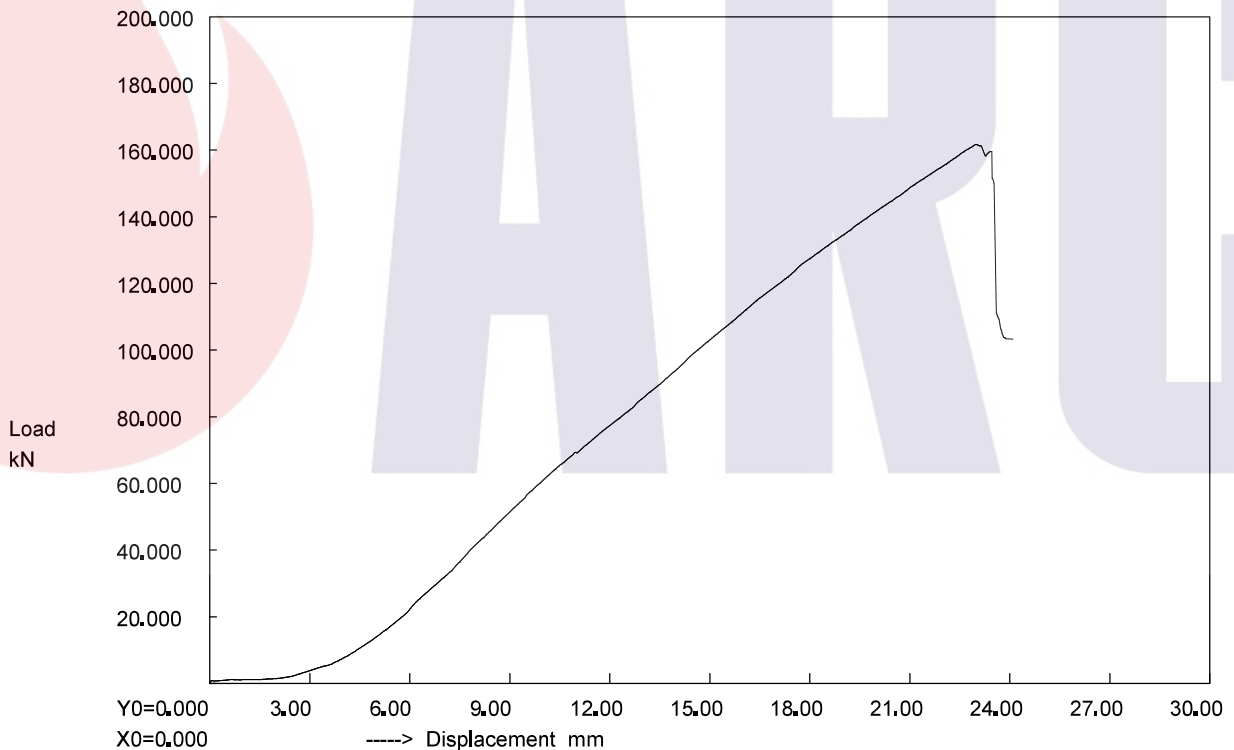
Maximum Force (Fm) : 161.640 kN

Disp. at Fm : 22.96 mm

Max. Disp. : 24.090 mm

Tensile strength (Rm) : 803.932 MPa

Graph : Load Vs Displacement



TESTED BY

INSPECTED BY

APPROVED BY

SUBHADIP ROY

MANISH BAJORIA



# TEST CERTIFICATE

Date : 03-11-2023 , 05:37 PM

INV NO.: 127/23-24

**ARC INSULATION & INSULATORS PVT LTD**  
**RAMDEVPUR**

Report No.: ARC/QC/23-24/JOB-82/101

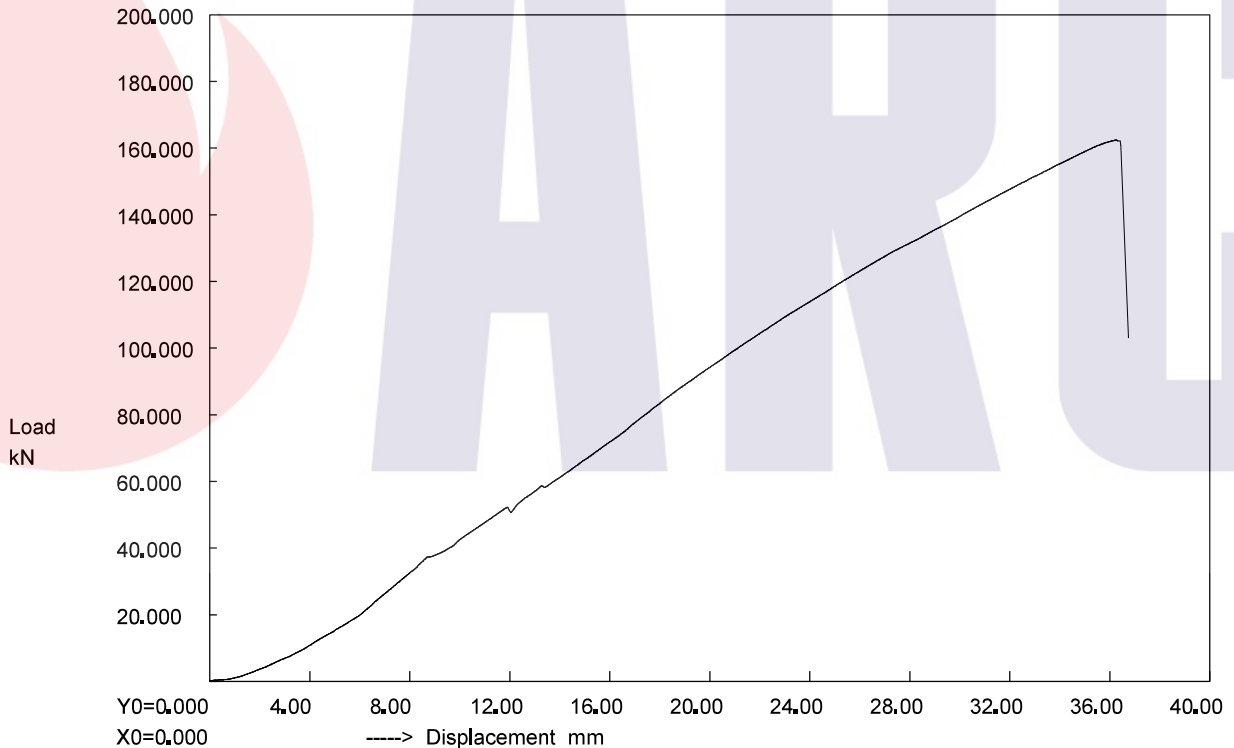
To / Dept. : INHOUSE (J. Kumar Infra)  
Address : ARC KOLKATA  
sample Identification : GFRP BAR  
Part description : BATCH: 021123R16  
Part Number :  
Machine : KRYSTAL Make Universal Testing Machine 1200 kN

