ACTION RESEARCH PROJECT

Practical Problems in Plywood Manufacturing

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INTRODUCTION

Manufacturing process of plywood

Plywood is a construction material made from different species of trees. It consists of thin wood layers or piles known as veneers bonded with an adhesive. With the use of resin, veneers are glued together with the adjacent layers causing each of its wood grain to be rotated up to a maximum angle of 90 degrees. The purpose of this is to improve the strength of the finished product and to reduce shrinkage.

There are two kinds of plywood: the hardwood and the softwood. In manufacturing plywood, the commonly used hardwoods are those fall in with the deciduous species such as larch, maple, oak, cherry, and poplar.

On the other hand, softwood falls in with the family of coniferous. Firs and pines are softwoods used in manufacturing plywood. By bonding several layers of dry softwood veneers together with a resin, softwood plywood is being made.. The most common application of softwood plywood is those in construction. It is used as construction materials such as roof decking, sheathing, wall sliding, floors, concrete form boards, and containers.

Manufacturing hardwood or softwood plywood undergo different processes to ensure the quality of the product produced. These methods include selecting the log, debarking, cutting the logs, peeling the log, making a continuous ribbon of wood, cutting and stacking, gluing the wood, pressing the wood, trimming, sanding, and finishing.

Selecting the log

The initial step in manufacturing plywood is selecting the logs. Logs are chosen according to its physical properties. Maturity, straightness, and roundness are the most critical factors to be considered in selecting raw logs. Plywood manufacturers also ensure that all raw logs used in plywood come from a legal source and sustainable forest concession.

Submerging logs in water over a period helps to peel and cut down logs into various sizes easily. Some other mills, especially in cold places use heat as a way to improve the quality of peeling. These methods are known as hydrothermal processing.

Debarking

The second step is the debarking process. Logs are feed into a debarking machine. Just like shown in the picture. As the logs rotate from the ridged wheels, the cutting head on the track is reversely rotating with the log from end to end, causing the bark to be removed. The purpose of this is to peel the bark without damaging the wood.

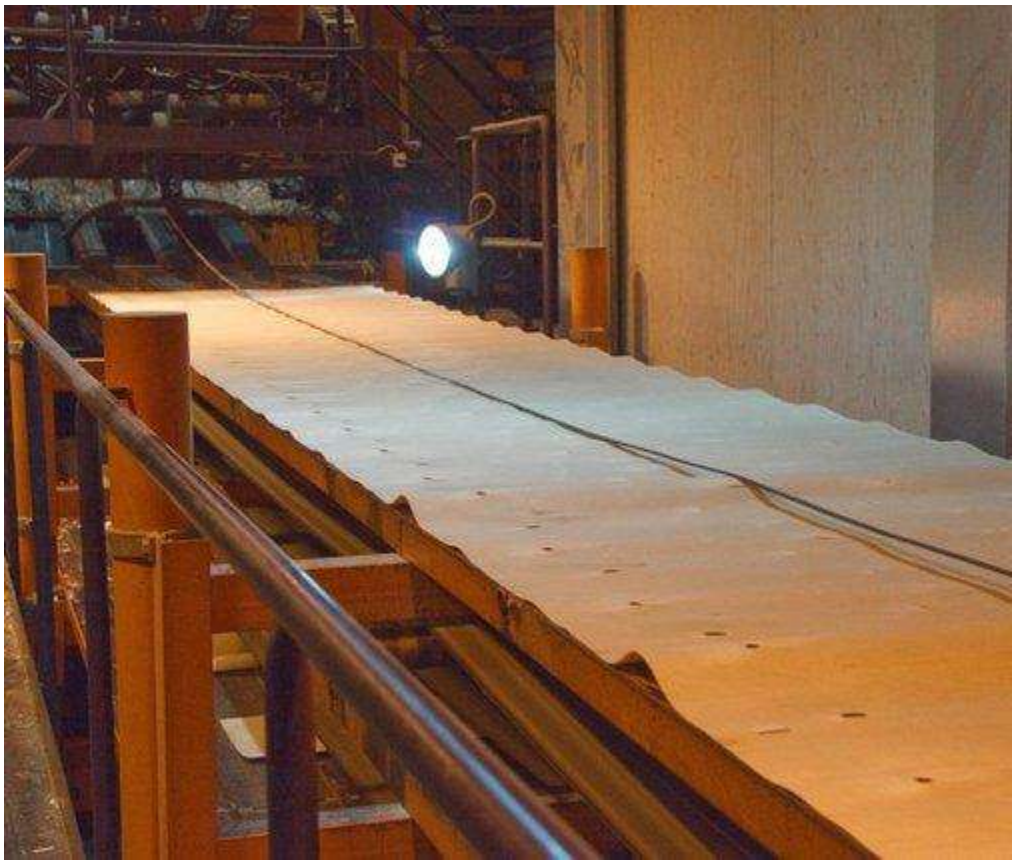
Cutting the logs

After the debarking process, the logs are cut into desired lengths in step known as bucking. This process is done so that the next operation which is peeling the bark can be efficiently executed.

Peeling the logs

The next step is the peeling process. The markings in the log made by the debarking knives during the debarking process are removed using a substantial rotary lathe. The log revolves on the machine against a long blade cutter. The cutting process is like sharpening a pencil except that the blade is parallel with the log at the time of cutting.

Making a continuous ribbon of wood



After peeling, the next method to be done is creating a continuous ribbon of wood. The log rotates and feeds towards the cutting edge of the lathe creating continuous and unwounded thin layers of wood. The thickness of the veneer depends upon how it is used.

Cutting and stacking

The piece of wood is cut to a standard size of 4’ x 8’. The ideal thickness of plywood range from 1/4'' to 3¼’, but the actual thickness of the plywood after production is determined after the sheets are pressed and glued together. The sheets are automatically scanned as it comes up in the peeler. After scanning, it is stack in preparation for transferring and drying using drying ovens.

Gluing the wood

After cutting and stacking, the next step is sticking the sheets of veneer together. This is done to determine the desired thickness of the plywood sheets. The commonly used adhesive in manufacturing plywood are those synthetic plastics such as phenol – formaldehyde or urea resins. The thin sheets of wood run through the gluing machine. As the sheet pass through, the glue is spread evenly on the back and face of the veneer. The glued veneer is placed on top of unglued veneer, then followed by glued veneer. The process is alternating: glued, unglued, glued, unglued and so on.

Pressing the wood

After doing he glued and unglued alternating process, the sheets which are glued together is pressed using a hot press machine to attain the desired thickness of plywood. An example of this pressing machine is the hydraulic or pneumatic pressing machine wherein pressure, or sometimes heat and pressure are applied to the plies. When heat is applied, the glue hardens quickly and then solidifies as the combined veneer is pressed together. The plywood is considered dry once the pressure is released.

Trimming, Sanding, and Finishing

The sheet will undergo processes to make it presentable and saleable in the market. These methods include trimming, sanding, and finishing. Because of these processes, the sheets takes down into standard sizes which meet the needs of the customers. Also, these processes are the reason why plywood seen in the market has smooth edges and texture. The finished plywood products are divided into two categories indicating whether it is for exterior or interior used.

Market Situation in India:

While working as a dealing officer for plywood product in GZBO-Certification, I always experienced one common concern from the local manufacturers that the face veneer availability as per standard is too difficult. The cost of obtaining and using that thickness of face veneer was also very high. Thus, in India all the manufacturers are bound to use face veneers for thickness in the ranges of 0.25-0.30 mm and even less.

The Action Research Proposal:

The actual Market situation led me to take up the matter in my Action Research Project which was approved by the committee. The proposal outlined why many manufacturers find it difficult to enter/retain into BIS Licensing system because of face veneer scarcity in India.

The Action: (Phase-I)

As the concern was obtained from local manufacturers, hence it was important to find the relevance from manufacturers all around the country.

Initially a meeting was held in Hapur, Ghaziabad on 27.10.2020, with the local manufacturers. The conclusion of the meeting was that the firms are finding it difficult to obtain face veneers as per ISS. They expressed their inability due to high cost factor involved in getting face veneers from other countries due to lack of face veneer availability in India. The firms also mentioned that they are using face veneer thicknesses in the range of 0.22-0.30 mm, confirming that the practice is followed all across India.

After this, the matter was discussed with Federation of Indian Plywood and Panel Industry (FIPPI). It was decided to conduct a Webinar from manufacturers all across the country and with Principal technical Advisor- Shri CN Pandey.

The Webinar was held on 08.12.2020 in the presence of Sh CN Pandey and other manufacturers namely:

Mr Ambuj Mishra – Sukhna Plywood Hapur

- Mr Anup Daruka-Top Ply Patna
- Mr Devinder Kumar- Pasand plywood-Ghaziabad
- Mr Hardeep Singh- Rampur
- Mr Mayank Jain- Jain Doors Haryana
- Mr Muhammad Sha- Kerela

- MrJaved CP- Kannur Kerela
- NaasPlywoodIndustry- Bijnor
- Mr Naval Kishor-Amba Plywood Ghaziabad
- Mr Sanjay Kripal Garg- Navrang Venners – Ghaziabad.
- Mr Ravi Bhushan-Ghaziabad
- Mr Sunil Kumar-Lucknow
- Mr Surya Verma-Lucknow
- Mr VaibhavBatra-Rampur
- Mr Vinay Batra-Rampur
- MrJaideep Singh- Bilaspur, Rudrapur.

Conclusion of Webinar:

In the webinar, the problem of face veneer was discussed with all the manufacturers by seeking comments from all of them. Most of the manufacturers in India, being MSME, expressed that the face veneer requirement as per Indian Standards are not being met considering the scenario for the availability of face veneers in India and the cost associated with importing face veneers is also very high, leading to loss in sales. Also, all manufactures including the giants like Century plywood ,SRG and even Greenply, agreed that the face veneers is not available like before and the cost they inculcate to bring required sizes of face veneers as per ISS is too much to survive in the market as plywood comes under voluntary certification. Also, they emphasized on the fact the strength requirements in the Indian Standards for MOR/MOE is too high, as mostly General plywood is used in household furniture. The plywood associations also said that many manufacturers still do not take a BIS License due to their inability to get desired face veneer thickness as per ISS.

It was then mutually agreed that a study may be conducted to see the variation of the strength values obtained from lower face veneer thickness at any Licensee premises having complete facility.

The BIS View:

From BIS point of view, while scrutinizing the test reports, it is observed that most failures occurring in samples are either in MOR or MOE or both.

Basically, while applying for BIS License for IS 303, all the manufacturers arrange min. 0.5 mm face veneers and get it tested in BIS/BIS Approved Laboratories. After getting the license, they again find it difficult to import such 0.5mm thickness face veneers on regular basis, thus leading to the usage of a lesser thickness face veneer (generally 0.25mm and even below) being a regular and most common practice all across the country. This is why mostly Market samples drawn are found failing in MOR/MOE requirements.

The question is when manufacturers know that the strength would be affected by using lower thickness face veneers and at the same time, it is not feasible for them to use BIS required thickness face veneers, then why not we study and understand how to deal with such situation as availability of raw materials like face veneers and core veneers would always be on the decline and also that plywood manufacturing technology has become more advanced in comparison to when standards were initially developed. Thus, an amendment in the standard is pretty much there in the likelihood.

The Action: (Phase-II)

As decided in the webinar, about a study to be conducted for analyzing outcomes of Bending strength with different face veneer thickness, the matter was proposed to my Head-BO, Mrs. Rosy Dhawan-Scientist-F, who was kind enough to give me approval for the same.

The Action plan Phase-II was a series of visits at Century Plywood, Kandla, Gujarat as it had peeling facilities as well.

First visit was conducted on 21st Dec 2020 at Century Plywood Kandla, in which, peeling process was verified and imported peeled face veneers were checked for its thickness and the values were recorded. The details are explained further in the observations.

Second visit at Century Plywood Kandla unit was held during 06-08th Jan 2021. The plywood prepared from the inspected face veneers during last visit were cut into required specimens as per IS 1734(Part 11) and kept for conditioning. It was further tested by Central Loading method for obtaining MOR,MOE values which has been studied and explained in detail in the observations.

Observations at Century Plywood, Kandla visit (21st Dec 2020)

The plywood was prepared for thicknesses 6mm, 12mm and 19 mm from face veneer of Gurjan and Okume varieties.

During visit at Kandla unit on 21st Dec 2020, face veneers were inspected for its thickness and moisture content. The face veneers of two different and most common varieties i.e Okume and Gurjan were inspected. For each veneer, 4 readings of thickness were measured.

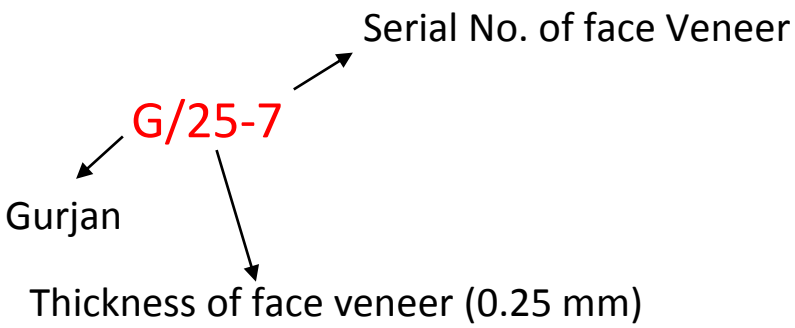
The face veneer was then coded with unique code and signed and also counter sign was obtained from firm, to ensure traceability of that veneer.

Example:

Variety- Gurjan , Thickness of Face veneer-0.25

In this case, a face veneer (say No. 7) was selected from the measured face veneers and was then coded to G/25-7

The coding was done as below:



Accordingly face veneers were coded for different varieties and different face veneer thicknesses.

The above face veneers were then left with the firm for manufacturing plywood.

Firm informed that the plywood manufacturing process will be completed by 02.01.2021.

Accordingly subsequent inspection was planned for testing of plywood at Kandla Unit.

Observations at Century Plywood, Kandla visit-II (06-08th Jan 2021)

1. The plywood was manufactured using the same face veneers and it was ensured by the presence of the unique codes on them along with signatures of BIS official and firm's representative.
   NOTE: As I was not present during the manufacturing process of plywood, the entire manufacturing process is as per declaration of Century Plywood, Kandla.

2. Firm prepared plywood and also declared its manufacturing details which are as follows:

(a) The In process controls used while manufacturing all offered plywood of thicknesses 6mm, 12mm & 19 mm.

1	Chemical Checking on receipt : Phenol Purity = 93% & Formaldehyde = 37%
2	Resin & Glue Properties check & 24hrs conditioning of Resin prior to use
3	Raw Material Quality Check-Face /Core Veneer & 5days conditioning of Veneer post drying
	Grading , Moisture , Margin , Chopping Edge
4	Hot Press – Assembly
	Straight Assembly & Core+Panel Sizing
	Proper Gap Filling & No over/gap
	As per system Assembled Load Load Pack shifting = Max 30mints
	Prepress time = 25 Mints & S.Pressure = 14kg/cm2
	Hot Press Check- Temperature , Pressure & Time
5	Finishing Section
	24 hrs Conditionoing of Plywood stacks prior to cutting
	DD Saw - cutting quality
	WBS - Paper grit & quality = 60no for Base ply & 220no for Faced ply
	ACC Preservative Spread quality & Finishing
	Finished Products quality check & Testing as per norms

(b) The type and quality of resin used.

Resin Type/grade	Phenol Formaldehyde Resin (Acid- alkali)/BWR grade as per IS848
pH	10.5
Water tolerance	1:17
Resin Flow (B4 Cup)	68 Sec
Solid content (%)	46.68
Adhesive Viscosity (B6 Cup)	64 Sec
Resin Coverage (Sqm/Kg)	3.35
RH %	40%
Ambient temperature	28 deg C

(c) The Type/Grade of plywood manufactured.

Type AA / BWR grade plywood

(d) The pressure/temperature used.

HP Specific Pressure = 12Kg/cm2 & Platen temp = 130C

(e) The Core veneer Treatment done (if any)

Raw Material treatment not done, as we have mixed preservative chemical “Chlorpyrifos 50% EC” in the glue used.

(f) The type core veneer used.

Hardwood timber = Eucalyptus Core

(g) Moisture Content of core veneer and face veneer being used for testing.

Core Veneer Species = Eucalyptus		
Thickness (in mm)	**CL**	**LCL**
	1.80	1.75
Moisture content		6% to 10%
OD Density		580 kg/m3

Face Veneer Species		**Okume**		**Gurjan**	
Thickness Norm		**0.25 mm**	**0.28 mm**	**0.25 mm**	**0.28 mm**
Thickness(dry)	**LCL**	0.25	0.27	0.24	0.26
	CL	0.26	0.29	0.26	0.27
	Min	0.24	0.25	0.24	0.24
	Max	0.28	0.32	0.29	0.3
Moisture %	**Avg**	6%	8%	8%	10%
OD Density	**Avg**	360 Kg/m3		690 /m3	

The construction of plywood for its different thickness and different varieties is also detailed below:

(a) Okume Variety

06 mm Ply with 0.25 mm Okume face			
Cross core	1.80 mm X 2 Layers		3.60
Panel core	2.40 mm X 1 Layer		2.35
Face veneer	0.25 mm X 2 Layers		0.50
Total construction			**6.45**
Final Thickness observed			**5.70**
Compression loss %			11.6

06 mm Ply with 0.30 mm Okume face			
Cross core	1.80 mm X 2 Layers		3.60
Panel core	2.35 mm X 1 Layer		2.35
Face veneer	0.30 mm X 2 Layers		0.60
Total construction			**6.55**
Final Thickness observed			**5.80**
Compression loss %			11.5

12 mm Ply with 0.25 mm Okume face			
Cross core	1.80 mm X 4 layers		7.20
Panel core	1.80 mm X 3 layers		5.40
Face	0.25 mm X 2 layers		0.50
Total construction			**13.10**
Final Thickness observed			**12.14**
Compression loss %			7.3

12 mm Ply with 0.30 mm Okume face			
Cross core	1.80 mm X 4 layers		7.20
Panel core	1.80 mm X 3 layers		5.40
Face	0.30 mm X 2 Layers		0.60
Total construction			**13.20**
Final Thickness observed			**12.33**
Compression loss %			6.6

19 mm Ply with 0.25 mm Okume face			
Cross core	1.80 mm X 6 layers		10.80
Panel core	1.80 mm X 5 layers		9.00
Face	0.25 mm X 2 layers		0.50
Total construction			**20.30**
Final Thickness observed			**19.32**
Compression loss %			4.8

19 mm Ply with 0.30 mm Okume face			
Cross core	1.80 mm X 6 layers		10.80
Panel core	1.80 mm X 5 layers		9.00
Face	0.30 mm X 2 Layers		0.60
Total construction			**20.40**
Final Thickness observed			**19.38**
Compression loss %			5.0

(b) Gurjan variety

06 mm Ply with 0.25 mm Gurajan face			
Cross core	1.80 mm X 2 Layers		3.60
Panel core	2.35 mm X 1 Layer		2.35
Face veneer	0.25 mm X 2 Layers		0.50
Total construction			**6.45**
Final Thickness observed			**5.70**
Compression loss %			11.6

06 mm Ply with 0.28 mm Gurajan face			
Cross core	1.80 mm X 2 Layers		3.60
Panel core	2.35 mm X 1 Layer		2.35
Face veneer	0.30 mm X 2 Layers		0.60
Total construction			**6.55**
Final Thickness observed			**5.85**
Compression loss %			10.7

12 mm Ply with 0.25 mm Gurajan face			
Cross core	1.80 mm X 4 layers		7.20
Panel core	1.80 mm X 3 layers		5.40
Face	0.25 mm X 2 layers		0.50
Total construction			**13.10**
Final Thickness observed			**12.16**
Compression loss %			7.2

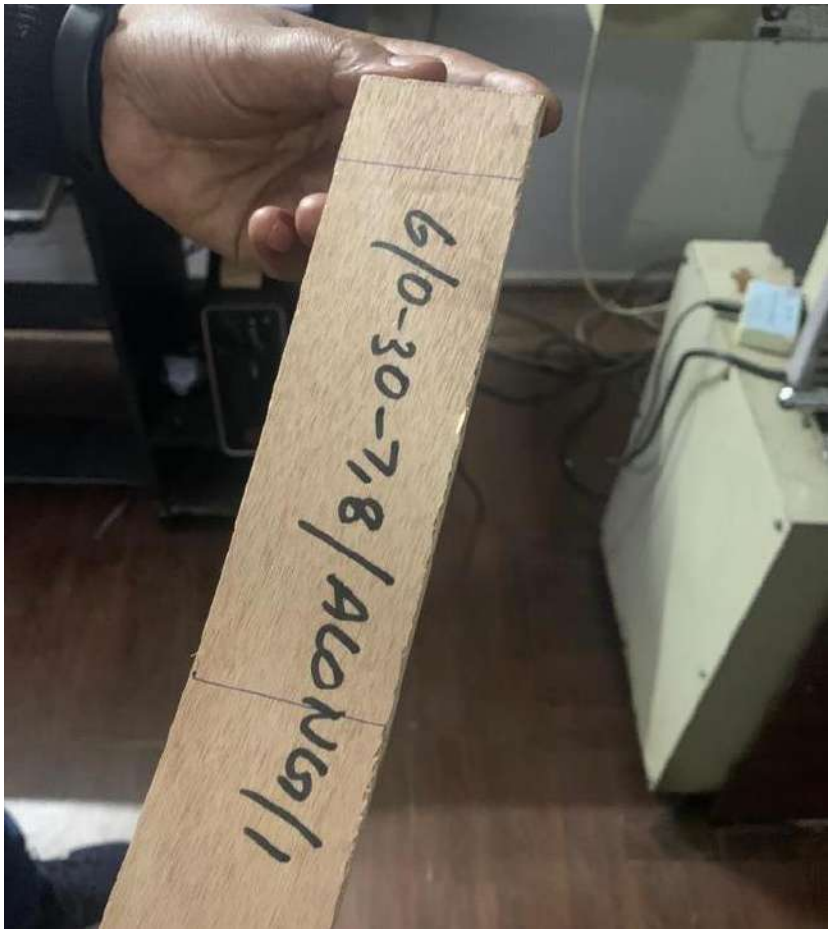
12 mm Ply with 0.28 mm Gurajan face			
Cross core	1.80 mm X 4 layers		7.20
Panel core	1.80 mm X 3 layers		5.40
Face	0.30 mm X 2 Layers		0.60
Total construction			**13.20**
Final Thickness observed			**12.11**
Compression loss %			8.3

19 mm Ply with 0.25 mm Gurajan face			
Cross core	1.80 mm X 6 layers		10.80
Panel core	1.80 mm X 5 layers		9.00
Face	0.25 mm X 2 layers		0.50
Total construction			**20.30**
Final Thickness observed			**19.43**
Compression loss %			4.3

19 mm Ply with 0.28 mm Gurajan face			
Cross core	1.80 mm X 6 layers		10.80
Panel core	1.80 mm X 5 layers		9.00
Face	0.30 mm X 2 Layers		0.60
Total construction			**20.40**
Final Thickness observed			**19.45**
Compression loss %			4.7

3. The plywood were cut into required dimensions, both along the grain and across the grain, according to IS 1734 (Part 11). The prepared specimens were then coded with a unique code. The coding was done as below:
Suppose face veneer no. 7 and face veneer no. 8 were used to manufacture plywood of Gurjan variety and its thickness is 0.25 mm and also the final plywood thickness is 19 mm, then the specimen which has been cut ALONG the grain and let it be the 1st of the 3 specimens prepared along the grain then, it will be coded as
19/G-25-7,8/ALONG/1
Similarly its 2nd of 3 specimen would be coded as **19/G-25-7,8/ALONG/2.**

Sample Code for 6mm plywood with 0.30mm gurjan face veneer in ALONG the grain direction



4. The specimen was then preconditioned to a constant mass at a relative humidity of 65 ± 5 percent and at a temperature of 27 ± 2°C and then taken up for testing of Modulus of Rupture (MOR) and Modulus of Elasticity (MOE) by Central Loading Method.

5. As the plywood made is of BWR grade as per IS 303:1989, hence the requirement of MOR and MOE is as per Amendment No.04 of IS 303:1989.

Another important parameter to keep in mind is the minimum requirement of face veneer thickness for different types of plywood as per ISS. Hence, the details of face veneer thickness requirement are as below:

a) IS 303- 0.5 mm (min)- regular practice
b) IS 4990- 1.2 mm (min)
c) IS 2202(P-1)- 0.5 mm (min)
d) IS 1659- 0.5 mm

Now as this study is pertaining to IS 303, as it being the most widely type of plywood, hence we analyzed the results of the above plywood specimens prepared from BWR plywood as per IS 303:1989.

The requirements of MOR/MOR for BWR grade are as below:

S.No	BWR Grade	MOE (N/mm^2)		MOR (N/mm^2)	
1	Along (direction parallel to the grain direction of the face veneer)	Average	Min. individual	Average	Min. Individual
		5000	4500	40	36
2	Across (direction perpendicular to the grain direction of the face veneer)	Average	Min. individual	Average	Min. individual
		2500	2200	20	18

Few important details:

S.No	Face Veneer Variety	Thickness of Face Veneer (mm)	Thickness of Plywood & corresponding Quantity of specimens					
			6 mm		12 mm		19 mm	
			Along	Across	Along	Across	Along	Across
1	Gurjan	0.25	3	3	3	3	3	3
		0.28	3	3	3	3	3	3
2	Ockume	0.25	3	3	3	3	3	3
		0.30	3	3	3	3	3	3

Hence 6 x 4 x 3 = 72 samples were tested for MOR and MOE. Also one piece each of each variety and each thickness of face veneer and plywood was cut and kept as counter sample. It is kept sealed, coded and signed.

Bending Test Results:

S.no	Batch/Count	Sample Code	MOE(N/mm^2)	MOR(N/mm^2)
1	1	19/O-30-1,2/ALONG/3	6709.07-P	57.38-P
2	2	19/O-30-1,2/ALONG/2	6522.97-P	39.83-P
3	3	19/O-30-1,2/ALONG/1	5771.08-P	68.97-P
		Average	6334.37-P	55.39-P
4	4	19/G-25-7,8/ALONG/1	6932.84-P	72.24-P
5	5	19/G-25-7,8/ALONG/2	7285.56-P	73.43-P
6	6	19/G-25-7,8/ALONG/3	5253.69-P	63.25-P
		Average	6490.69-P	69.64-P
7	7	12/O-30-9,10/ALONG/1	4214.52-F (by **-6.34%**)	35.42-F (by **-1.61%**)
8	8	12/O-30-9,10/ALONG/2	3838.01-F (by **-14.71%)**	23.65-F (by **-34.30%**)
9	9	12/O-30-9,10/ALONG/3	4713.52-P	50.36-P
		Average	4255.35-F (by **-14.89%**)	36.47-P
10	10	12/O-25-9,10/ALONG/1	3055.49-F	33.53-F (by **-6.86%**)
11	11	12/O-25-9,10/ALONG/2	2388.18-F	27.30-F (by **-24.16%**)
12	12	12/O-25-9,10/ALONG/3	2725.01-F	29.42-F (by **-18.27%**)
		Average	2722.89-F	30.08-F (by -24.80%)
13	13	12/G-28-9,10/ALONG/1	5616.80-P	41.89-P
14	14	12/G-28-9,10/ALONG/2	6489.68-P	43.30-P
15	15	12/G-28-9,10/ALONG/3	Test pc did not break	Test pc did not break
		Average	6053.24-P	42.59-P
16	16	19/G-28-7,8/ALONG/1	7825.21-P	47.71-P
17	17	19/G-28-7,8/ALONG/2	6759.3-P	61.91-P

18	18	19/G-28-7,8/ALONG/3	5976.58-P	65.77-P
		Average	6853.69-P	58.46-P
19	19	19/O-25-7,8/ALONG/1	6057.59-P	45.04-P
20	20	19/O-25-7,8/ALONG/2	4658.12-P	55.59-P
21	21	19/O-25-7,8/ALONG/3	5950.90-P	49.50-P
		Average	5555.53-P	50.04-P
22	22	12/G-25-9,10/ALONG/1	3686.66-F	39.65-P
23	23	12/G-25-9,10/ALONG/2	4041.73-F	41.77-P
24	24	12/G-25-9,10/ALONG/3	3929.26-F	48.48-P
		Average	3885.88-F	43.30-P
25	25	19/O-30-1,2/ACROSS/1	4011.08-P	32.96-P
26	26	19/O-30-1,2/ACROSS/2	3463.89-P	37.08-P
27	27	19/O-30-1,2/ACROSS/3	3851.88-P	44.55-P
		Average	3775.56-P	38.19-P
28	28	19/G-25-7,8/ACROSS/1	4613.02-P	51.69-P
29	29	19/G-25-7,8/ACROSS/2	3636.76-P	38.50-P
30	30	19/G-25-7,8/ACROSS/3	4103.61-P	55.18-P
		Average	4117.79-P	48.45-P
31	31	12/G-28-9,10/ACROSS/1	4706.10-P	38.48-P
32	32	12/G-28-9,10/ACROSS/2	2814.58-P	37.89-P
33	33	12/G-28-9,10/ACROSS/3	4747.97-P	37.83-P
		Average	4089.55-P	38.06-P

34	34	12/O-25-9,10/ACROSS/1	4404.46-P	64.07-P
35	35	12/O-25-9,10/ACROSS/2	4210-P	52.36-P
36	36	12/O-25-9,10/ACROSS/3	702.77-F	20.79-P
		Average	3105.48-P	45.74-P
37	37	6/O-30-7,8/ALONG/1	1295.86-F	21.65-F (by **-39.86%**)
38	38	6/O-30-7,8/ALONG/2	1136.09-F	23.77 (by **-33.97%**)
39	39	6/O-30-7,8/ALONG/3	965.16-F	20.24 (by **-43.77%**)
		Average	770.39-F	20.63 (by **-48.42%**)
40	40	6/O-30-7,8/ACROSS/1	3513.47-P	58.25-P
41	41	6/O-30-7,8/ACROSS/2	2863.36-P	54.03-P
42	42	6/O-30-7,8/ACROSS/3	3389.24-P	67.07-P
		Average	3255.35-P	59.78-P
43	43	19/G-28-7,8/ACROSS/1	1923.9-F	24.71-P
44	44	19/G-28-7,8/ACROSS/2	4535.34-P	31.03-P
45	45	19/G-28-7,8/ACROSS/3	2506.07-P	36.01-P
		Average	2988.16-P	30.58-P
46	46	19/O-25-7,8/ACROSS/1	4478.32-P	53.10-P
47	47	19/O-25-7,8/ACROSS/2	4398.81-P	43.96-P
48	48	19/O-25-7,8/ACROSS/3	4694.86-P	47.30-P
		Average	4523.99-P	48.12-P
49	49	12/G-25-9,10/ACROSS/1	2770.85-P	36.77-P
50	50	12/G-25-9,10/ACROSS/2	3079.82-P	36.30-P

51	51	12/G-25-9,10/ACROSS/3	3435.34-P	28.53-P
		Average	3095.33-P	33.86-P
52	52	12/O-30-9,10/ACROSS/1	4273.14-P	67.13-P
53	53	12/O-30-9,10/ACROSS/2	3595.30-P	48.78-P
54	54	12/O-30-9,10/ACROSS/3	3934.37-P	51.60-P
		Average	3934.27-P	55.83-P
55	55	6/O-25-5,6/ALONG/1	1379.89-F	36.95-P
56	56	6/O-25-5,6/ALONG/2	1460.09-F	31.77-P
57	--	6/O-25-5,6/ALONG/3	Not tested	Not tested
		Average	1419.99-F	34.36-P
58	57	6/O-25-5,6/ACROSS/1	4374.76-P	45.19-P
59	58	6/O-25-5,6/ACROSS/2	3361.10-P	35.06-P
60	59	6/O-25-5,6/ACROSS/3	2895.55-P	57.42-P
		Average	3444.80-P	45.89-P
61	60	6/G-25-5,6/ACROSS/1	3142.24-P	47.89-P
62	61	6/G-25-5,6/ACROSS/2	2542.74-P	48.60-P
63	62	6/G-25-5,6/ACROSS/3	3088.68-P	30.83-P
		Average	2924.55-P	42.44-P
64	63	6/G-28-5,6/ACROSS/1	3062.79-P	39.18-P
65	64	6/G-28-5,6/ACROSS/2	3709.78-P	44.95-P
66	65	6/G-28-5,6/ACROSS/3	3908.67-P	42.95-P
		Average	3560.41-P	42.36-F

67	66	6/G-28-5,6/ALONG/2	5312.42-P	47.54-P
68	67	6/G-28-5,6/ALONG/3	4747.91-P	43.54-P
69	68	6/G-28-5,6/ALONG/1	DID NOT BREAK	DID NOT BREAK
		Average	5030.16-P	45.54-P
70	69	6/G-25-5,6/ALONG/2	3516.98-F	32.01-F (by **–11.08%**)
71	70	6/G-25-5,6/ALONG/3	1902.76-F	35.30-F (by **-1.94%**)
72	71	6/G-25-5,6/ALONG/1	1791.82-F	32.01-F (by **-11.08%**)
		Average	2403.85-F	33.10- F (by **-17.25%**)

The graphs for above samples are attached below

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	19MM PF PLYWOOD	1	19/O-30-1,2/ALONG/3	PLYWOOD

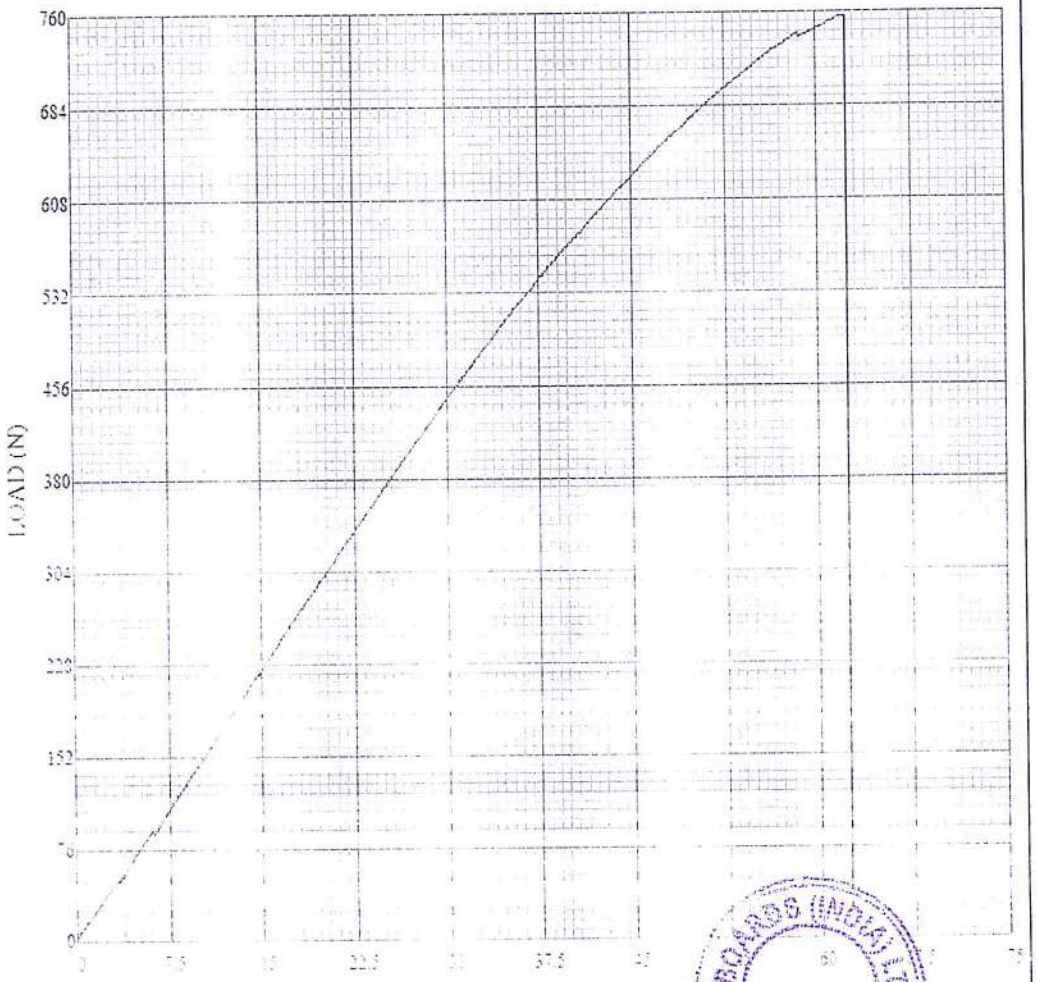
Specimen No.	0						
Width (mm)	50						
Length (mm)	912						
Thickness (mm)	19						

Peak Load (N)	757.1						
Load @ Break	24.51						
Elong @ Peak	62.03						
Elong @ Break	62.4						

Avg. Peak Force (N) 757.1

M O R (N mm²)	5738	57.38					
M O E	6709.07						
% Elongation	7						

Test Time (sec)	365						
Test Speed (mm/min)	10.94						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

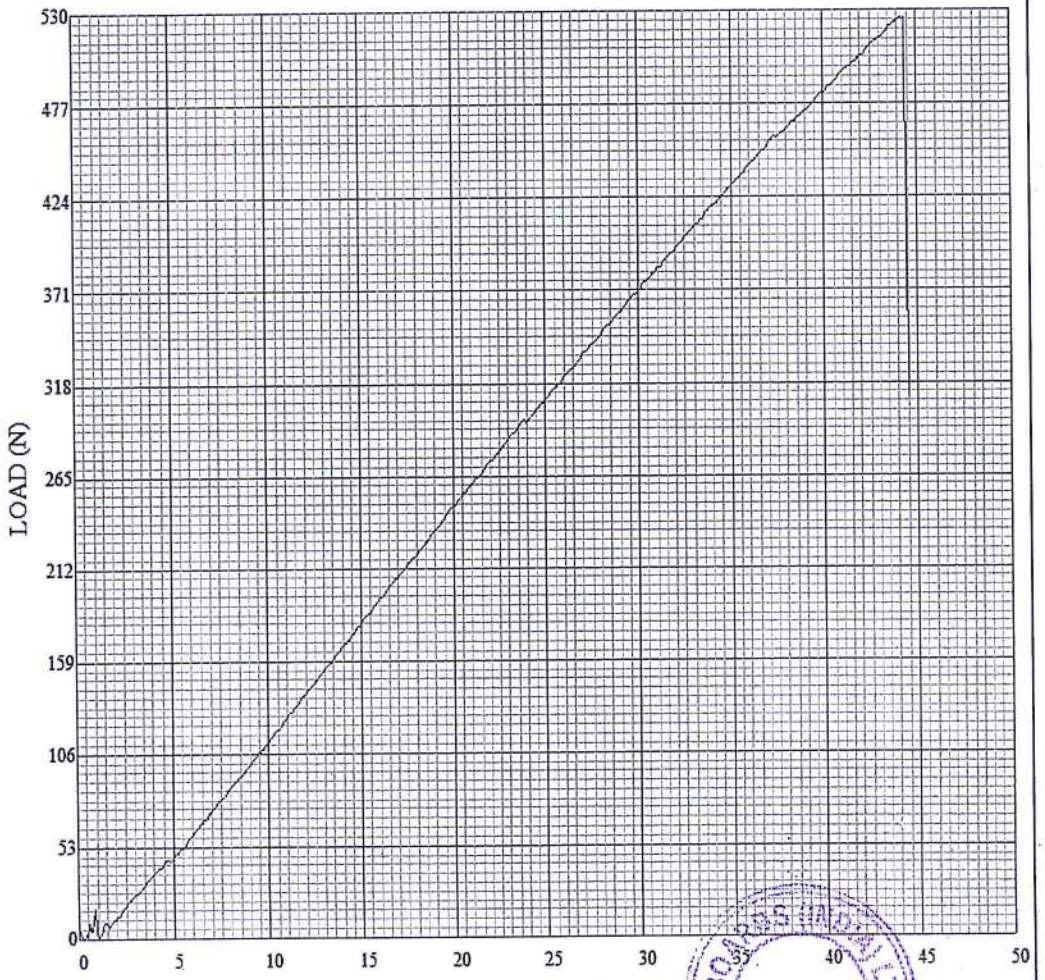
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	19MM PF PLYWOOD	2	19/O-30-1,2/ALONG/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	912						
Thickness (mm)	19						

Peak Load (N)	525.65						
Load @ Break	307.93						
Elong @ Peak	44.12						
Elong @ Break	44.56						
Avg. Peak Force (N)	525.65						
M O R (N/mm²)	3983.87	39.838					
M O E	6522.97						
% Elongation	5						

Test Time (sec)	249.2						
Test Speed (mm/min)	10.94						



Checked By : Mohit Chauhan

Verified By :

Remarks : .....