**Input Data** File Name : GFRP BAR , Record No. : 8  
Sample Type : Round Solid Bar Area : 201.062 mm<sup>2</sup>  
Diameter : 16 mm Final Dia : 15.9 mm  
Gauge Length : 80 mm Final Gauge Length: 80.1 mm

## Results of Tension Test

Maximum Force (Fm) : 162.420 kN  
Disp. at Fm : 36.21 mm  
Max. Disp. : 36.740 mm  
Tensile strength (Rm) : 807.812 MPa

Graph : Load Vs Displacement



TESTED BY

INSPECTED BY

APPROVED BY

SUBHADIP ROY

MANISH BAJORIA

# TEST CERTIFICATE

Date : 08-03-2023 , 03:50 PM

**ARC INSULATION & INSULATORS PVT LTD**  
**RAMDEVPUR**

INV NO.: 208/22-23

To / Dept. : INHOUSE (L&T PATNA)

Report No.: ARC/QC/22-23/JOB-119/156

Address : ARC KOLKATA

sample Identification : GFRP BAR

Part description : BATCH 080323R19

Part Number :

Machine : KRYSTAL Make Universal Testing Machine 1200 kN

**Input Data** File Name : GFRP BAR , Record No. : 48  
Sample Type : Round Solid Bar Area : 283.529 mm<sup>2</sup>  
Diameter : 19 mm Final Dia : 18.9 mm  
Gauge Length : 95 mm Final Gauge Length: 95.1 mm

## Results of Tension Test

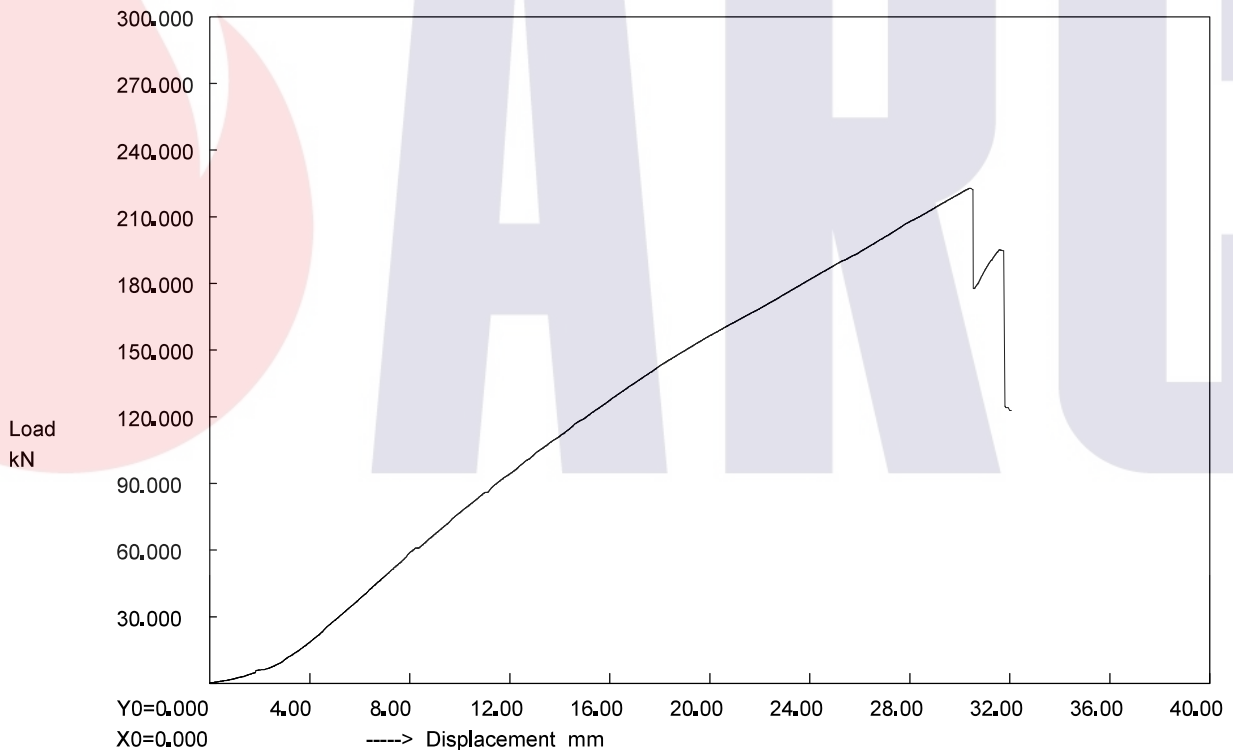
Maximum Force (Fm) : 222.840 kN

Disp. at Fm : 30.39 mm

Max. Disp. : 32.060 mm

Tensile strength (Rm) : 785.953 MPa

Graph : Load Vs Displacement



TESTED BY

INSPECTED BY

APPROVED BY

SUBHADIP ROY

MANISH BAJORIA

# TEST CERTIFICATE

Date : 18-05-2023 , 01:43 PM

**ARC INSULATION & INSULATORS PVT LTD**  
**RAMDEVPUR**

INV NO.: 030/23-24

To / Dept. : INHOUSE (L&T Patna)  
Address : ARC KOLKATA  
sample Identification : GFRP BAR  
Part description : BATCH 170523R19  
Part Number :  
Machine : KRYSTAL Make Universal Testing Machine 1200 kN