BENDING TEST REPORT

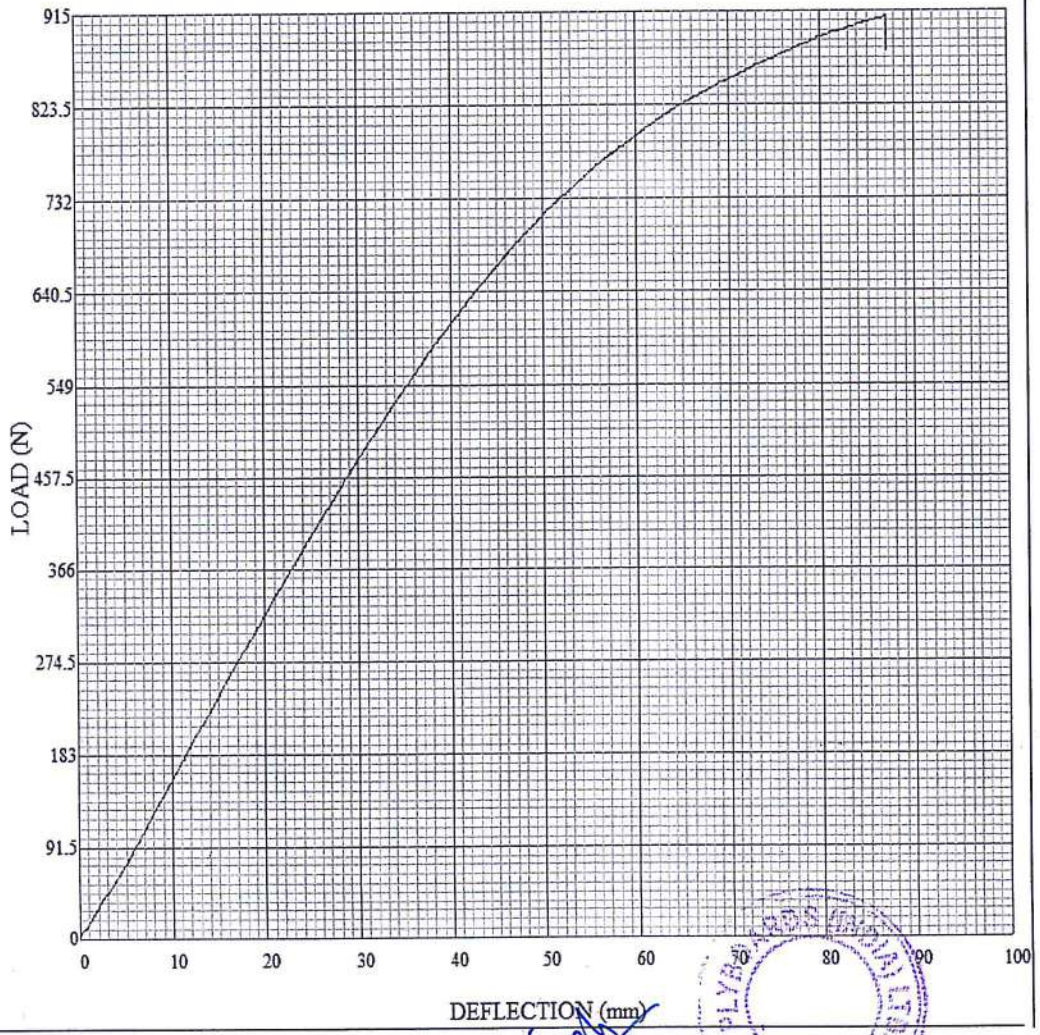
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	19MM PF PLYWOOD	3	19/O-30-1,2/ALONG/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	912						
Thickness (mm)	19						

Peak Load (N)	910.08						
Load @ Break	874.78						
Elong @ Peak	87.02						
Elong @ Break	87.2						
Avg. Peak Force (N)	910.08						
M O R (N/mm²)	6897.45	68.97					
M O E	5771.08						
% Elongation	10						

Test Time (sec)	555						
Test Speed (mm/min)	10.94						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

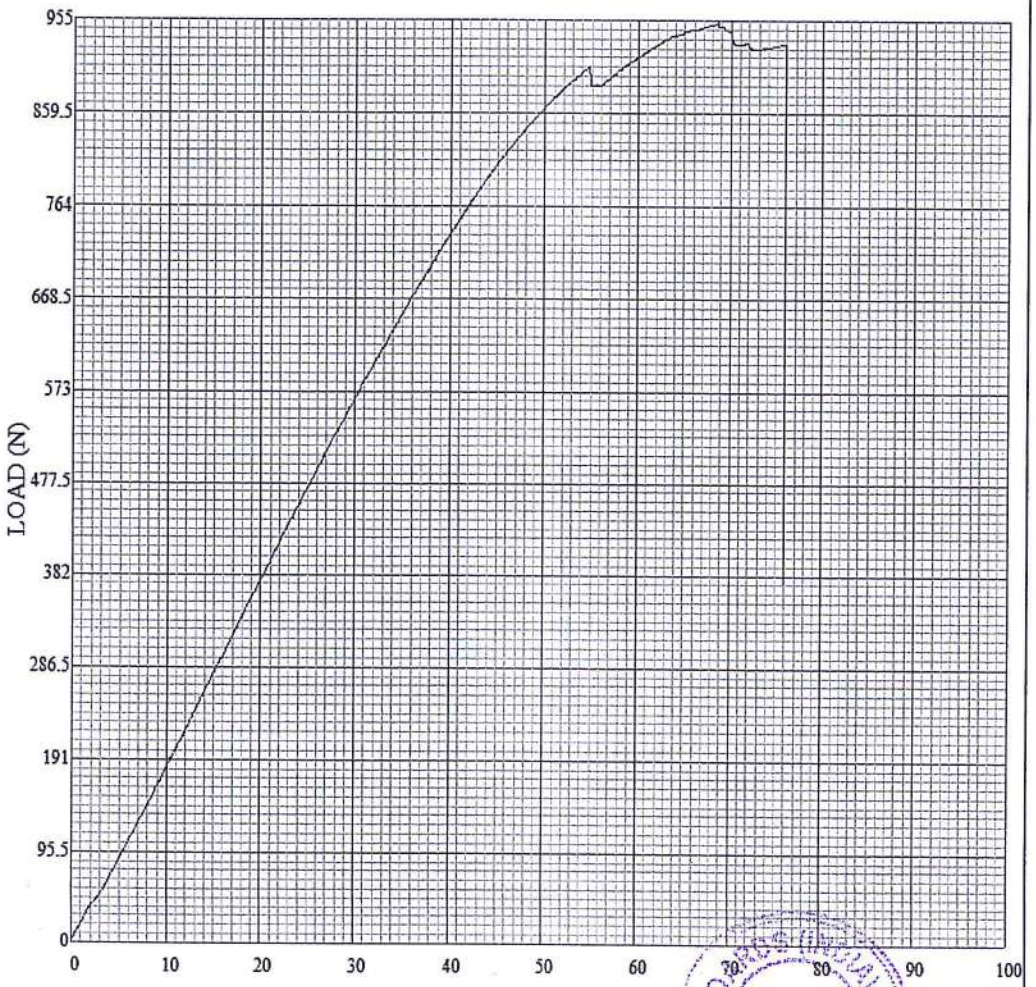
Date	Group	Batch	Operator	Specimen
07-Jan-21	19MM PF PLYWOOD	4	19/G-25-7,8/ALONG/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	912						
Thickness (mm)	19						

Peak Load (N)	953.24						
Load @ Break	373.64						
Elong @ Peak	68.53						
Elong @ Break	76.03						
Avg. Peak Force (N)	953.24						

M O R (N/mm²)	7224.56	72.24					
M O E	6932.84						
% Elongation	8						

Test Time (sec)	436.2						
Test Speed (mm/min)	10.94						



Checked By : Rohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

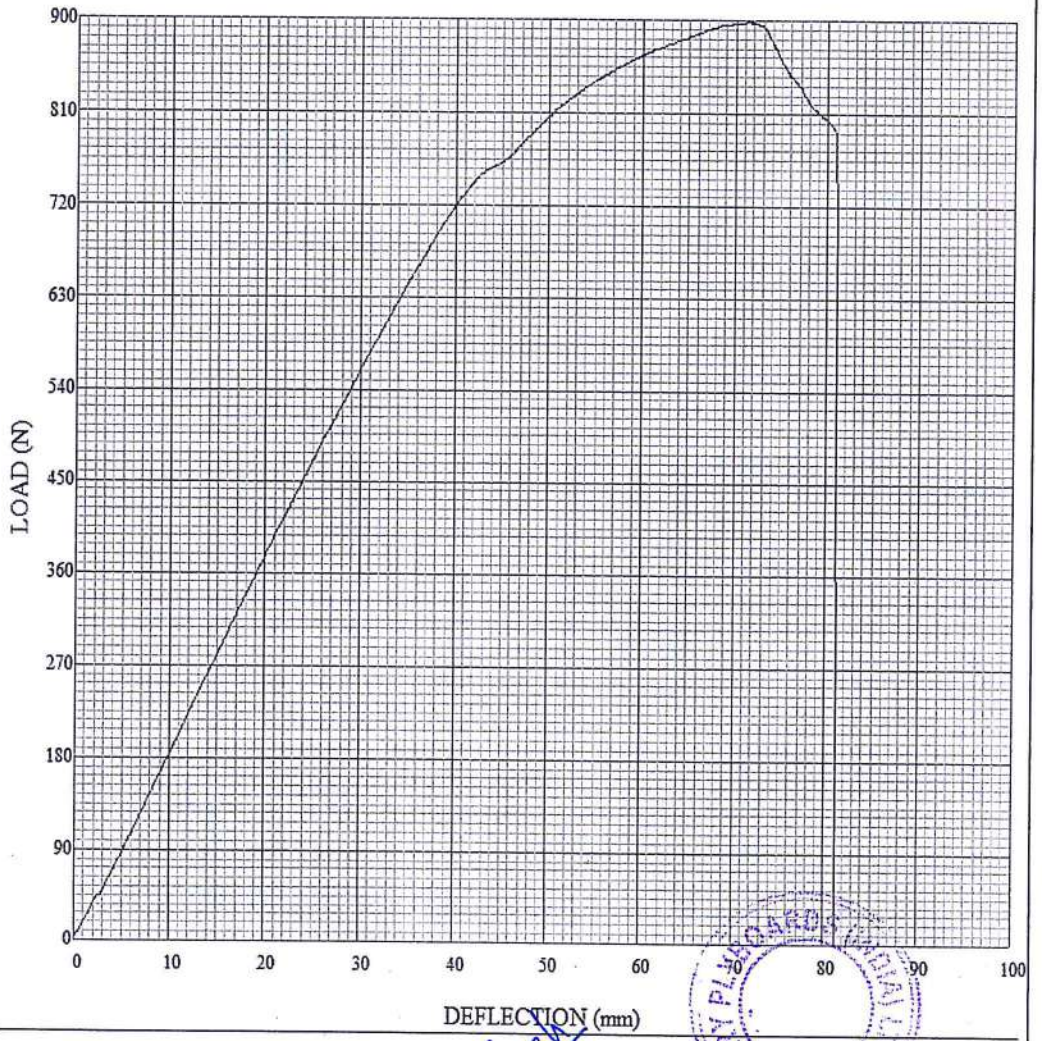
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	19MM PF PLYWOOD	5	19/G/25-7,8/-ALONG/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	912						
Thickness (mm)	19						

Peak Load (N)	898.32						
Load @ Break	0						
Elong @ Peak	70.98						
Elong @ Break	81.15						
Avg. Peak Force (N)	898.32						
M O R (N/mm²)	6808.32	68.08					
M O E	6121.2						
% Elongation	9						

Test Time (sec)	465.6						
Test Speed (mm/min)	10.94						



Checked By : Mahitchauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

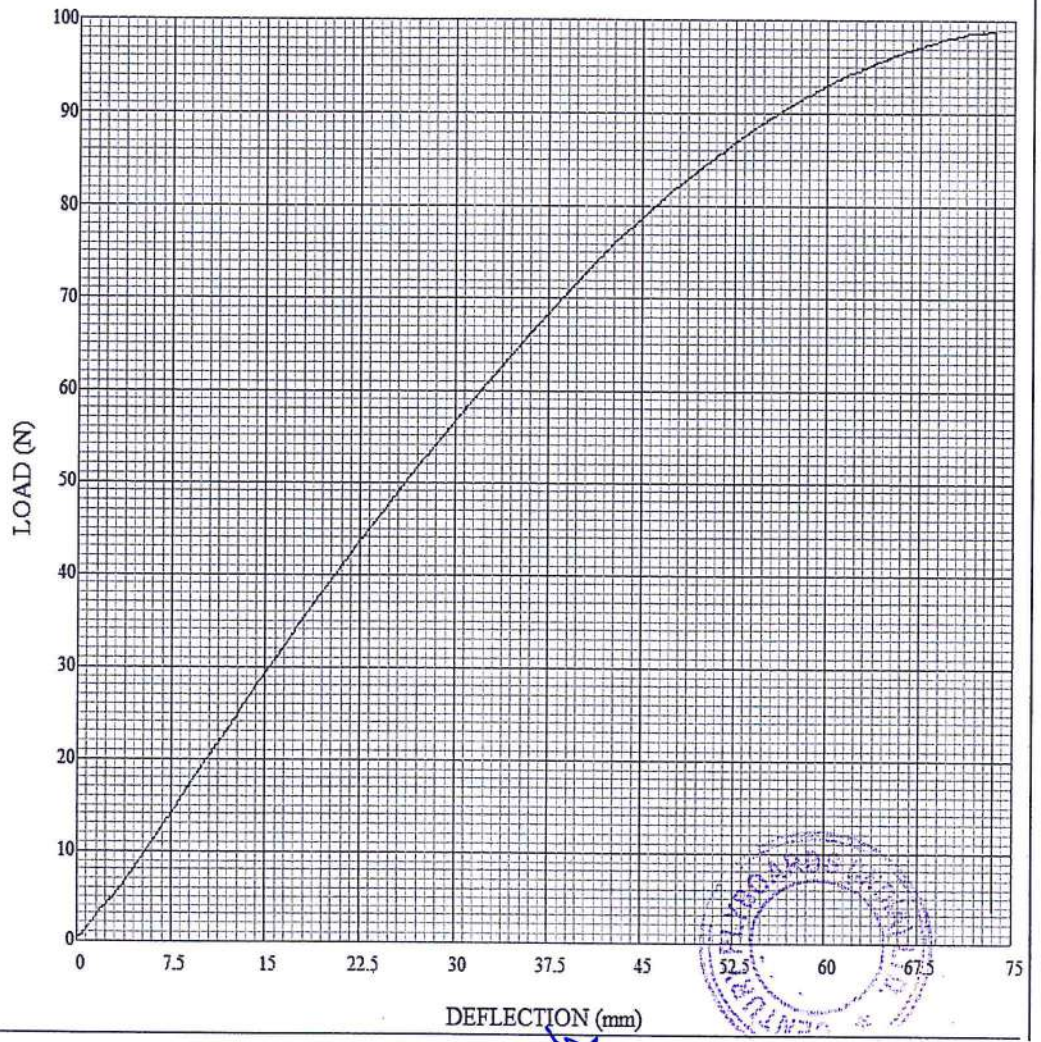
Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	5	19/G-25-7,8/ALONG/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	912						
Thickness (mm)	19						

Peak Load (N)	98.8						
Load @ Break	3.4						
Elong @ Peak	72.52						
Elong @ Break	73.54						
Avg. Peak Force (N)	98.8						

M O R (N/mm²)	7343.48						
M O E	7285.56						
% Elongation	8						

Test Time (sec)	429.3						
Test Speed (mm/min)	10.94						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

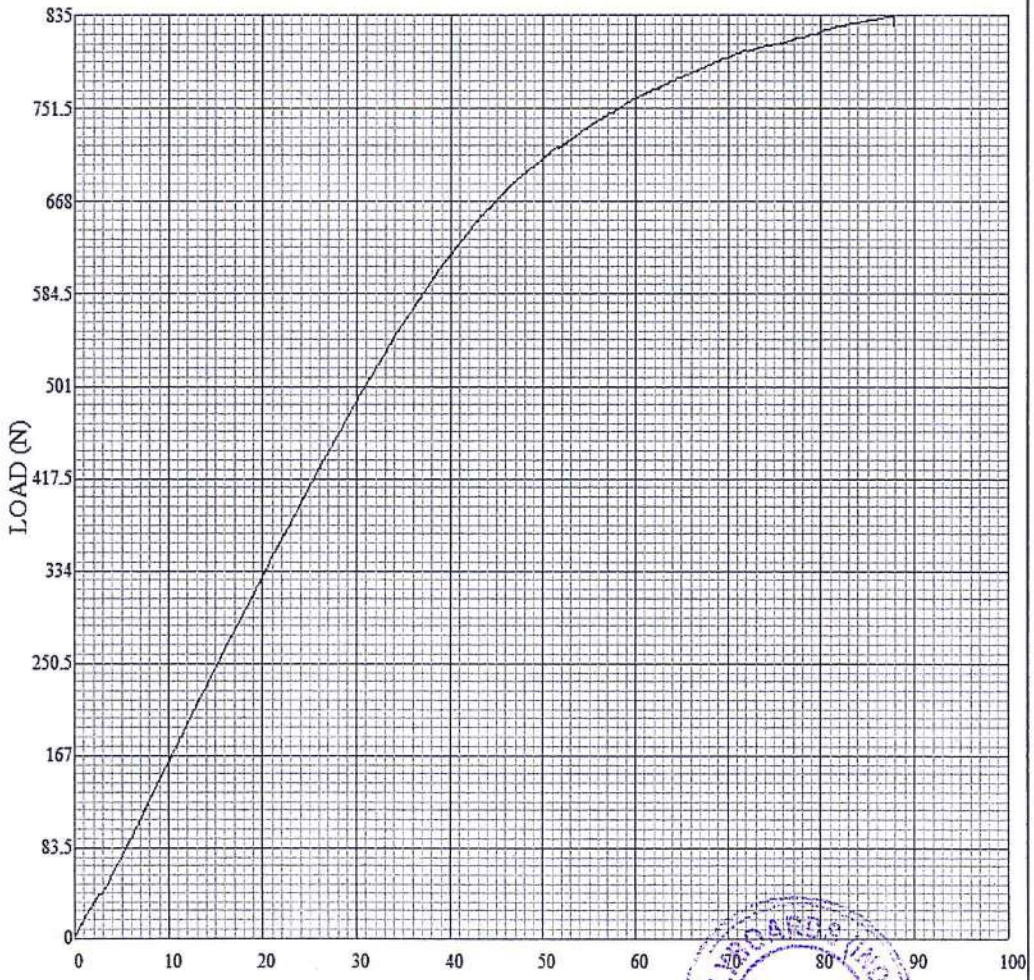
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	19MM PF PLYWOOD	6	19/G/25-7,8/-ALONG/3	PLYWOOD

Specimen No.	0					
Width (mm)	50					
Length (mm)	912					
Thickness (mm)	19					

Peak Load (N)	834.57					
Load @ Break	823.78					
Elong @ Peak	87.26					
Elong @ Break	87.84					
Avg. Peak Force (N)	834.57					
M O R (N/mm²)	6325.16	63.25				
M O E	5253.69					
% Elongation	10					