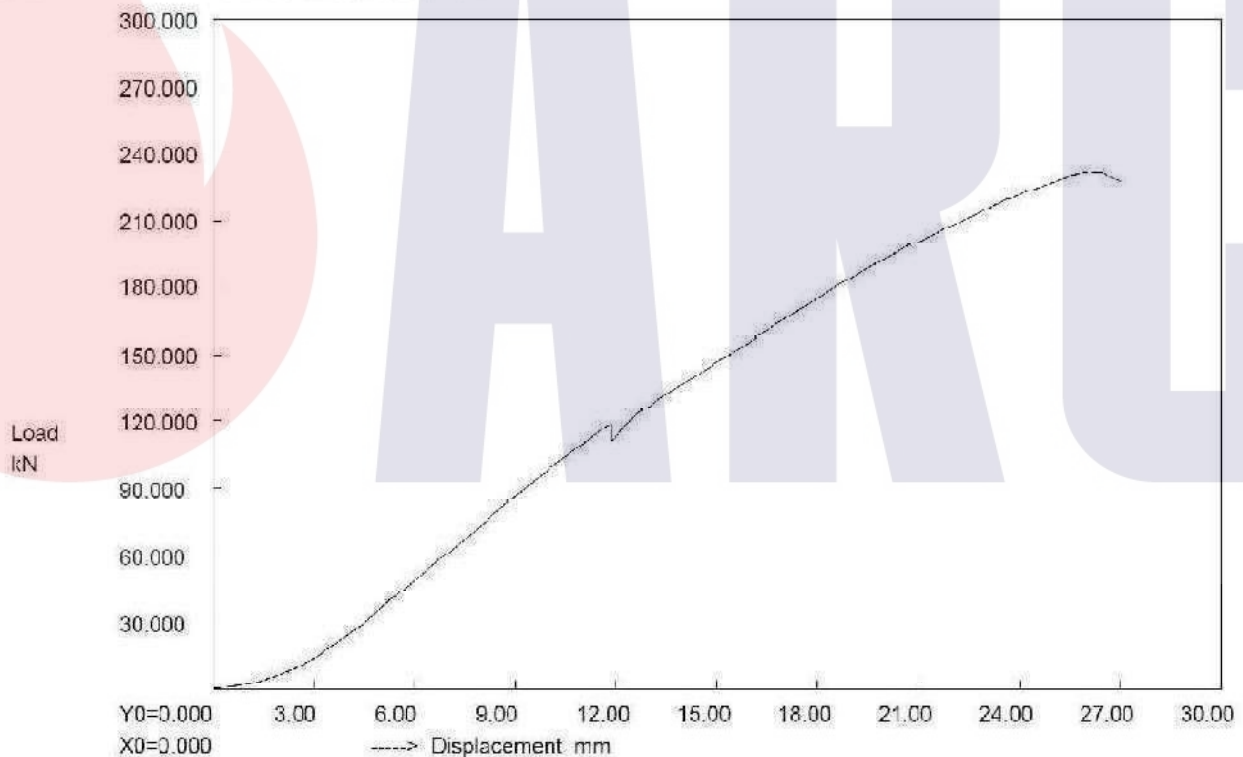
REPORT NO.: ARC/QTN/23-24/JOB 33/25

**Input Data** File Name : GFRP BAR , Record No. : 51  
Sample Type : Round Solid Bar Area : 283.529 mm<sup>2</sup>  
Diameter : 19 mm Final Dia : 18.9 mm  
Gauge Length : 95 mm Final Gauge Length: 95.1 mm

## Results of Tension Test

Maximum Force (Fm) : 231.600 kN  
Disp. at Fm : 26.05 mm  
Max. Disp. : 27.040 mm  
Tensile strength (Rm) : 816.049 MPa

Graph : Load Vs Displacement



TESTED BY

INSPECTED BY

APPROVED BY

SURHAJIP ROY

MANISH BAJORIA

# TEST CERTIFICATE

Date : 25-09-2023, 04:15 PM

INV NO.: 106/23-24

## ARC INSULATION & INSULATORS PVT LTD RAMDEVPUR

Report No.: ARC/QC/23-24/JOB-64/85

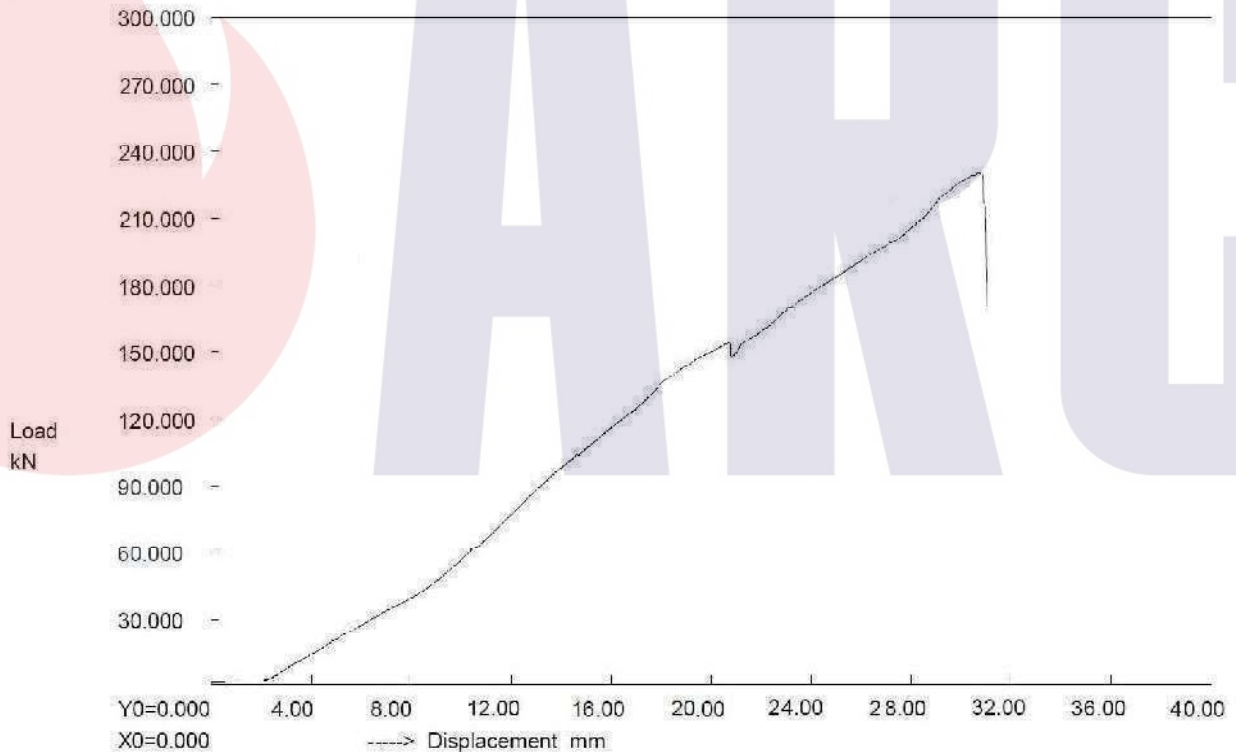
To / Dept. : INHOUSE (J. Kumar Infra)  
Address : ARC KOI KATA  
sample Identification : GFRP BAR  
Part description : BATCH: 250923R20  
Part Number :  
Machine : KRYSTAL Make Universal Testing Machine 1200 kN

**Input Data** File Name : GFRP BAR, Record No. : 8  
Sample Type : Round Solid Bar Area : 314.160 mm<sup>2</sup>  
Diameter : 20 mm Final Dia : 19.9 mm  
Gauge Length : 100 mm Final Gauge Length: 100.1mm

### Results of Tension Test

Maximum Force (Fm) : 232.090 kN  
Disp. at Fm : 30.46 mm  
Max. Disp. : 31.320 mm  
Tensile strength (Rm) : 738.763 MPa