Test Time (sec)	506.2					
Test Speed (mm/min)	10.94					



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

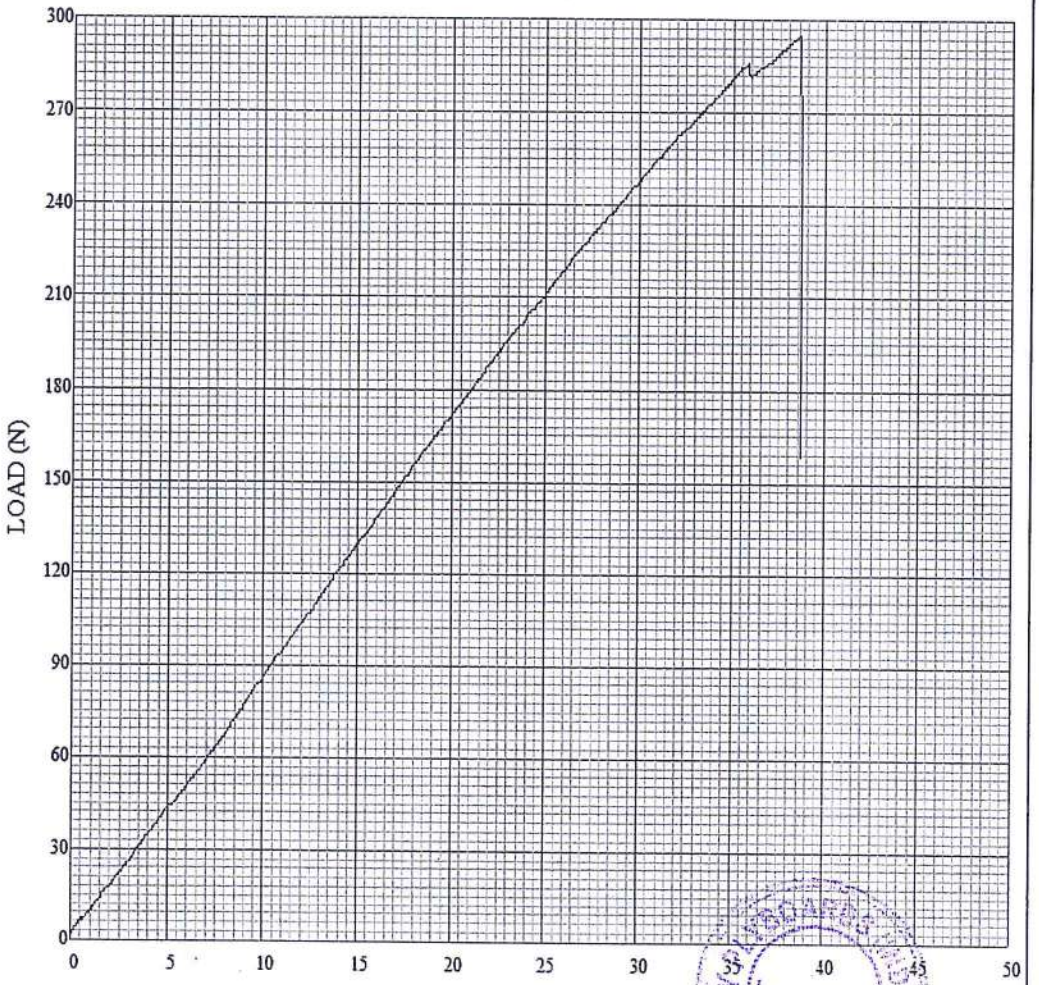
Date	Group	Batch	Operator	Specimen
07-Jan-21	12mm testing sample	7	12/O-30-9,10/ALONG/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	576						
Thickness (mm)	12						

Peak Load (N)	295.19						
Load @ Break	157.89						
Elong @ Peak	38.51						
Elong @ Break	38.73						
Avg. Peak Force (N)	295.19						

M O R (N/mm²)	3542.28	3542					
M O E	4214.52						
% Elongation	7						

Test Time (sec)	356.7						
Test Speed (mm/min)	6.91						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

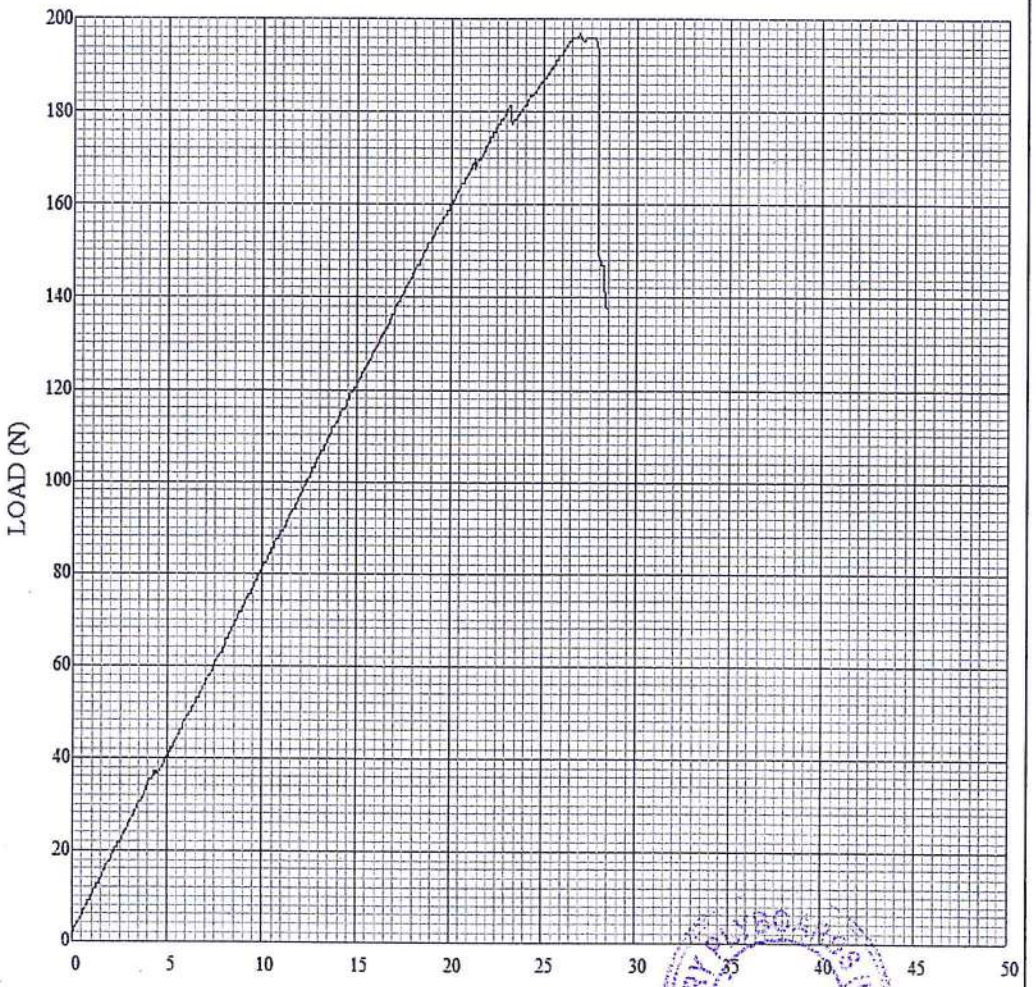
Date	Group	Batch	Operator	Specimen
07-Jan-21	12mm testing sample	8	12/O-30-9,10/ALONG/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	576						
Thickness (mm)	12						

Peak Load (N)	197.12						
Load @ Break	137.29						
Elong @ Peak	26.86						
Elong @ Break	28.4						
Avg. Peak Force (N)	197.12						

M O R (N/mm²)	2365.44	23.65					
M O E	3838.01						
% Elongation	5						

Test Time (sec)	258.2						
Test Speed (mm/min)	6.91						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

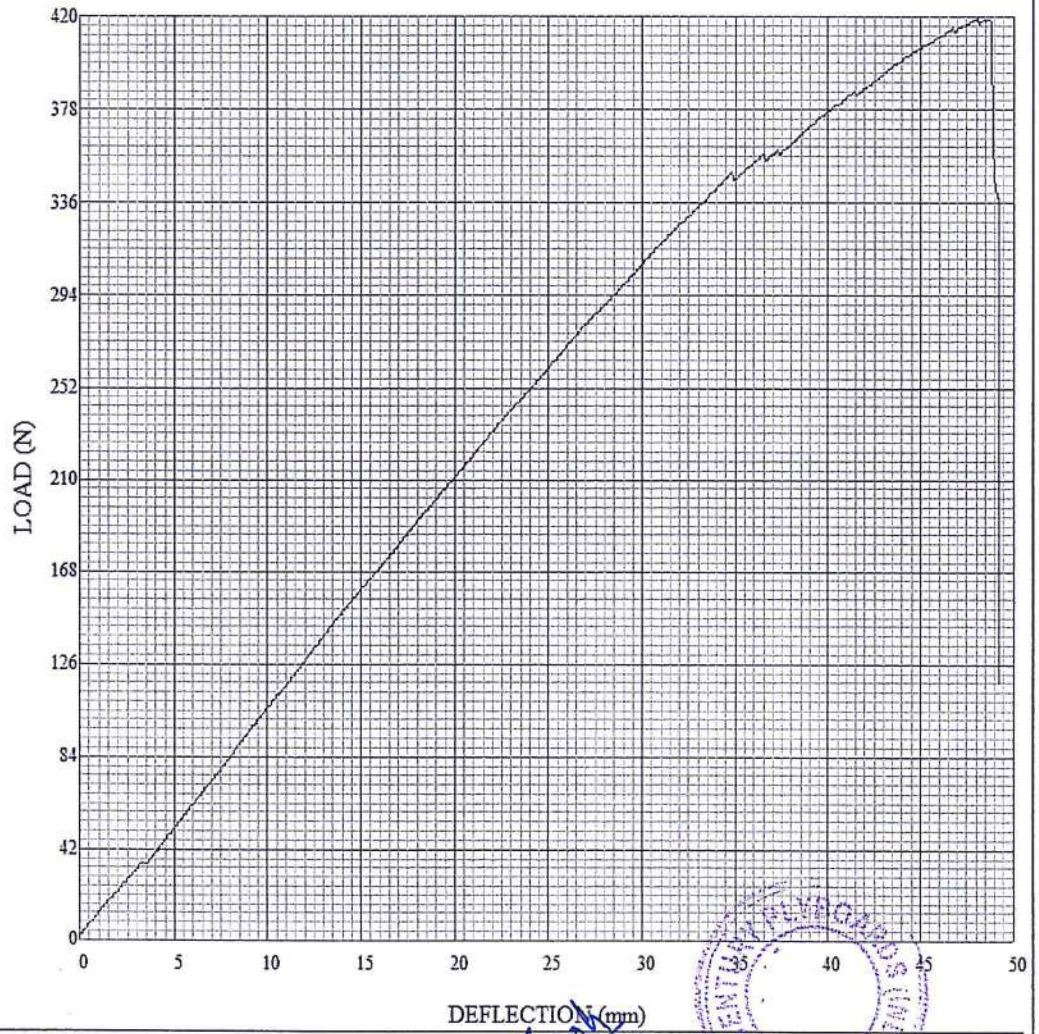
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	12mm testing sample	9	12/O-30-9,10/ALONG/3	PLYWOOD

Specimen No.	0					
Width (mm)	50					
Length (mm)	576					
Thickness (mm)	12					

Peak Load (N)	419.73					
Load @ Break	116.7					
Elong @ Peak	48.12					
Elong @ Break	49.24					
Avg. Peak Force (N)	419.73					
M O R (N/mm²)	5036.76	5036				
M O E	4713.52					
% Elongation	9					

Test Time (sec)	444					
Test Speed (mm/min)	6.91					



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

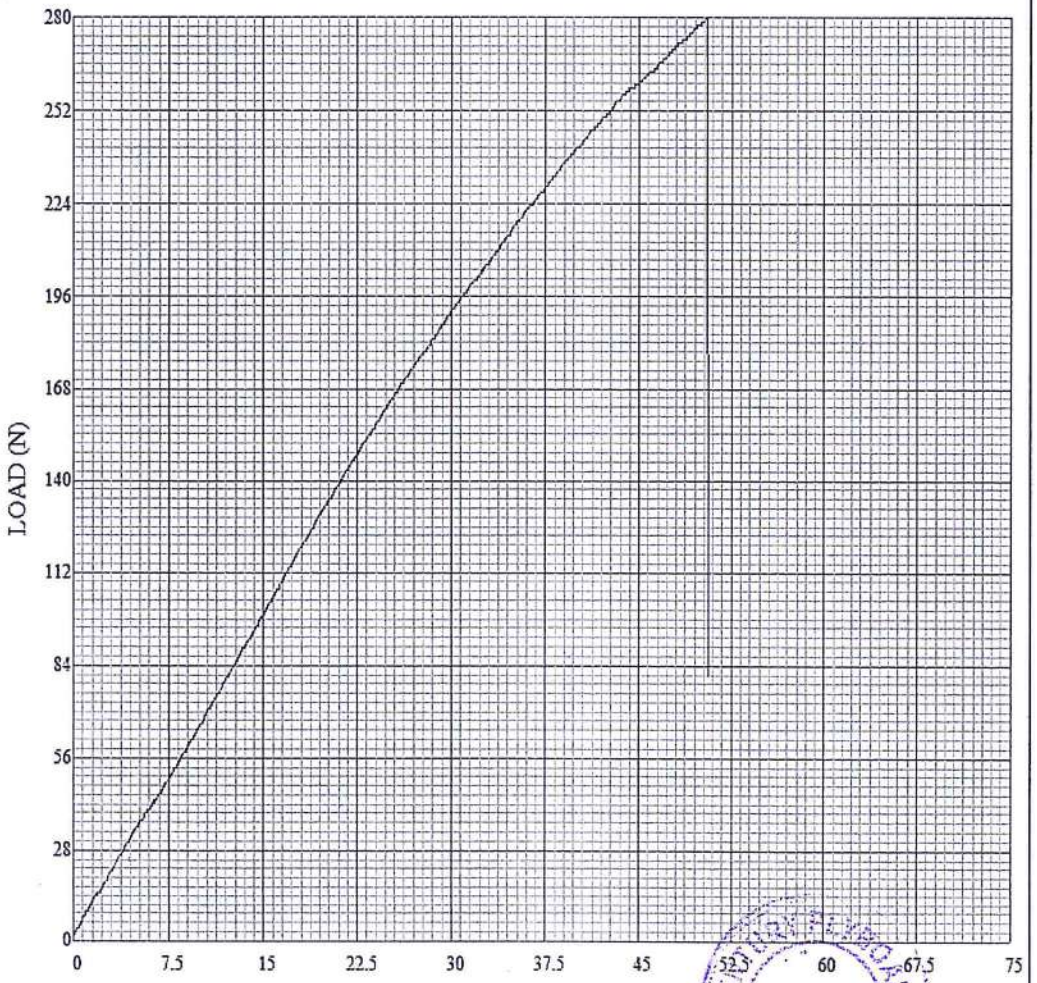
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	12mm testing sample	10	12/O-25-9,10/ALONG/1	PLYWOOD

Specimen No.	0					
Width (mm)	50					
Length (mm)	576					
Thickness (mm)	12					

Peak Load (N)	279.49					
Load @ Break	80.41					
Elong @ Peak	50.35					
Elong @ Break	50.58					
Avg. Peak Force (N)	279.49					
M O R (N/mm²)	3353.88	33.53				
M O E	3055.49					
% Elongation	9					

Test Time (sec)	461.2					
Test Speed (mm/min)	6.91					



Checked By : Mohit Chauhary

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

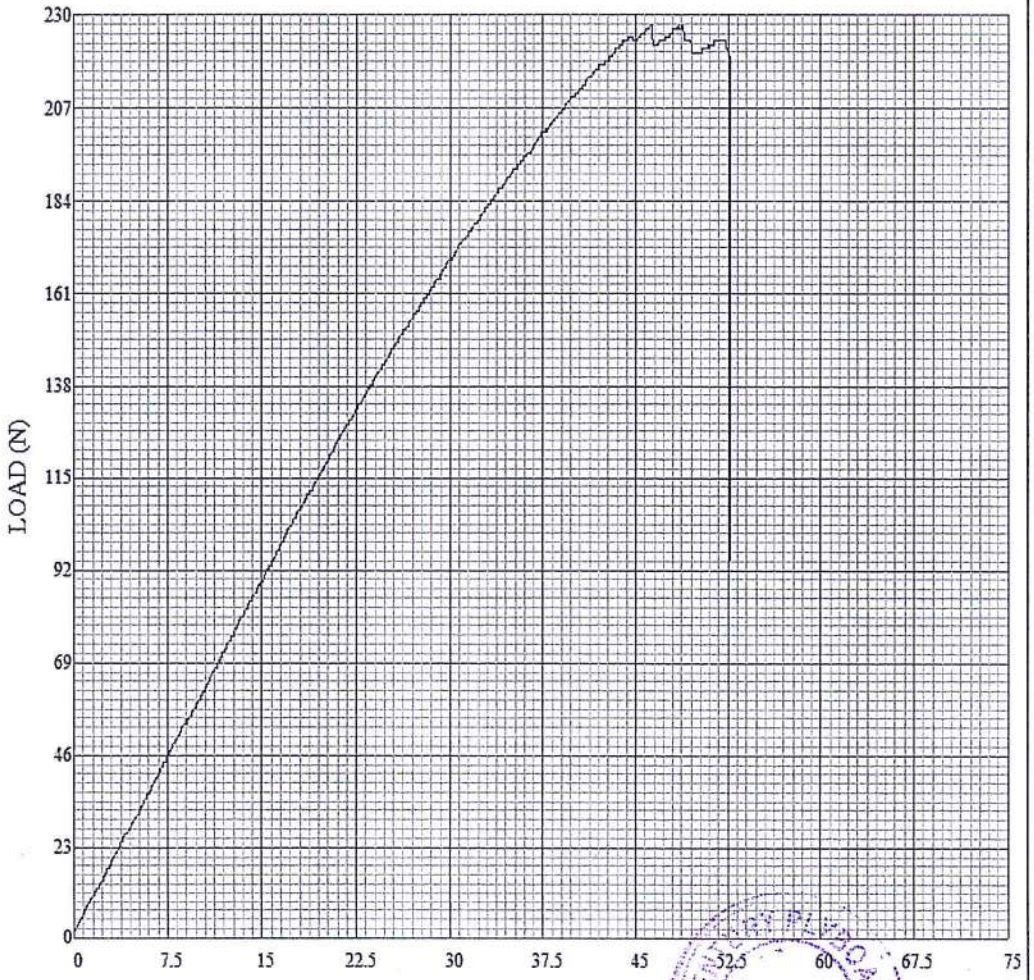
Date	Group	Batch	Operator	Specimen
07-Jan-21	12mm testing sample	11	12/O 25-9,10/ALONG/2	PLYWOOD

Specimen No.	0					
Width (mm)	50					
Length (mm)	576					
Thickness (mm)	12					

Peak Load (N)	227.52					
Load @ Break	94.14					
Elong @ Peak	46.13					
Elong @ Break	52.68					
Avg. Peak Force (N)	227.52					

M O R (N/mm²)	2730.24	27.30				
M O E	2388.18					
% Elongation	9					

Test Time (sec)	476.7					
Test Speed (mm/min)	6.91					



Checked By : Mohit Chaudhary

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

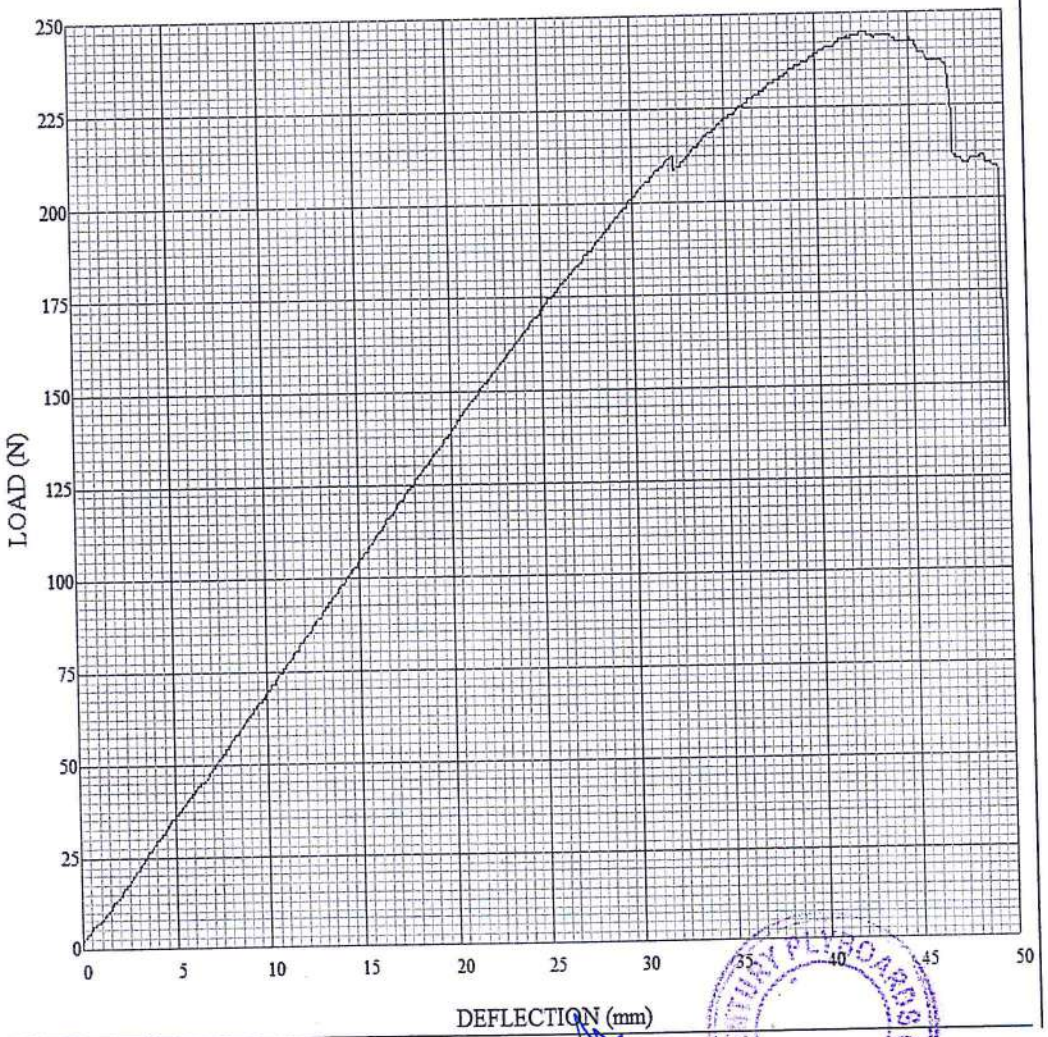
Date	Group	Batch	Operator	Specimen
07-Jan-21	12mm testing sample	12	12/O-25-9,10/ALONG/3	PLYWOOD

Specimen No.	0					
Width (mm)	50					
Length (mm)	576					
Thickness (mm)	12					

Peak Load (N)	245.17					
Load @ Break	137.29					
Elong @ Peak	42.4					
Elong @ Break	49.75					
Avg. Peak Force (N)	245.17					

M O R (N/mm²)	2942.04	29.42				
M O E	2725.01					
% Elongation	9					

Test Time (sec)	453.2					
Test Speed (mm/min)	6.91					



Checked By : Mohd Ghazali

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

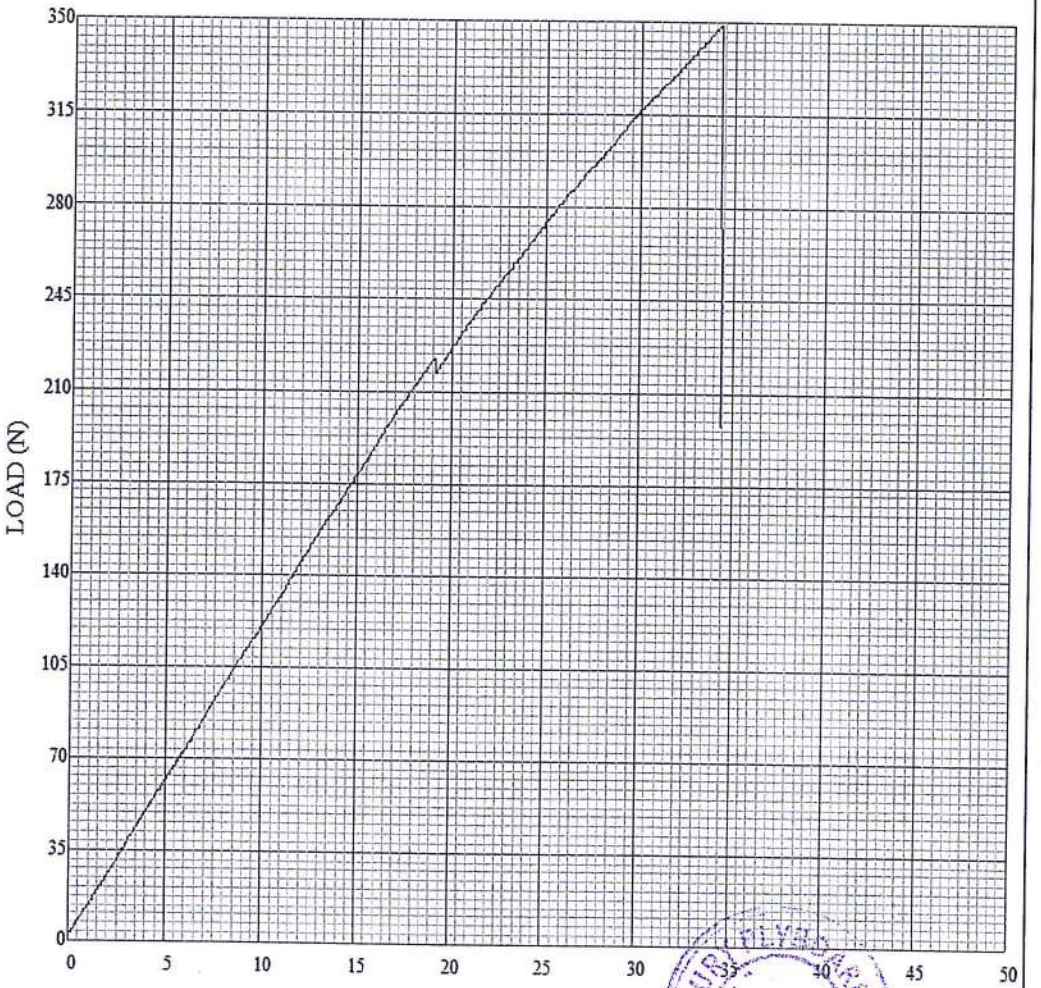
Date	Group	Batch	Operator	Specimen
07-Jan-21	12mm testing sample	13	12/G-28-9,10/ALONG/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	576						
Thickness (mm)	12						

Peak Load (N)	349.12						
Load @ Break	197.12						
Elong @ Peak	34.26						
Elong @ Break	34.37						
Avg. Peak Force (N)	349.12						

M O R (N/mm²)	4189.44	41.89					
M O E	5616.8						
% Elongation	6						

Test Time (sec)	316.2						
Test Speed (mm/min)	6.91						



Checked By : Mohd Ghouse

Remarks : .....

Verified By .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

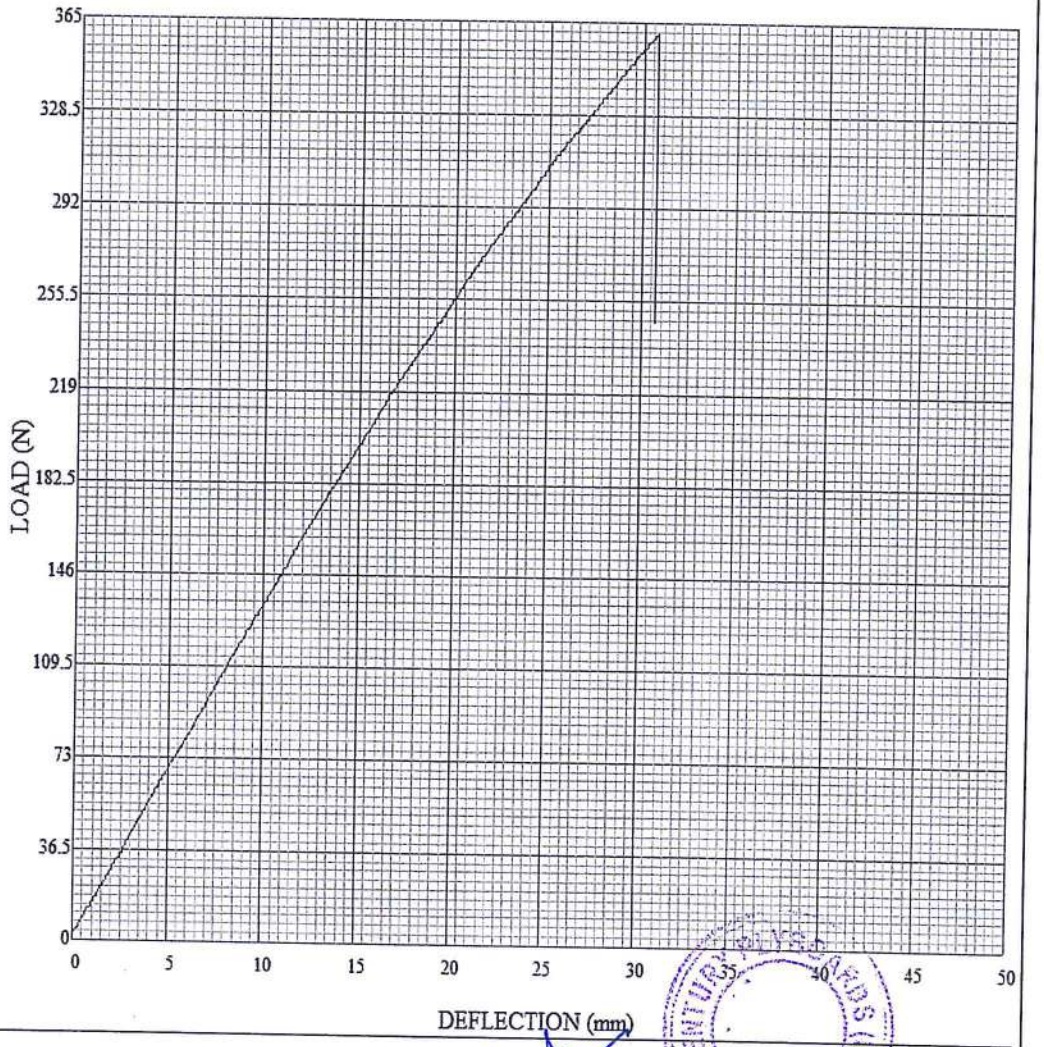
Date	Group	Batch	Operator	Specimen
07-Jan-21	12mm testing sample	14	12/G-28-9,10/ALONG/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	576						
Thickness (mm)	12						

Peak Load (N)	360.89						
Load @ Break	247.13						
Elong @ Peak	30.69						
Elong @ Break	30.75						
Avg. Peak Force (N)	360.89						

M O R (N/mm²)	4330.68	43.30					
M O E	6489.68						
% Elongation	5						

Test Time (sec)	281.1						
Test Speed (mm/min)	6.91						



Checked By : Mahitchauhan

Remarks : .....

Verified By .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

Date
07-Jan-21

Group
12mm testing sample

Batch
15

did not break

Operator
12/G-28-9,10/ALONG/3

Specimen
PLYWOOD

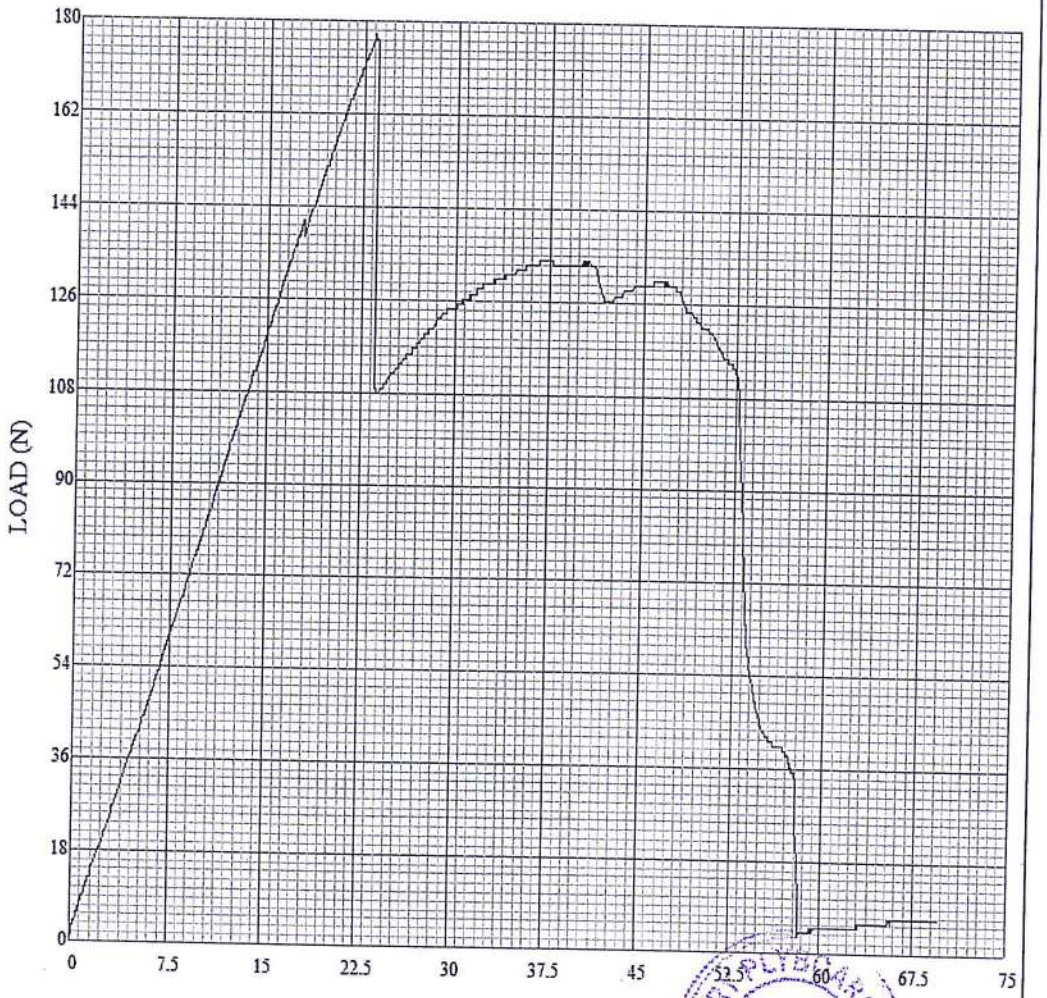
Specimen No.	0					
Width (mm)	50					
Length (mm)	576					
Thickness (mm)	12					

Peak Load (N)	177.5					
Load @ Break	6.86					
Elong @ Peak	23.37					
Elong @ Break	69.66					

Avg. Peak Force (N) 177.5

M O R (N/mm²)	2130	21.30				
M O E	1408.99					
% Elongation	12					

Test Time (sec)	630.9					
Test Speed (mm/min)	6.91					



Checked By : Mahitchaudhary

Remarks : .....

Verified By : .....

BENDING TEST REPORT

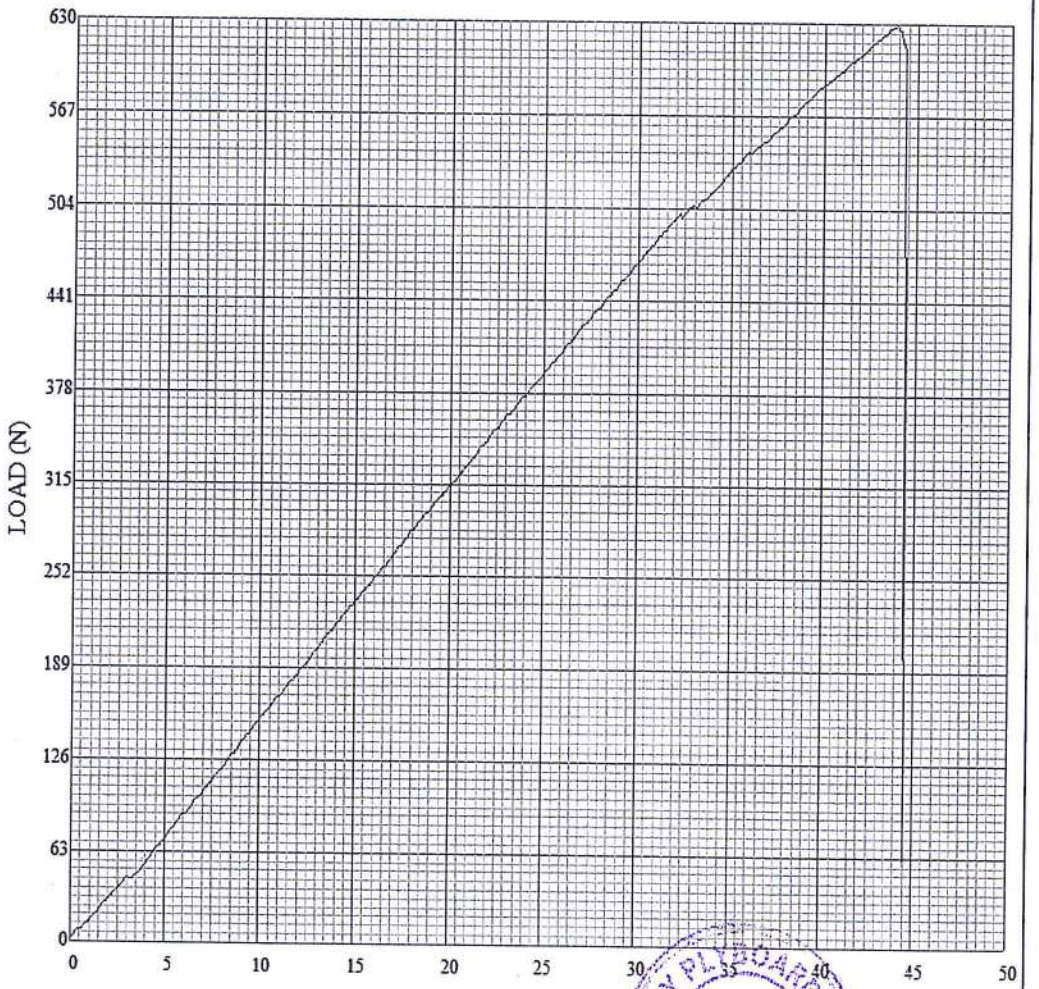
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	19mm plywood	16	19/G-28-7,8/ALONG/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	912						
Thickness (mm)	19						

Peak Load (N)	629.6						
Load @ Break	60.8						
Elong @ Peak	43.85						
Elong @ Break	44.49						
Avg. Peak Force (N)	629.6						
M O R (N/mm²)	4771.71	47.71					
M O E	7825.21						
% Elongation	5						

Test Time (sec)	261.2						
Test Speed (mm/min)	10.94						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

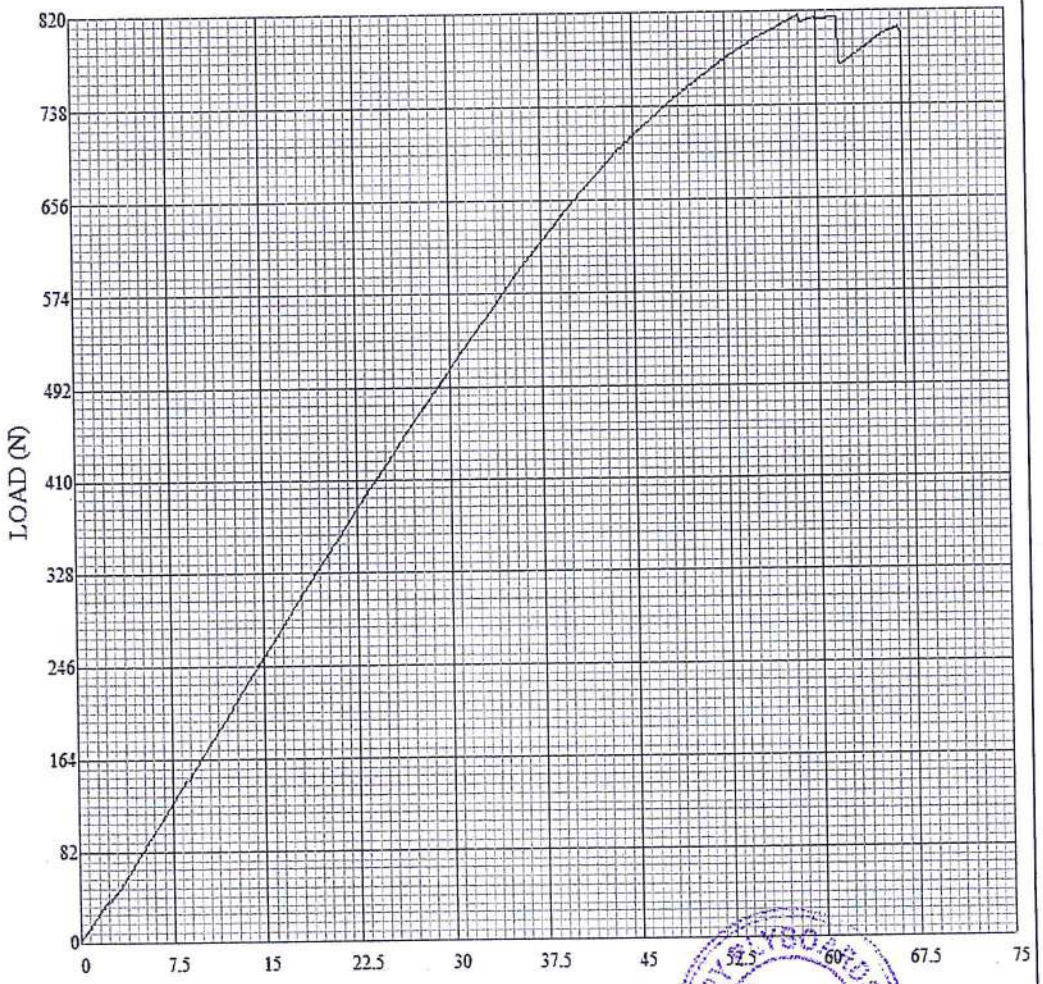
Date	Group	Batch	Operator	Specimen
07-Jan-21	19mm plywood	17	19/G-28-7,8/ALONG/2	PLYWOOD

Specimen No.	0					
Width (mm)	50					
Length (mm)	912					
Thickness (mm)	19					

Peak Load (N)	816.92					
Load @ Break	505.06					
Elong @ Peak	58.48					
Elong @ Break	66.83					
Avg. Peak Force (N)	816.92					

M O R (N/mm²)	6191.39	61.91				
M O E	6759.3					
% Elongation	7					

Test Time (sec)	386.4					
Test Speed (mm/min)	10.94					



Checked By : Mohitchauhan

Verified By : .....