Graph : Load Vs Displacement



TESTED BY

INSPECTED BY

APPROVED BY

SUBHADIP ROY

MANISH BAJORIA

# TEST CERTIFICATE

Date : 27-11-2023 , 12:50 PM

INV. NO.: 132/23-24

REPORT NO.: ARC/QC/23-24/JOB-94/106

## ARC INSULATION & INSULATORS PVT LTD RAMDEVPUR

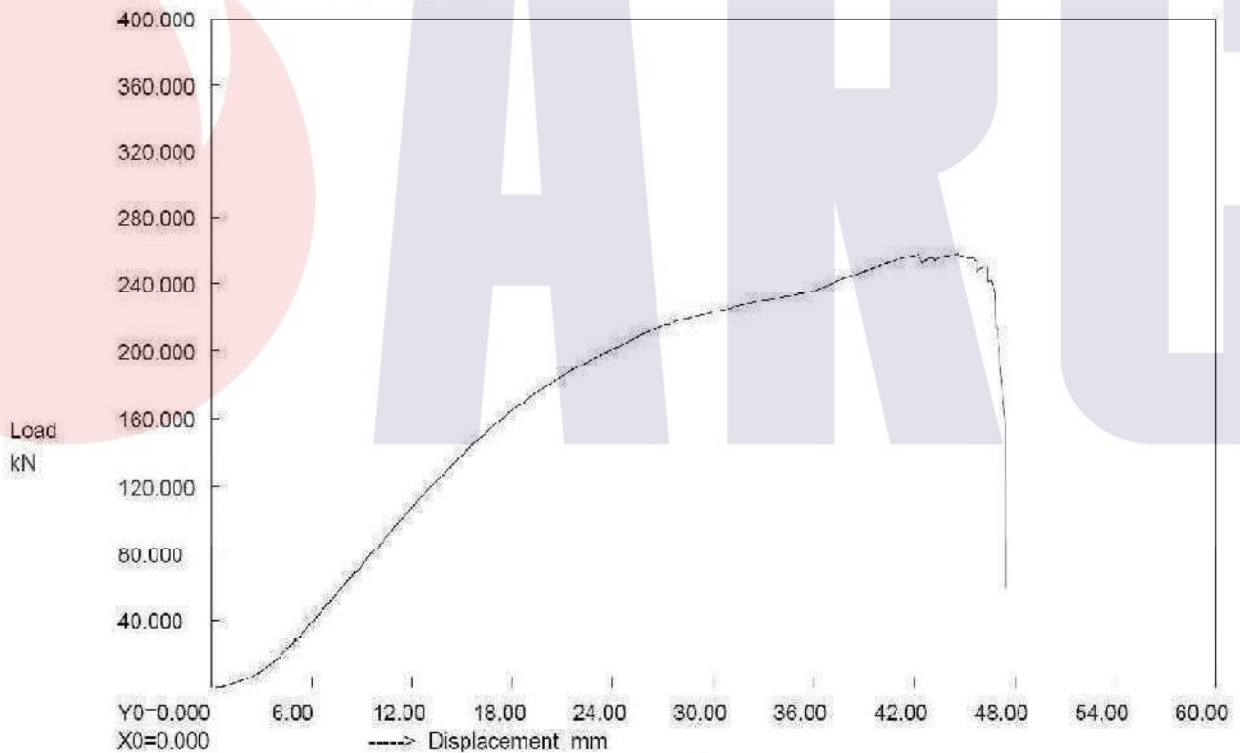
To / Dept. : INHOUSE (AFCONS INFRASTRUCTURE LTD)  
Address : ARC KOLKATA  
sample Identification : GFRP BAR  
Part description : BATCH 251123R20  
Part Number :  
Machine : KRYSTAL Make Universal Testing Machine 1200 kN

**Input Data** File Name : GFRP BAR , Record No. : 5  
Sample Type : Round Solid Bar Area : 314.160 mm<sup>2</sup>  
Diameter : 20 mm Final Dia : 19.9 mm  
Gauge Length : 100 mm Final Gauge Length: 100.1 mm

### Results of Tension Test

Maximum Force (Fm) : 251.340 kN  
Disp. at Fm : 42.16 mm  
Max. Disp. : 46.52 mm  
Tensile strength (RM) : 801.629 MPa

Graph : Load Vs Displacement



TESTED BY

INSPECTED BY

APPROVED BY

SUBHADIP ROY

MANISH BAJORIA

# TEST CERTIFICATE

Date : 29-11-2023 , 06:20 PM

## ARC INSULATION & INSULATORS PVT LTD RAMDEVPUR

INV. NO.: 137/23-24

REPORT NO.: ARC/QC/23-24/JOB-95/110

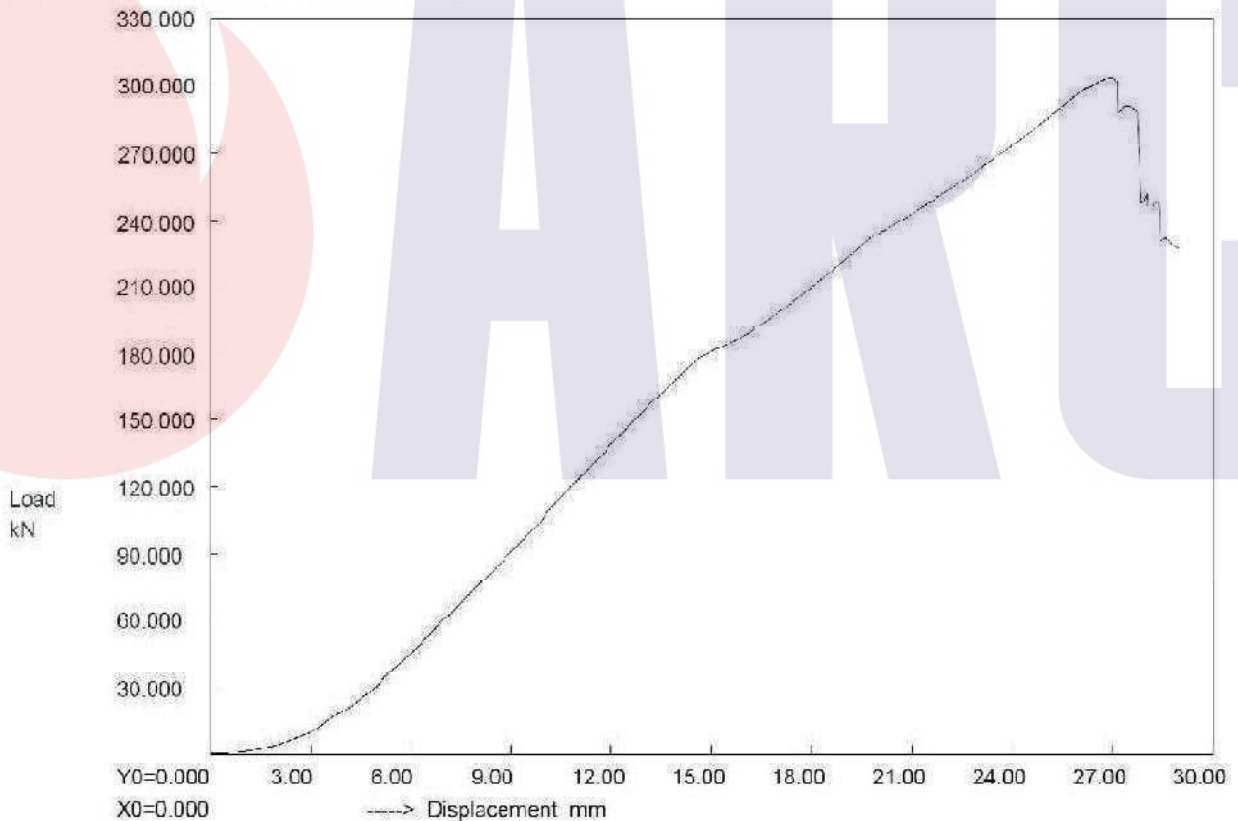
To / Dept. : INHOUSE (L&T DELHI)  
Address : ARC KOLKATA  
sample Identification : GFRP BAR  
Part description : BATCH 281123R25  
Part Number :  
Machine : KRYSTAL Make Universal Testing Machine 1200 kN

**Input Data** File Name : GFRP BAR , Record No. : 34  
Sample Type : Round Solid Bar Area : 490.873 mm<sup>2</sup>  
Diameter : 25 mm Final Dia : 24.9 mm  
Gauge Length : 125 mm Final Gauge Length: 125.1 mm

### Results of Tension Test

Maximum Force (F<sub>m</sub>) : 312.900 kN  
Disp. at F<sub>m</sub> : 26.91 mm  
Max. Disp. : 28.970 mm  
Tensile strength (R<sub>m</sub>) : 637.598 MPa

Graph : Load Vs Displacement



TESTED BY

INSPECTED BY

APPROVED BY

SUBHADIP ROY

MANISH BAJORIA



# TEST CERTIFICATE

Date : 19-07-2023 , 06:20 PM

## ARC INSULATION & INSULATORS PVT LTD RAMDEVPUR

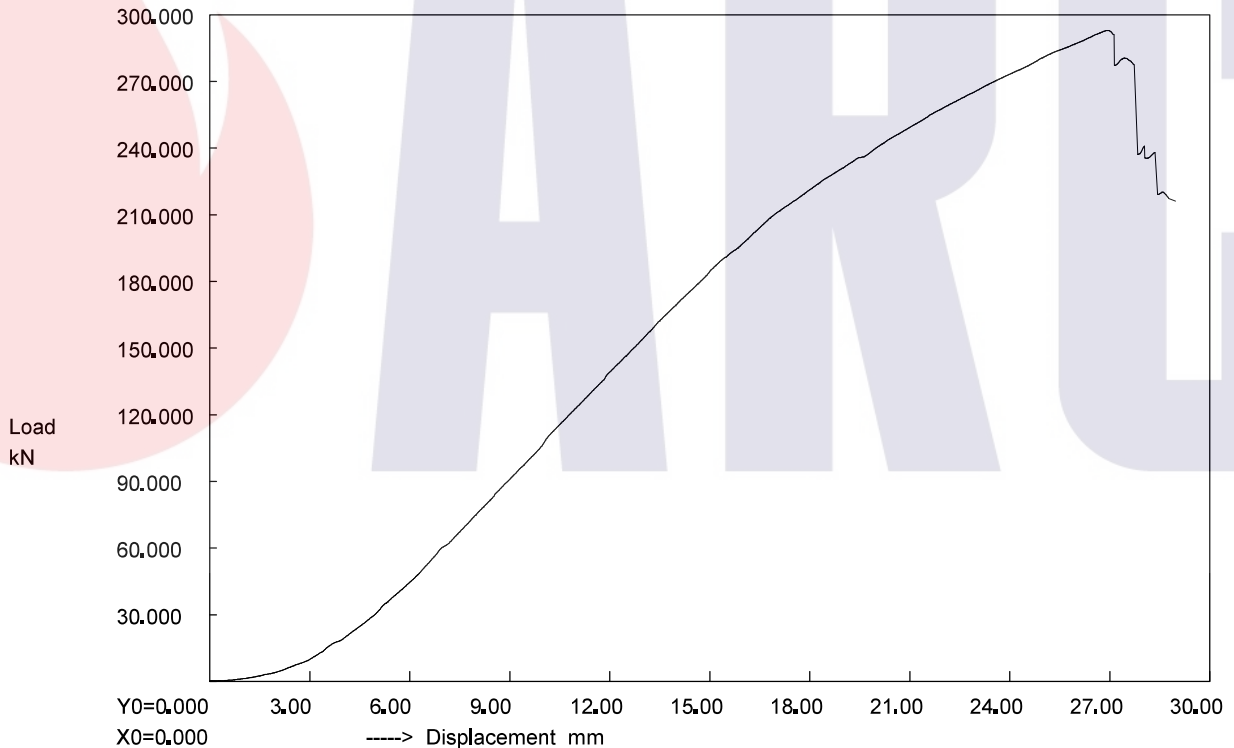
To / Dept. : INHOUSE  
Address : ARC KOLKATA  
sample Identification : GFRP BAR  
Part description :  
Part Number :  
Machine : KRYSTAL Make Universal Testing Machine 1200 kN

**Input Data** File Name : GFRP BAR , Record No. : 34  
Sample Type : Round Solid Bar Area : 490.873 mm<sup>2</sup>  
Diameter : 25 mm Final Dia : 24.9 mm  
Gauge Length : 125 mm Final Gauge Length: 125.1 mm

### Results of Tension Test

Maximum Force (Fm) : 292.980 kN  
Disp. at Fm : 26.91 mm  
Max. Disp. : 28.970 mm  
Tensile strength (Rm) : 596.854 MPa