Remarks : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	19mm plywood	18	19/G-28-7,8/ALONG/3	PLYWOOD

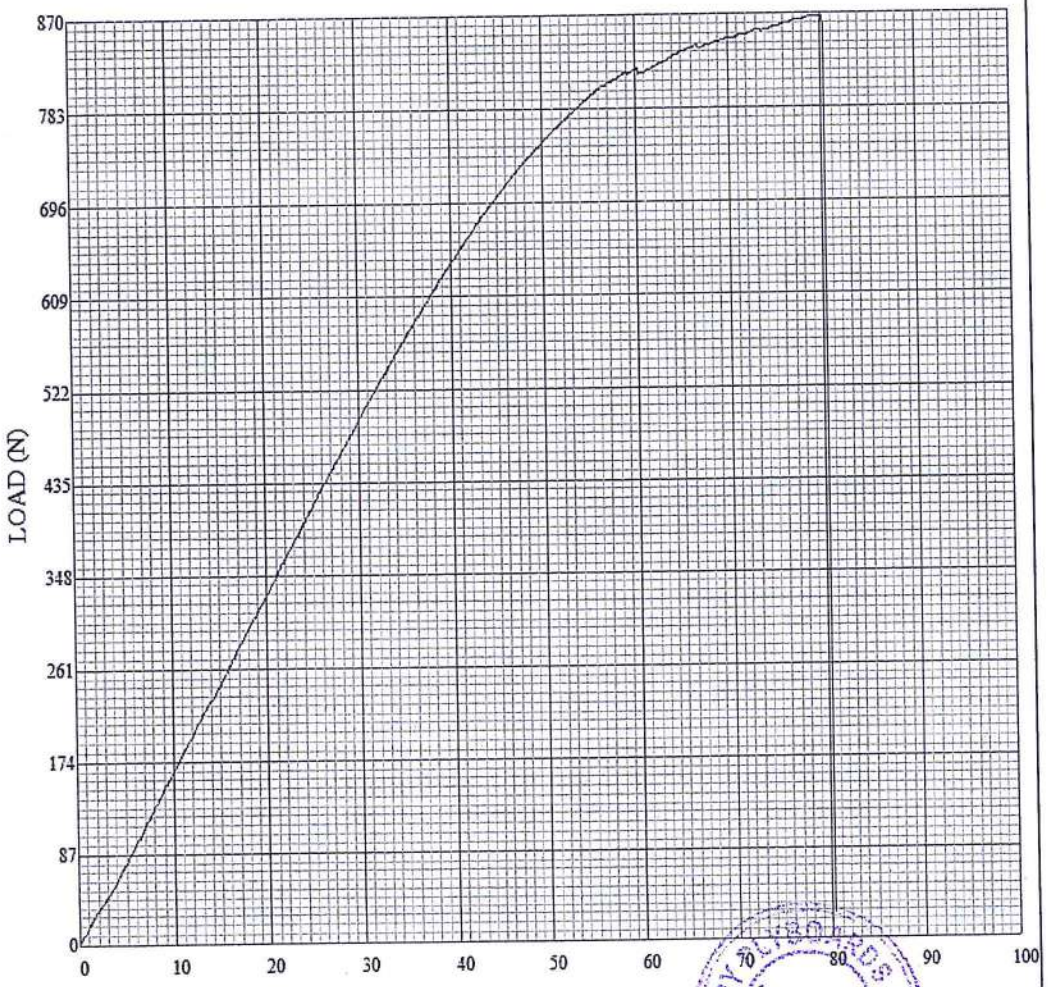
Specimen No.	0					
Width (mm)	50					
Length (mm)	912					
Thickness (mm)	19					

Peak Load (N)	867.91					
Load @ Break	21.57					
Elong @ Peak	79.16					
Elong @ Break	80.3					

Avg. Peak Force (N) 867.91

M O R (N/mm²)	6577.84	65.77				
M O E	5976.58					
% Elongation	9					

Test Time (sec)	462.4					
Test Speed (mm/min)	10.94					



Checked By : Mohit Lawleen

Verified By : .....

Remarks : .....

BENDING TEST REPORT

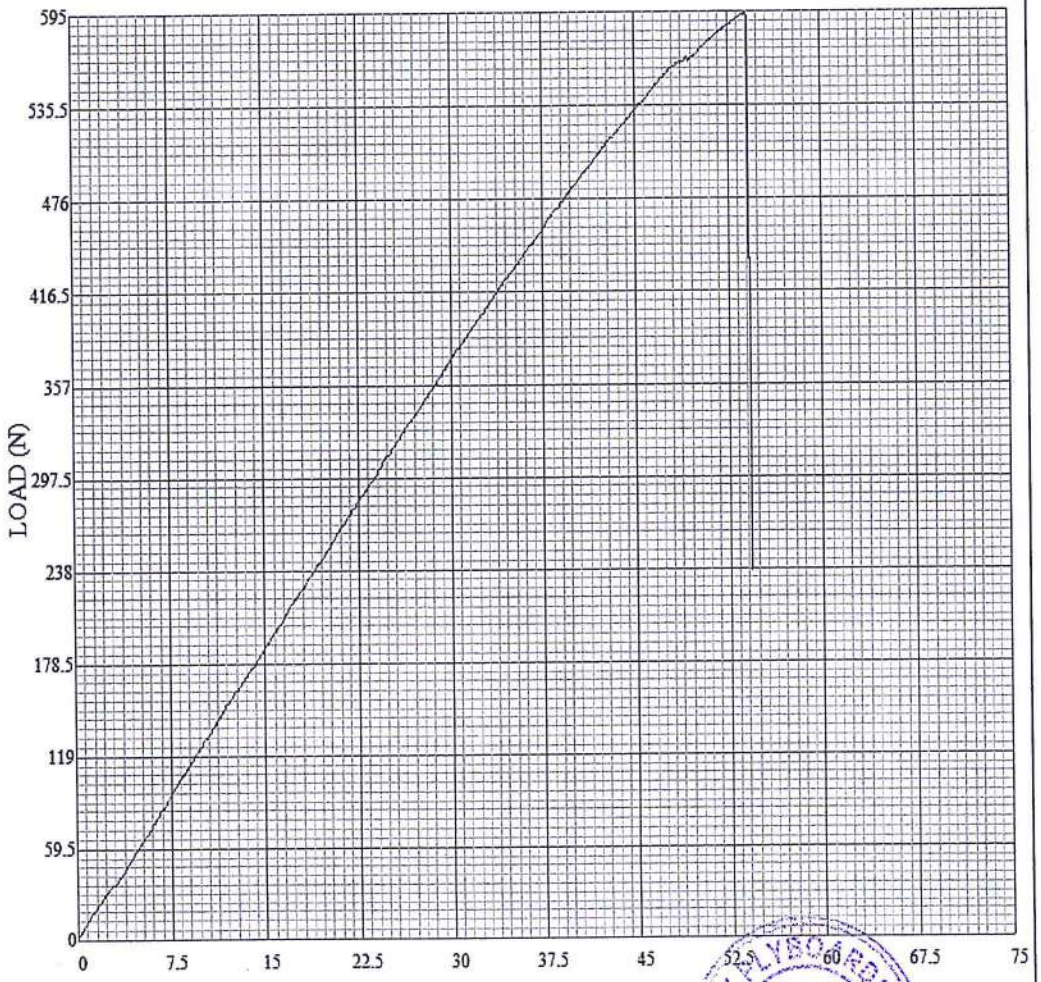
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	19mm plywood	19	19/O-25-7,8/ALONG/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	912						
Thickness (mm)	19						

Peak Load (N)	594.3						
Load @ Break	235.36						
Elong @ Peak	53.89						
Elong @ Break	54.25						
Avg. Peak Force (N)	594.3						
M O R (N/mm²)	4504.17	4504					
M O E	6057.59						
% Elongation	6						

Test Time (sec)	313.2						
Test Speed (mm/min)	10.94						



Checked By : Rohit Chauhan

Remarks : .....

Verified By : .....

CENTURY PLYBOARDS (INDIA) LTD.

BENDING TEST REPORT

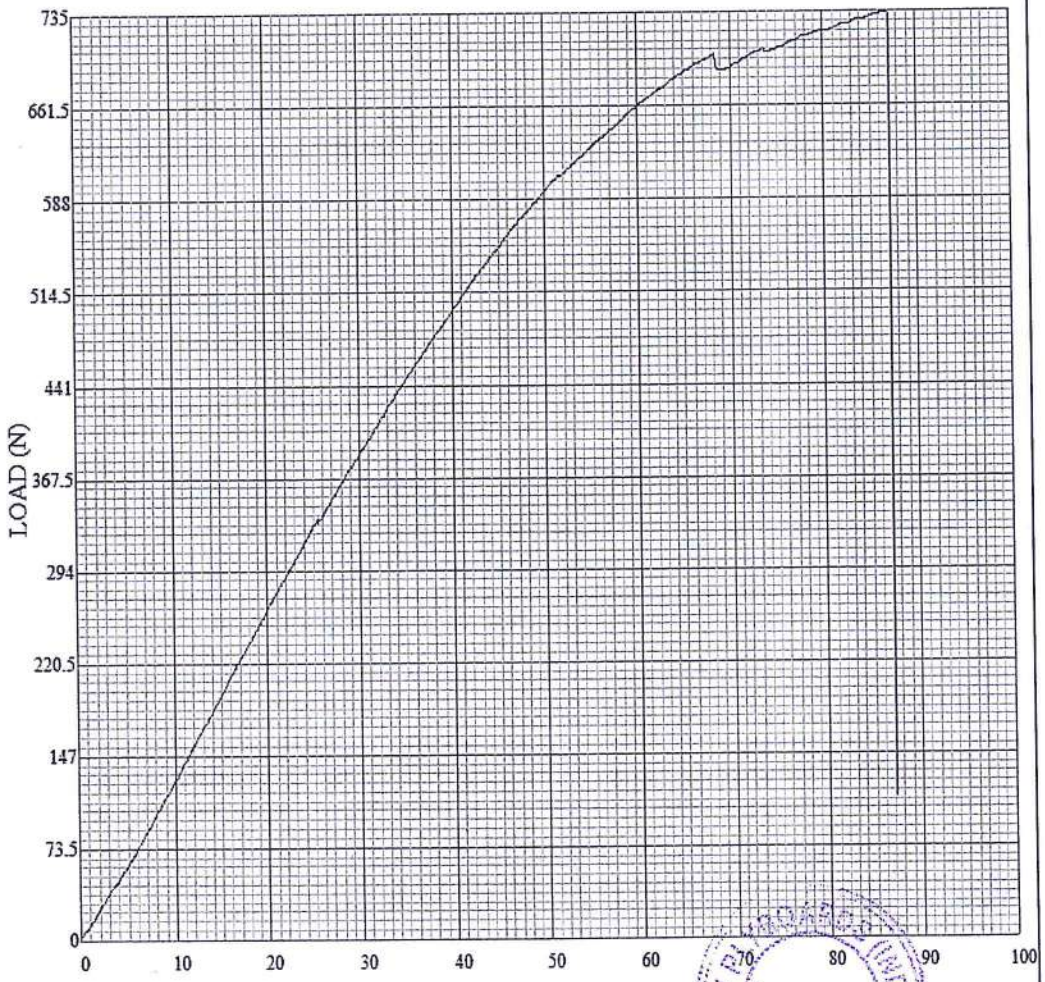
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	19mm plywood	20	19/O-25-7,8/ALONG/2	PLYWOOD

Specimen No.	0					
Width (mm)	50					
Length (mm)	912					
Thickness (mm)	19					

Peak Load (N)	733.56					
Load @ Break	110.81					
Elong @ Peak	86.24					
Elong @ Break	87.08					
Avg. Peak Force (N)	733.56					
M O R (N/mm²)	5559.61	55.59				
M O E	4658.12					
% Elongation	10					

Test Time (sec)	520					
Test Speed (mm/min)	10.94					



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

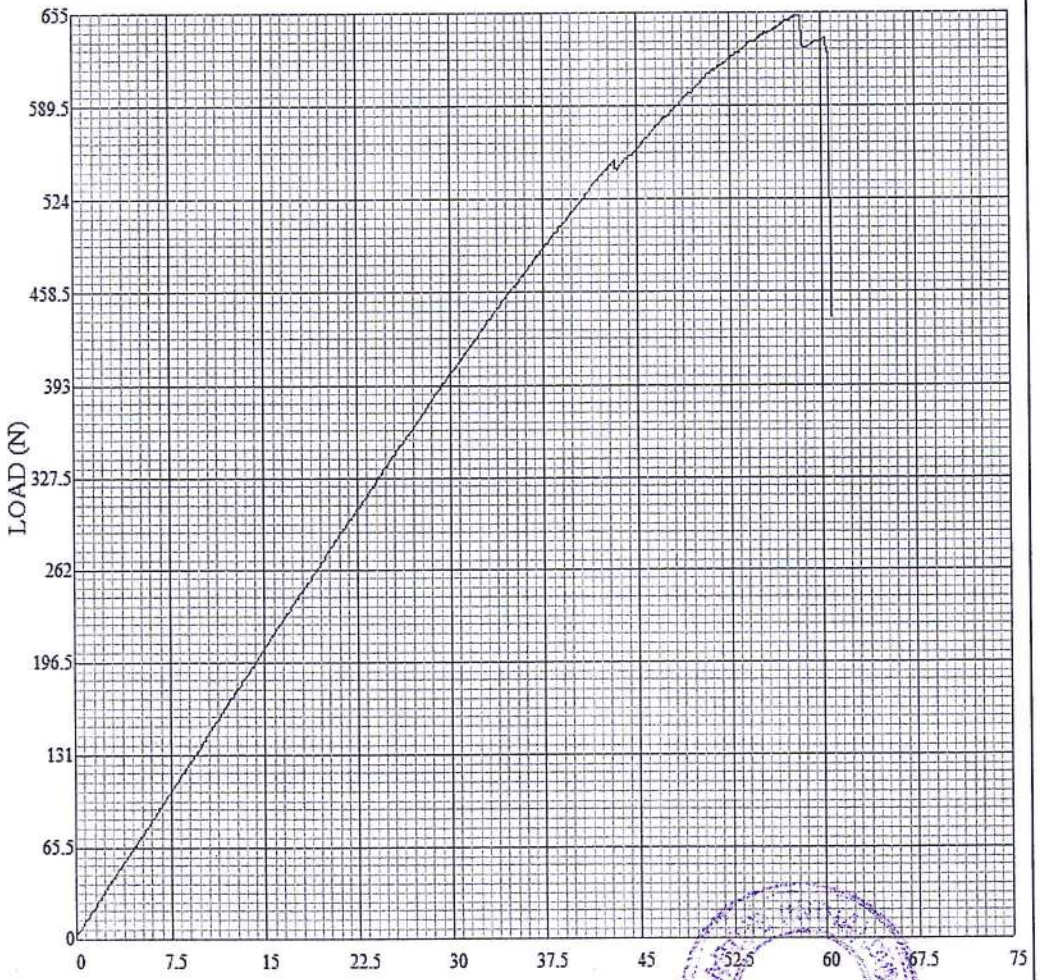
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	19mm plywood	21	19/O-25-7,8/ALONG/3	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	912						
Thickness (mm)	19						

Peak Load (N)	653.14						
Load @ Break	439.35						
Elong @ Peak	57.84						
Elong @ Break	60.69						
Avg. Peak Force (N)	653.14						
M O R (N/mm²)	4950.11	49.50					
M O E	5950.9						
% Elongation	7						

Test Time (sec)	349.4						
Test Speed (mm/min)	10.94						



Checked By : Mohit Chauhan

Verified By : .....

Remarks : .....

BENDING TEST REPORT

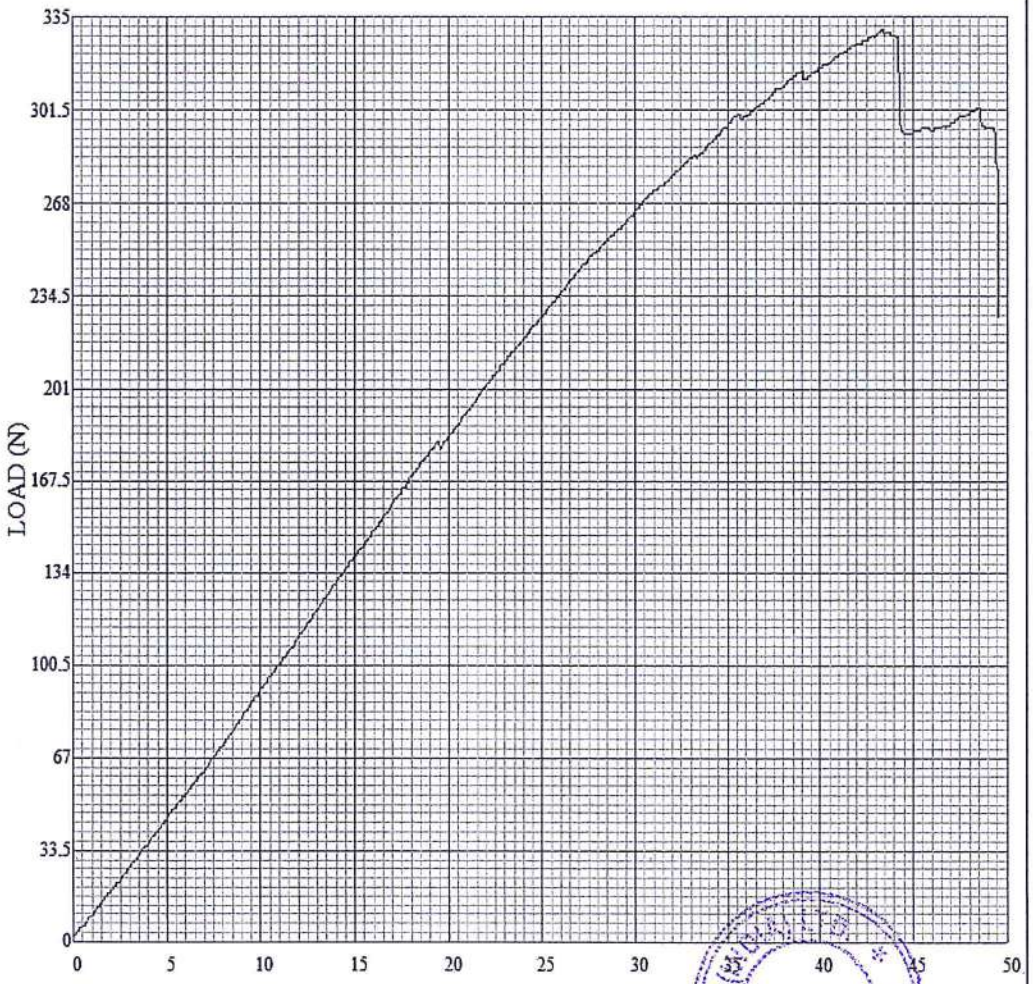
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	12mm testing sample	22	12/G-25-9/10/ALONG/1	PLYWOOD

Specimen No.	0					
Width (mm)	50					
Length (mm)	576					
Thickness (mm)	12					

Peak Load (N)	330.49					
Load @ Break	226.54					
Elong @ Peak	43.32					
Elong @ Break	49.57					
Avg. Peak Force (N)	330.49					
M O R (N/mm²)	3965.88	39.65				
M O E	3686.66					
% Elongation	9					

Test Time (sec)	508.5					
Test Speed (mm/min)	6.91					



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

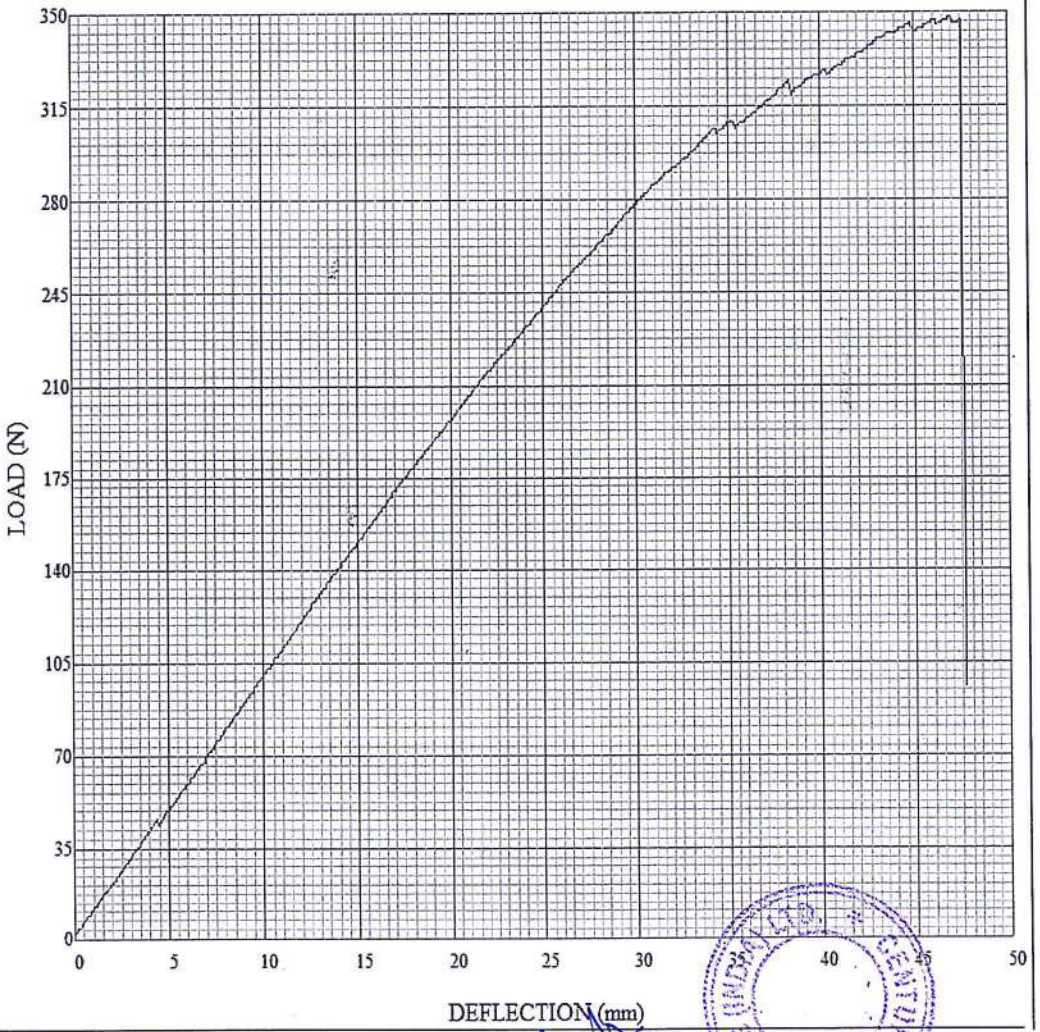
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	12mm testing sample	23	12/G-25-9/10/ALONG/2	PLYWOOD

Specimen No.	0					
Width (mm)	50					
Length (mm)	576					
Thickness (mm)	12					

Peak Load (N)	348.14					
Load @ Break	95.12					
Elong @ Peak	46.84					
Elong @ Break	47.63					
Avg. Peak Force (N)	348.14					
M O R (N/mm²)	4177.68	41.77				
M O E	4041.73					
% Elongation	8					

Test Time (sec)	434.6					
Test Speed (mm/min)	6.91					



Checked By : Mohitchauhan

Verified By : .....

Remarks : .....

BENDING TEST REPORT

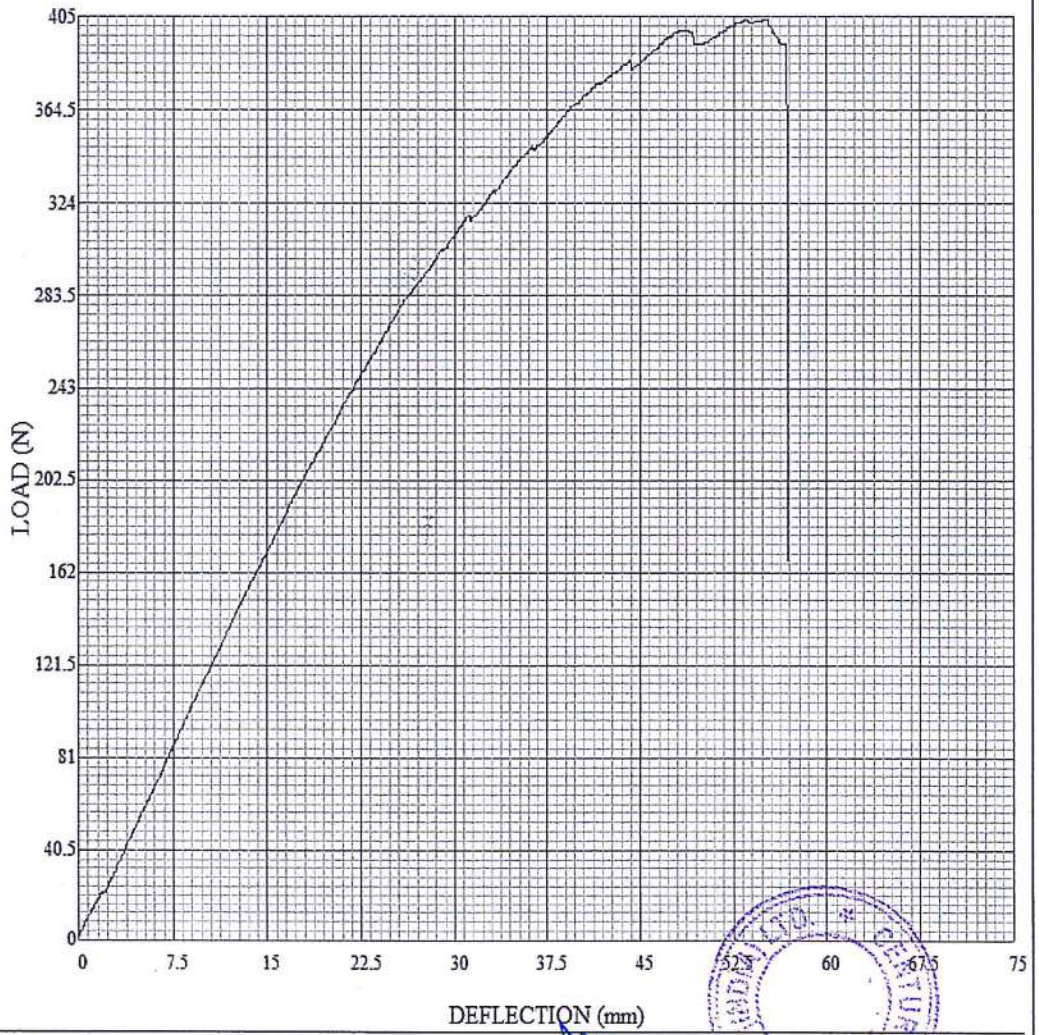
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	12mm testing sample	24	12/G-25-9/10/ALONG/3	PLYWOOD

Specimen No.	0					
Width (mm)	50					
Length (mm)	576					
Thickness (mm)	12					

Peak Load (N)	404.04					
Load @ Break	166.71					
Elong @ Peak	53.4					
Elong @ Break	56.86					
Avg. Peak Force (N)	404.04					
M O R (N/mm²)	4848.48	48.48				
M O E	3929.26					
% Elongation	10					

Test Time (sec)	516.4					
Test Speed (mm/min)	6.91					



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

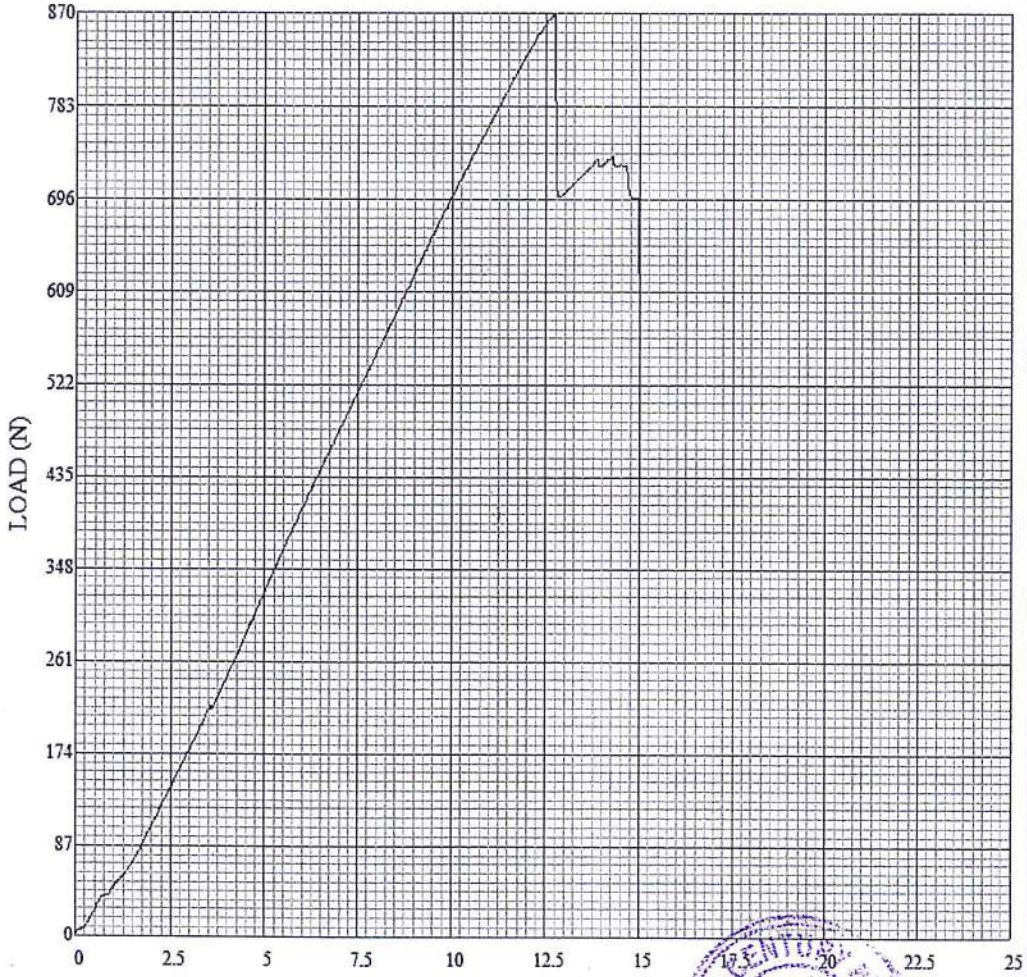
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	19mm plywood	25	19/O-30-1,2/ACROSS/1	PLYWOOD

Specimen No.	0					
Width (mm)	50					
Length (mm)	456					
Thickness (mm)	19					

Peak Load (N)	869.88					
Load @ Break	555.07					
Elong @ Peak	12.71					
Elong @ Break	14.99					
Avg. Peak Force (N)	869.88					
M O R (N/mm²)	3296.39	32.96				
M O E	4011.08					
% Elongation	3					

Test Time (sec)	426.8					
Test Speed (mm/min)	2.73					



Checked By : Mohit Chaudhary

Remarks : .....

Verified By : .....

BENDING TEST REPORT

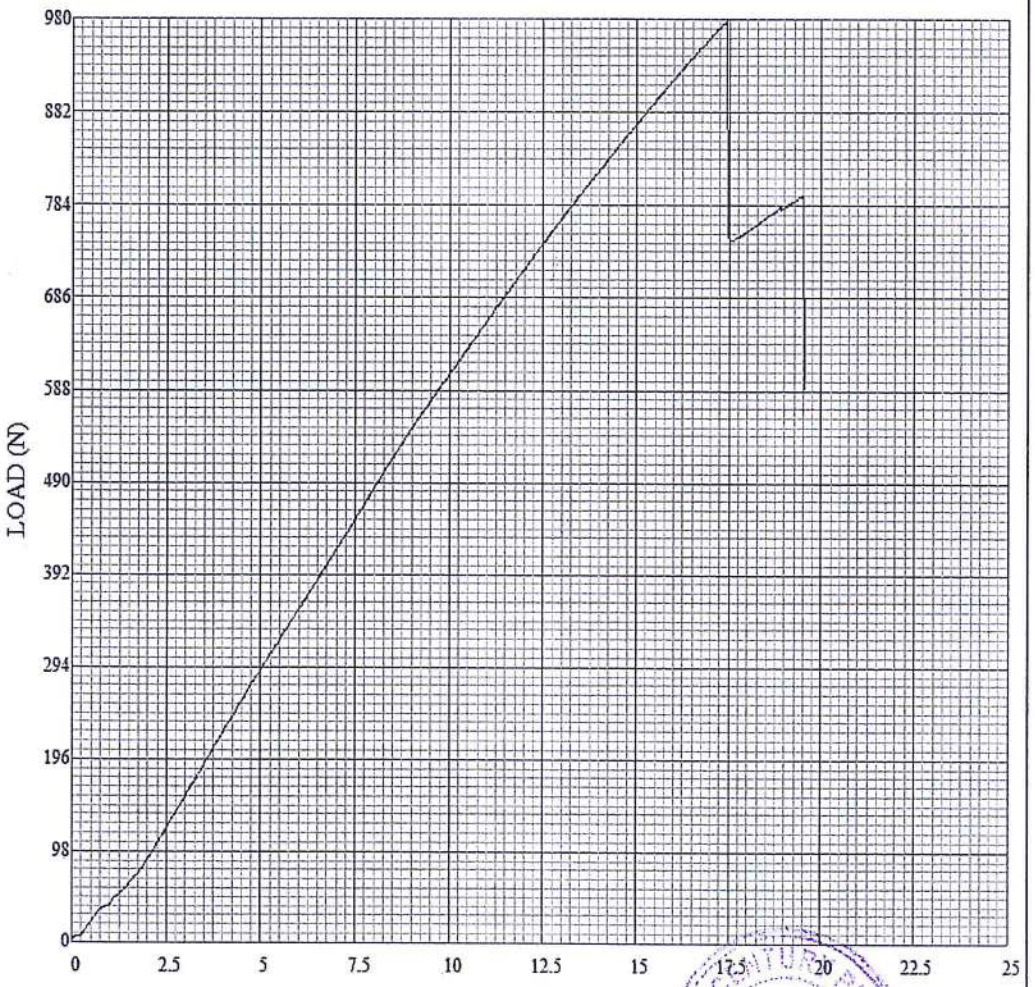
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	19mm plywood	26	19/O-30-1,2/ACROSS/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	456						
Thickness (mm)	19						

Peak Load (N)	978.73						
Load @ Break	588.42						
Elong @ Peak	17.44						
Elong @ Break	19.53						
Avg. Peak Force (N)	978.73						
M O R (N/mm²)	3708.87	37.08					
M O E	3463.89						
% Elongation	4						

Test Time (sec)	485.1						
Test Speed (mm/min)	2.73						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

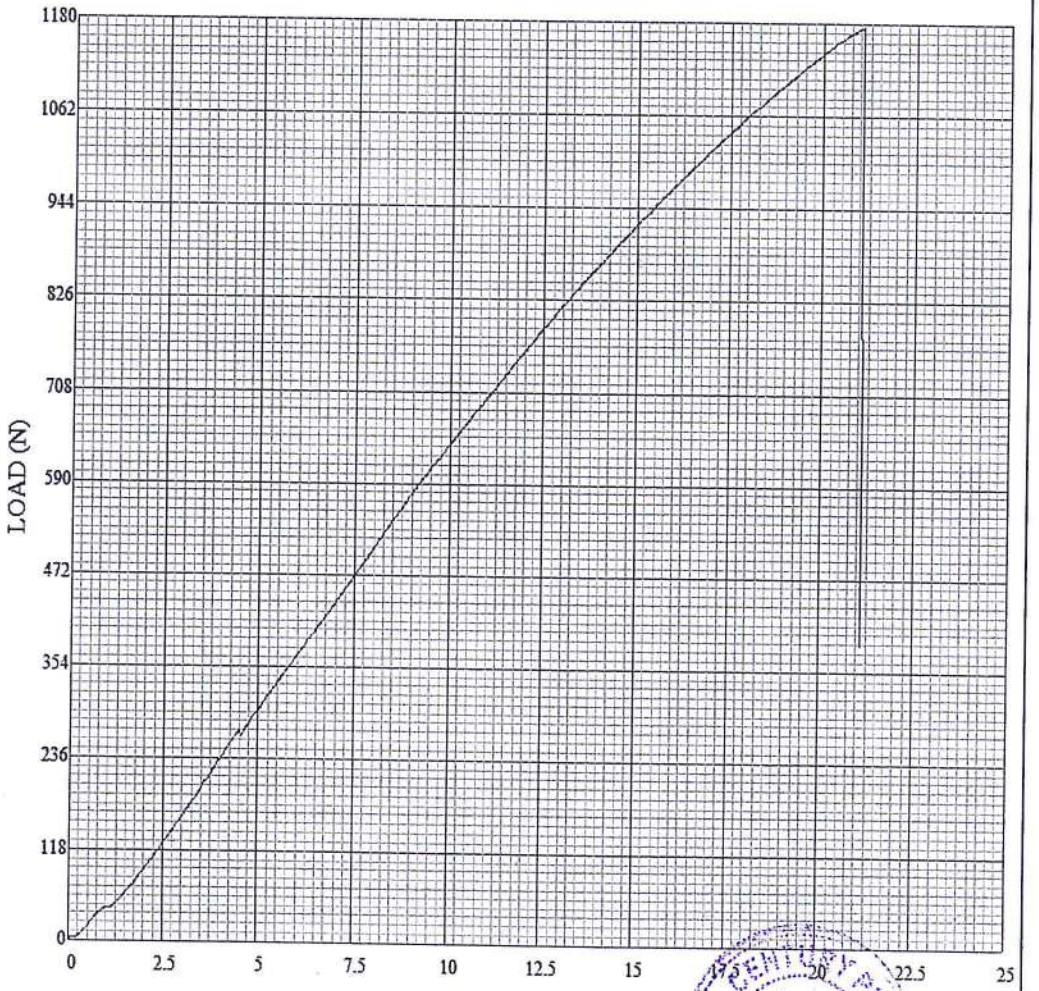
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	19mm plywood	27	19/O-30-1,2/ACROSS/3	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	456						
Thickness (mm)	19						