Graph : Load Vs Displacement



TESTED BY

INSPECTED BY

APPROVED BY

SUBHADIP ROY

MANISH BAJORIA



# TEST CERTIFICATE

Date : 28-06-2023 , 04:08 PM

## ARC INSULATION & INSULATORS PVT LTD RAMDEVPUR

INV NO. 057/23-24  
REPORT NO.: ARC/QC/23-24/JOB-41/45

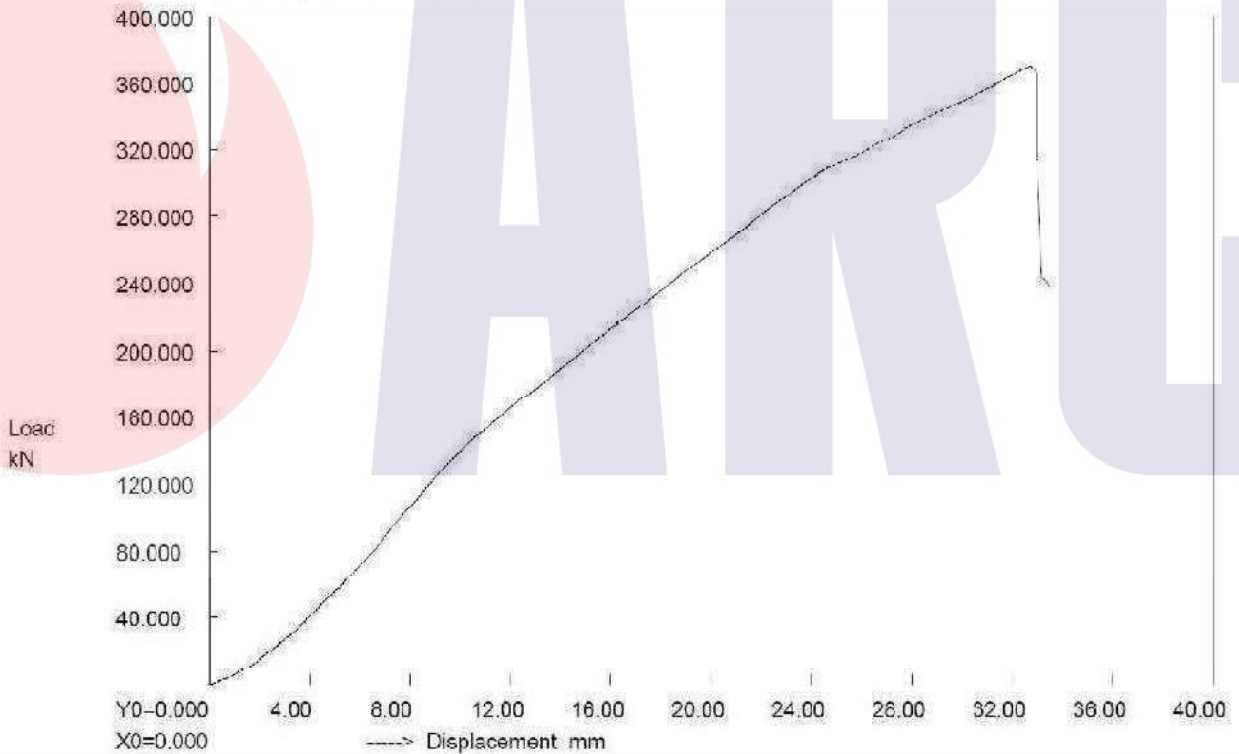
To / Dept. : INHOUSE (TATA PROJECTS LTD)  
Address : ARC KOLKATA  
Sample Identification : GFRP BAR  
Part description : BATCH 280623R28  
Part Number :  
Machine : KRYSTAL Make Universal Testing Machine 1200 KN

**Input Data** File Name : GFRP BAR , Record No. : 30  
Sample Type : Round Solid Bar Area : 615.752 mm<sup>2</sup>  
Diameter : 28 mm Final Dia : 27.9 mm  
Gauge Length : 140 mm Final Gauge Length: 140.1 mm

### Results of Tension Test

Maximum Force (Fm) : 370.340 kN  
Disp. at Fm : 32.70 mm  
Max. Disp. : 33.480 mm  
Tensile strength (Rm) : 601.443 MPa

Graph : Load Vs Displacement



TESTED BY

INSPECTED BY

APPROVED BY

GUDIADIP ROY

MANISH DAJORIA

# TEST CERTIFICATE

Date : 21-12-2023 , 01:50 PM

INV NO.: 147/23-24

Report No : ARC/QC/23-24/IOB-85/116

## ARC INSULATION & INSULATORS PVT LTD RAMDEVPUR

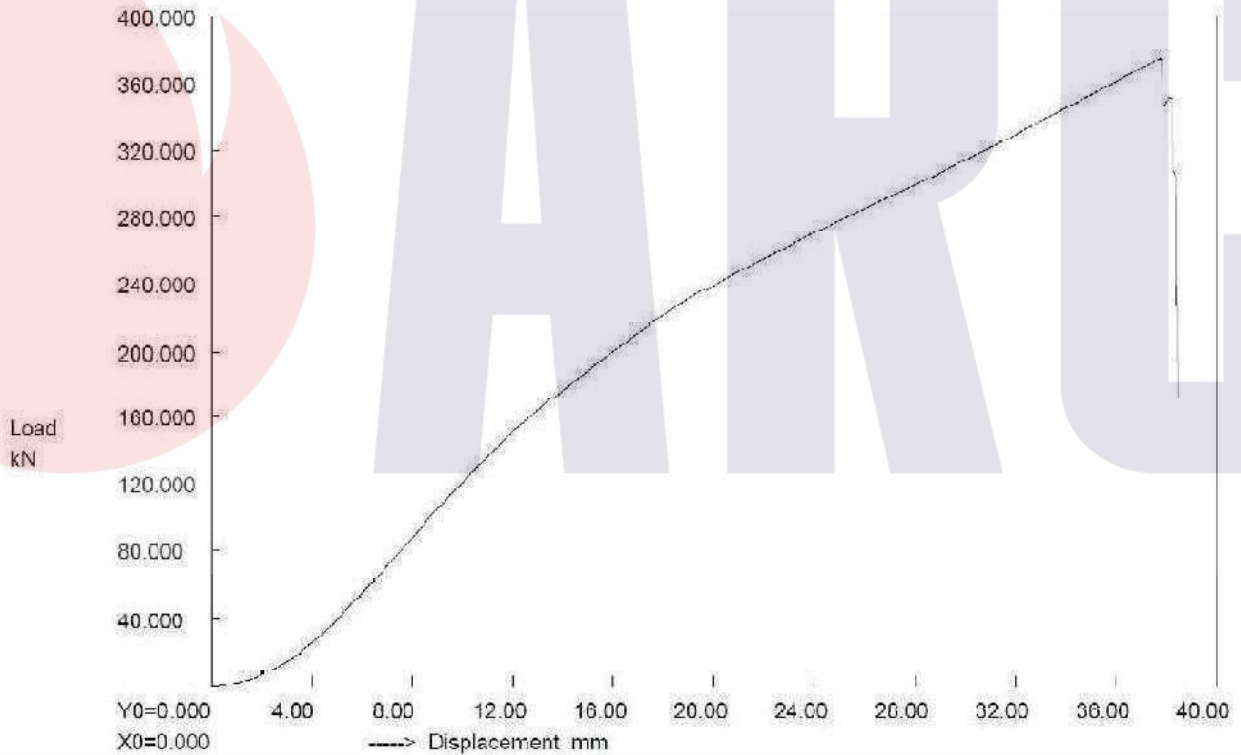
To / Dept: INHOUSE (L & T Patna)  
Address: ARC KOLKATA  
Sample Identification: GFRP BAR  
Part description: BATCH 201223R28  
Part Number:  
Machine: KRYSTAL Make Universal Testing Machine 1200 kN

**Input Data** File Name : GFRP BAR, Record No. : 52  
Sample Type : Round Solid Bar Area : 615.752 mm<sup>2</sup>  
Diameter : 28 mm Final Dia : 27.9 mm  
Gauge Length : 140 mm Final Gauge Length: 140.1 mm

### Results of Tension Test

Maximum Force (Fm) : 374.700 kN  
Disp. at Fm : 37.71 mm  
Max. Disp. : 38.460 mm  
Tensile strength (Rm) : 608.525 MPa

Graph : Load Vs Displacement



TESTED BY

INSPECTED BY

APPROVED BY

SUBHADIP ROY

MANISH DAJORIA

# TEST CERTIFICATE

Date : 14-11-2023 , 02:36 PM

INV NO.: 128/23-24

Report No.: ARC/QC/23-24/JOB-85/102

## ARC INSULATION & INSULATORS PVT LTD RAMDEVPUR

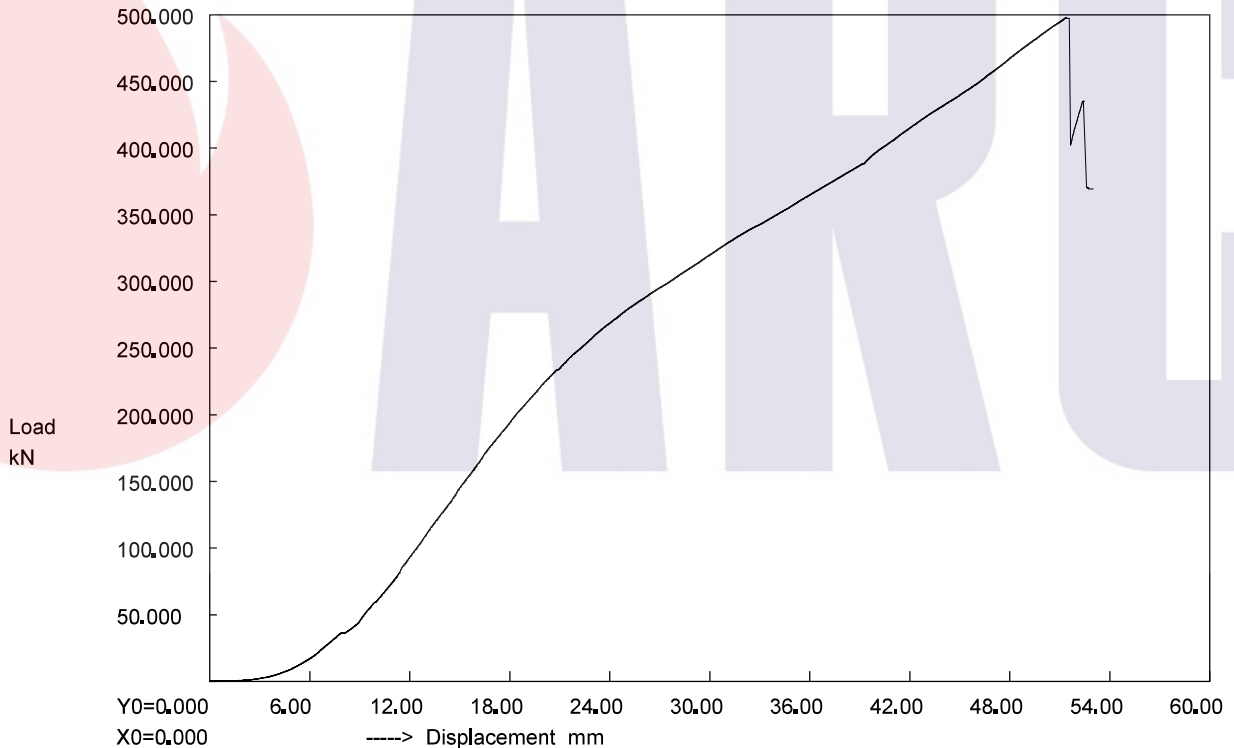
To / Dept. : INHOUSE (L&T PATNA)  
Address : ARC KOLKATA  
sample Identification : GFRP BAR  
Part description : BATCH: 131123R32  
Part Number :  
Machine : KRYSTAL Make Universal Testing Machine 1200 kN

**Input Data** File Name : GFRP BAR , Record No. : 12  
Sample Type : Round Solid Bar Area : 804.247 mm<sup>2</sup>  
Diameter : 32 mm Final Dia : 31.9 mm  
Gauge Length : 160 mm Final Gauge Length: 160.1 mm

### Results of Tension Test

Maximum Force (Fm) : 497.760 kN  
Disp. at Fm : 51.35 mm  
Max. Disp. : 53.000 mm  
Tensile strength (Rm) : 618.914 MPa

Graph : Load Vs Displacement



TESTED BY

INSPECTED BY

APPROVED BY

SUBHADIP ROY

MANISH BAJORIA

# TEST CERTIFICATE

Date : 14-11-2023 , 02:27 PM

INV NO.: 128/23-24

## ARC INSULATION & INSULATORS PVT LTD RAMDEVPUR

Report No.: ARC/QC/23-24/JOB-85/102

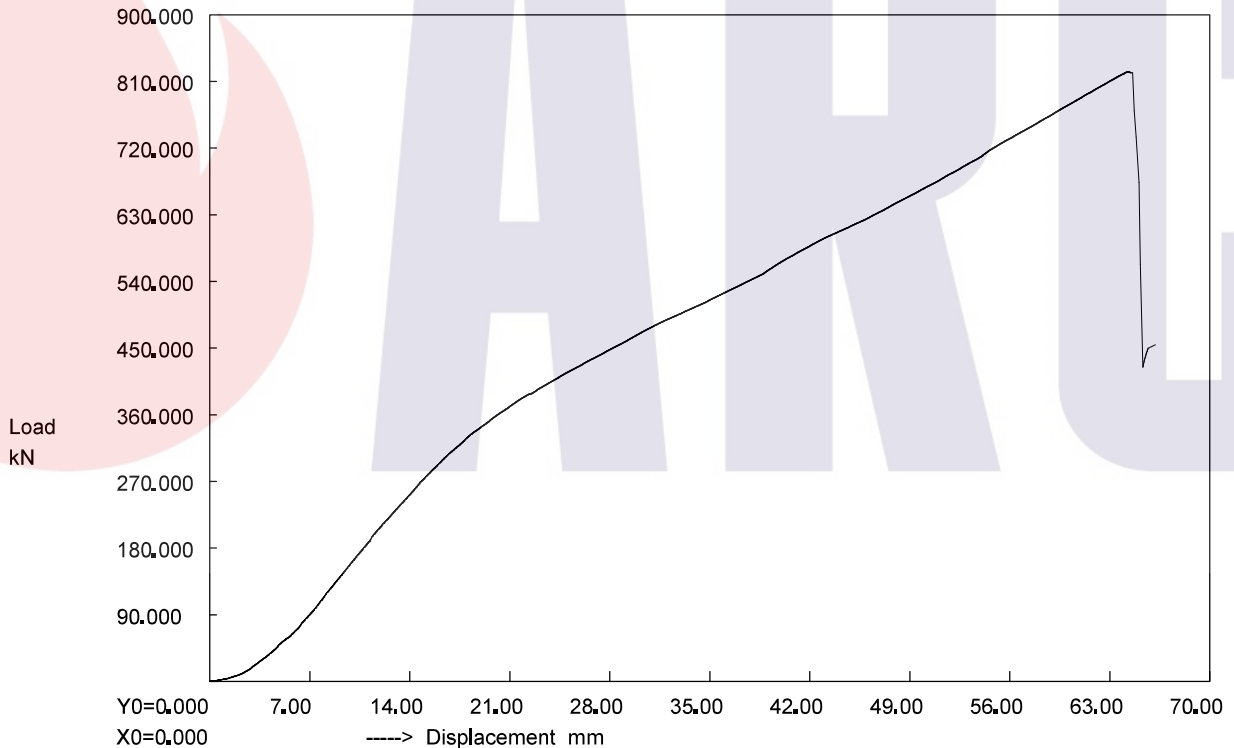
To / Dept. : INHOUSE (L&T PATNA)  
Address : ARC KOLKATA  
sample Identification : GFRP BAR  
Part description : BATCH: 131123R40  
Part Number :  
Machine : KRYSTAL Make Universal Testing Machine 1200 kN

**Input Data** File Name : GFRP BAR , Record No. : 11  
Sample Type : Round Solid Bar Area : 1256.636 mm<sup>2</sup>  
Diameter : 40 mm Final Dia : 39.9 mm  
Gauge Length : 200 mm Final Gauge Length: 200.1 mm

### Results of Tension Test

Maximum Force (Fm) : 822.960 kN  
Disp. at Fm : 64.25 mm  
Max. Disp. : 66.180 mm  
Tensile strength (Rm) : 654.891 MPa

Graph : Load Vs Displacement



TESTED BY

INSPECTED BY

APPROVED BY

SUBHADIP ROY

MANISH BAJORIA

# TEST CERTIFICATE

Date : 30-06-2023 , 03:54 PM

## ARC INSULATION & INSULATORS PVT LTD RAMDEVPUR

INV NO. 057/23-24

To / Dept. : INHOUSE (TATA PROJECTS LTD)

REPORT NO.: ARC/QC/23-24/JOB-41/45

Address : ARC KOLKATA

sample Identification : GFRP BAR

Part description : BATCH 300623R48

Part Number :

Machine : KRYSTAL Make Universal Testing Machine 1200 kN

**Input Data** File Name : GFRP BAR , Record No. : 29  
Sample Type : Round Solid Bar Area : 1809.556 mm<sup>2</sup>  
Diameter : 48 mm Final Dia : 47.9 mm  
Gauge Length : 240 mm Final Gauge Length: 240.1 mm

### Results of Tension Test

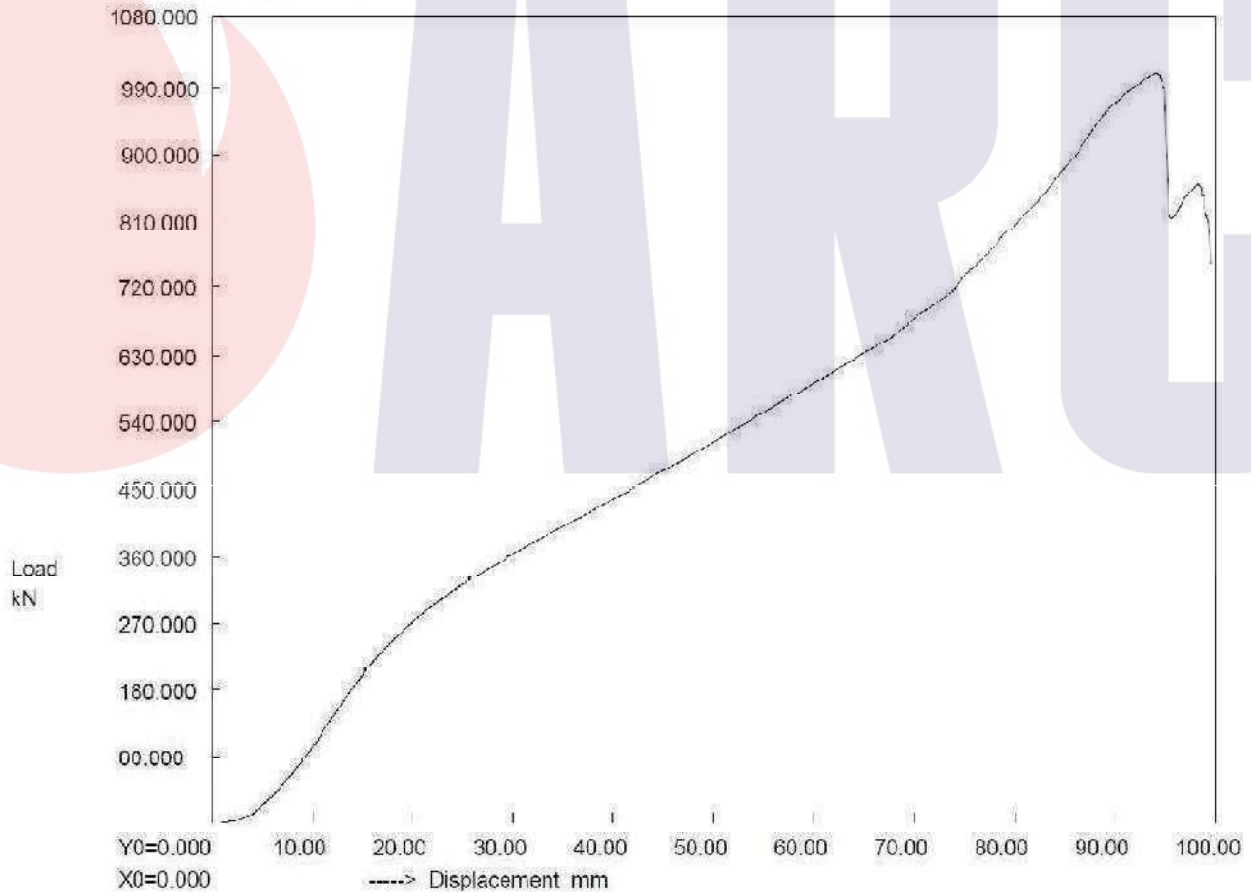
Maximum Force (Fm) : 1017.740 kN

Disp. at Fm : 94.00 mm

Max. Disp. : 99.610 mm

Tensile strength (Rm) : 562.425 MPa

Graph : Load Vs Displacement



TESTED BY

INSPECTED BY

APPROVED BY

SURHADIP ROY

MANISH BAJORIA