Peak Load (N)	1175.85						
Load @ Break	386.39						
Elong @ Peak	21.06						
Elong @ Break	21.1						
Avg. Peak Force (N)	1175.85						
M O R (N/mm²)	4455.85						
M O E	3851.88						
% Elongation	5						

Test Time (sec)	482.7						
Test Speed (mm/min)	2.73						



Checked By : Mahatchauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

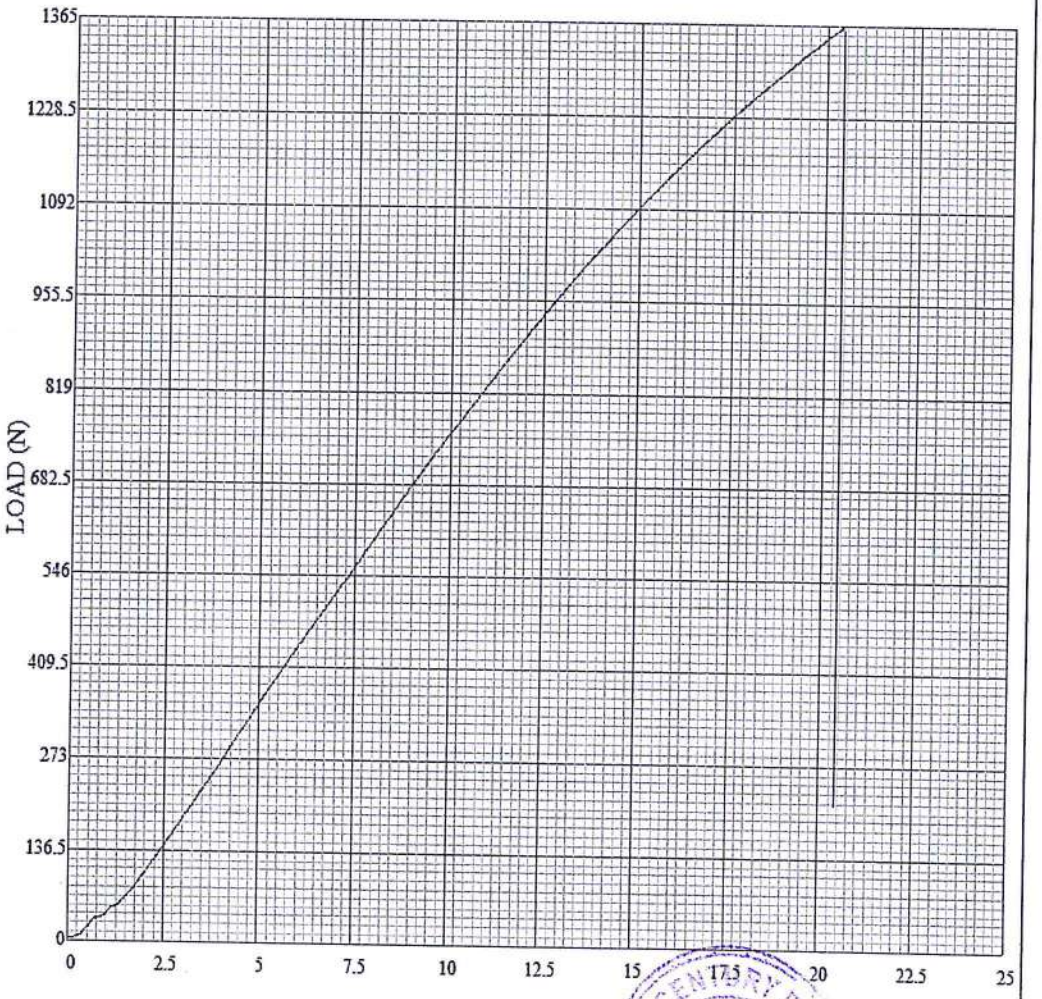
Date	Group	Batch	Operator	Specimen
07-Jan-21	19mm plywood	28	19/G/25-7,8/-ACROSS/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	456						
Thickness (mm)	19						

Peak Load (N)	1364.15						
Load @ Break	213.79						
Elong @ Peak	20.4						
Elong @ Break	20.44						
Avg. Peak Force (N)	1364.15						

M O R (N/mm²)	5169.41	51.69					
M O E	4613.02						
% Elongation	4						

Test Time (sec)	470.7						
Test Speed (mm/min)	2.73						



Checked By : M.A.H.Lashkari

Remarks : .....

Verified By : .....

BENDING TEST REPORT

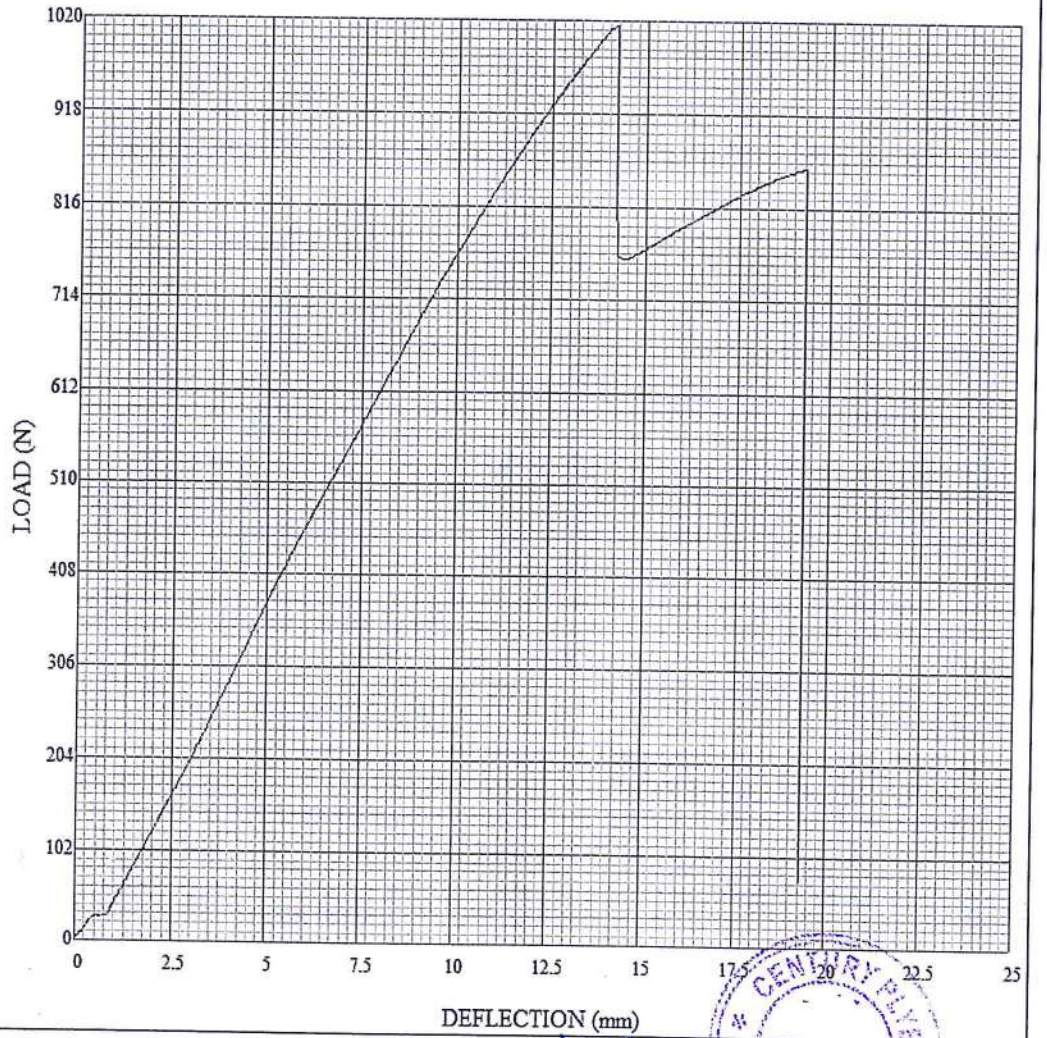
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	19mm plywood	29	19/G/25-7,8/-ACROSS/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	456						
Thickness (mm)	19						

Peak Load (N)	1016						
Load @ Break	73.55						
Elong @ Peak	14.18						
Elong @ Break	19.31						
Avg. Peak Force (N)	1016						
M O R (N/mm²)	3850.11	38.50					
M O E	3636.76						
% Elongation	4						

Test Time (sec)	444.6						
Test Speed (mm/min)	2.73						



Checked By : Mohit Lavkush

Remarks : .....

Verified By : .....

CENTURY PLYBOARDS (I) LTD. KOMI SOSA

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

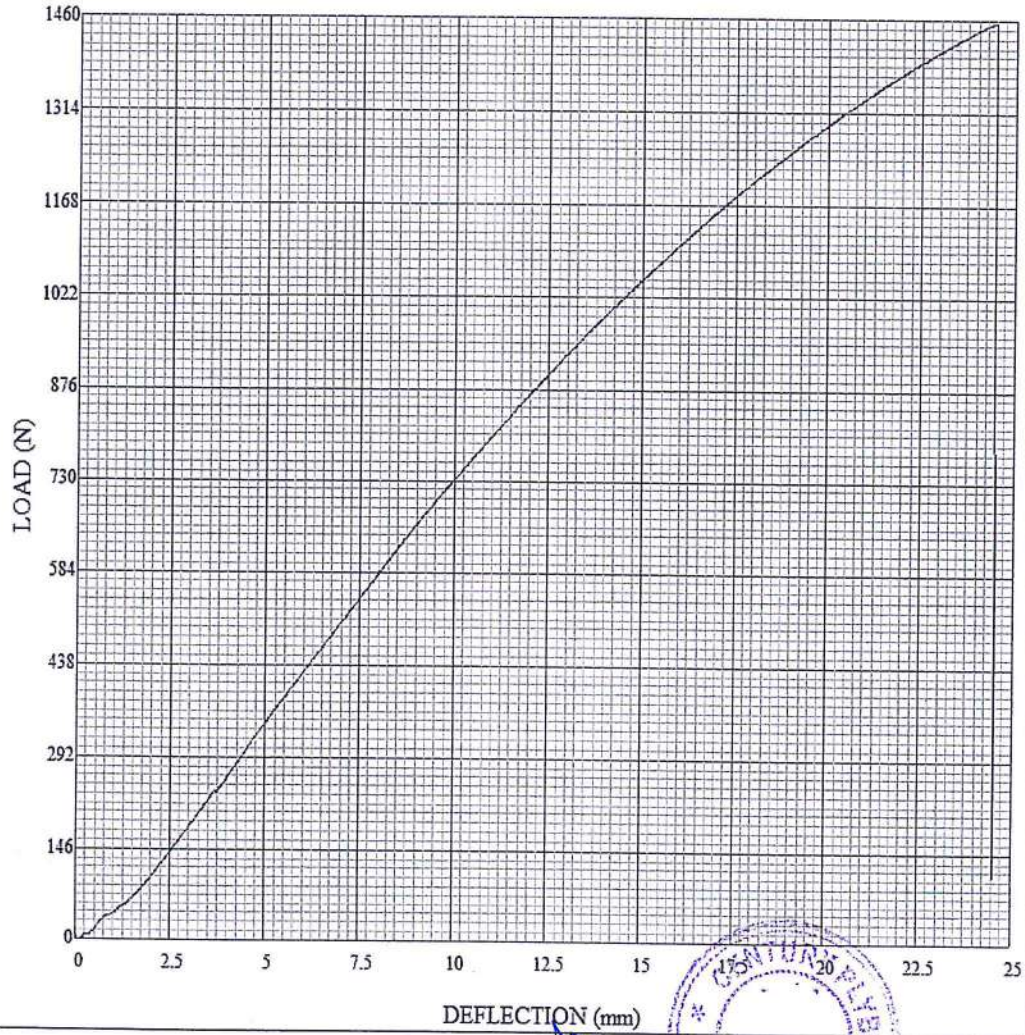
Date	Group	Batch	Operator	Specimen
07-Jan-21	19mm plywood	30	19/G/25-7,8/-ACROSS/3	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	456						
Thickness (mm)	19						

Peak Load (N)	1456.33						
Load @ Break	107.87						
Elong @ Peak	24.47						
Elong @ Break	24.53						
Avg. Peak Force (N)	1456.33						

M O R (N/mm²)	5518.72	55.18					
M O E	4103.61						
% Elongation	5						

Test Time (sec)	582						
Test Speed (mm/min)	2.73						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

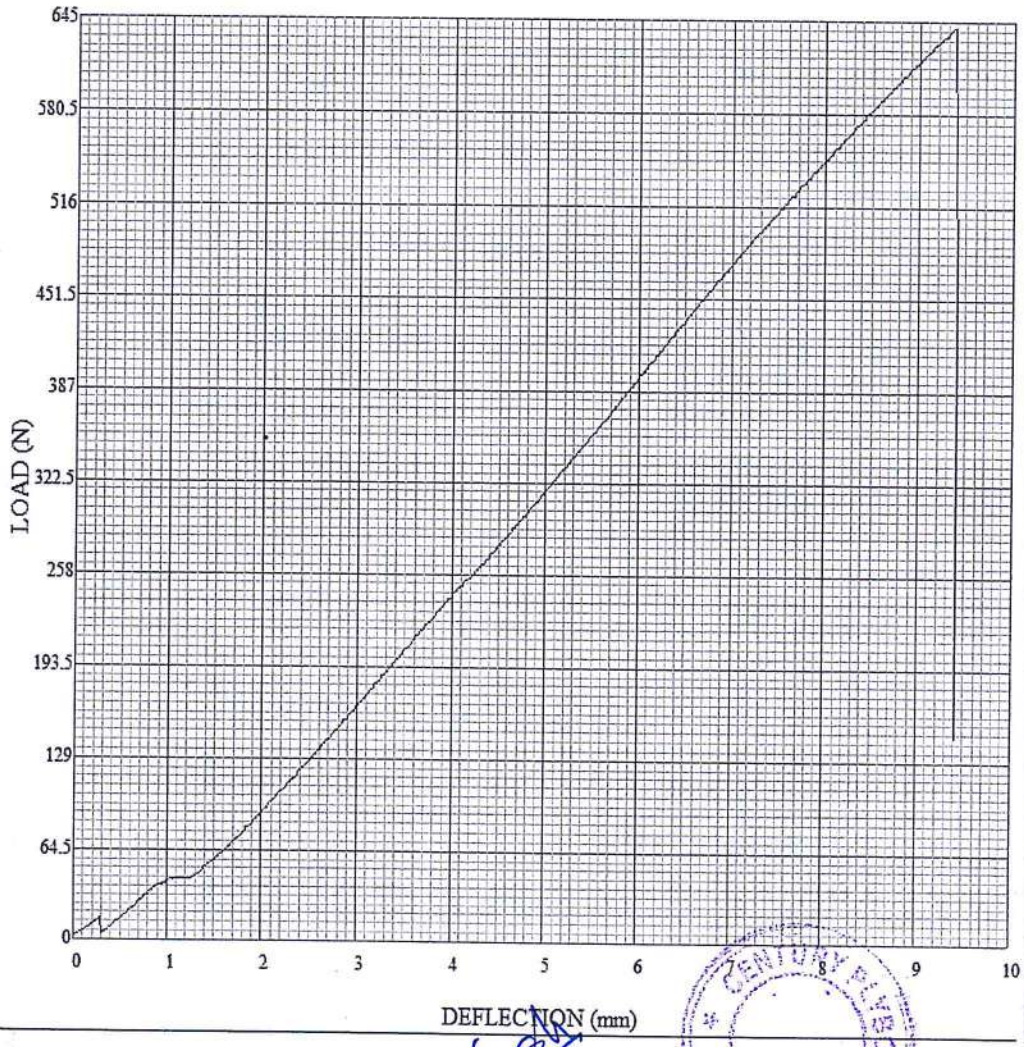
Date	Group	Batch	Operator	Specimen
07-Jan-21	12mm testing sample	31	12/G-28-9,10/ACROSS/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	12						

Peak Load (N)	641.37						
Load @ Break	145.14						
Elong @ Peak	9.38						
Elong @ Break	9.42						
Avg. Peak Force (N)	641.37						

M O R (N/mm²)	3848.22	38.48					
M O E	4706.1						
% Elongation	3						

Test Time (sec)	580.5						
Test Speed (mm/min)	1.72						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

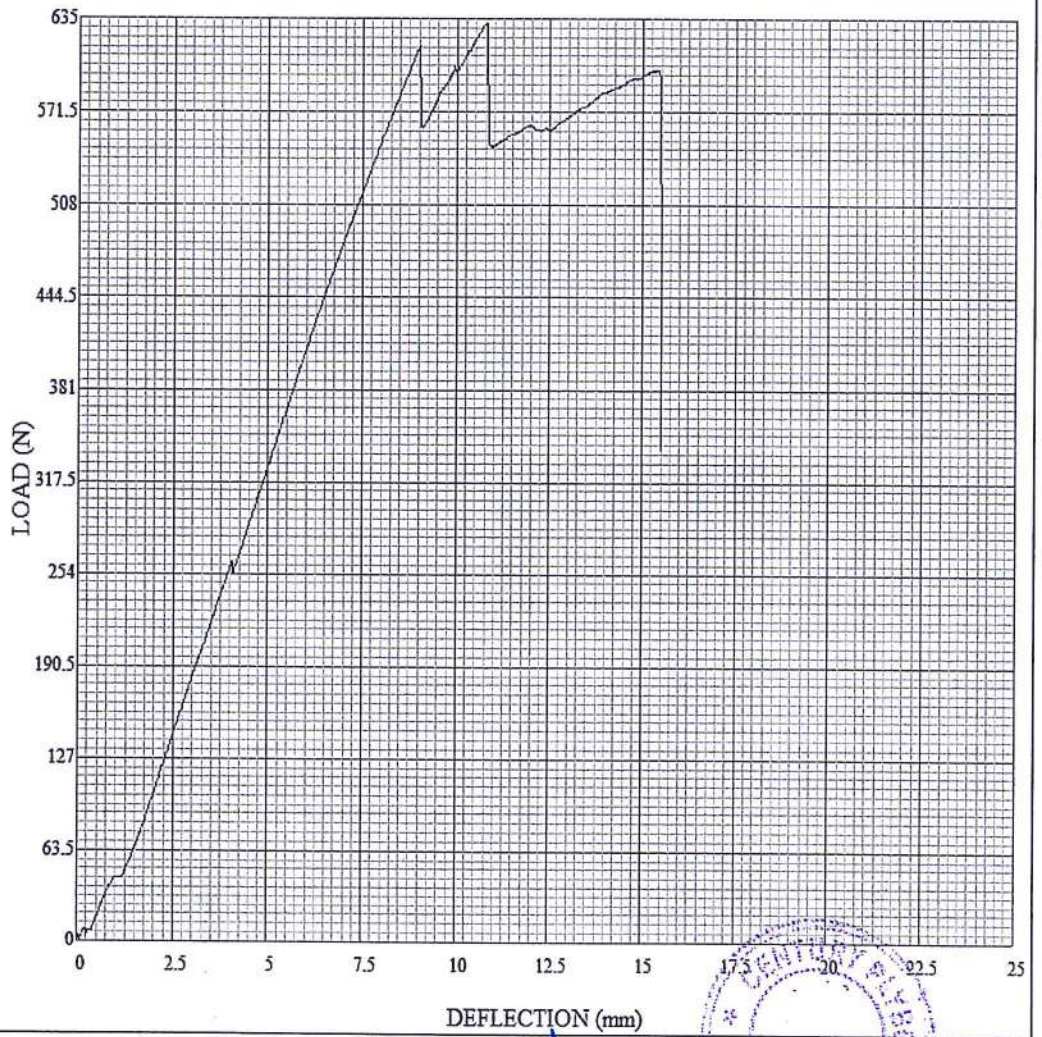
Date	Group	Batch	Operator	Specimen
07-Jan-21	12mm testing sample	32	12/G-28-9,10/ACROSS/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	12						

Peak Load (N)	631.57						
Load @ Break	339.32						
Elong @ Peak	10.77						
Elong @ Break	15.51						
Avg. Peak Force (N)	631.57						

M O R (N/mm²)	3789.42						
M O E	2814.58						
% Elongation	5						

Test Time (sec)	588						
Test Speed (mm/min)	1.72						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

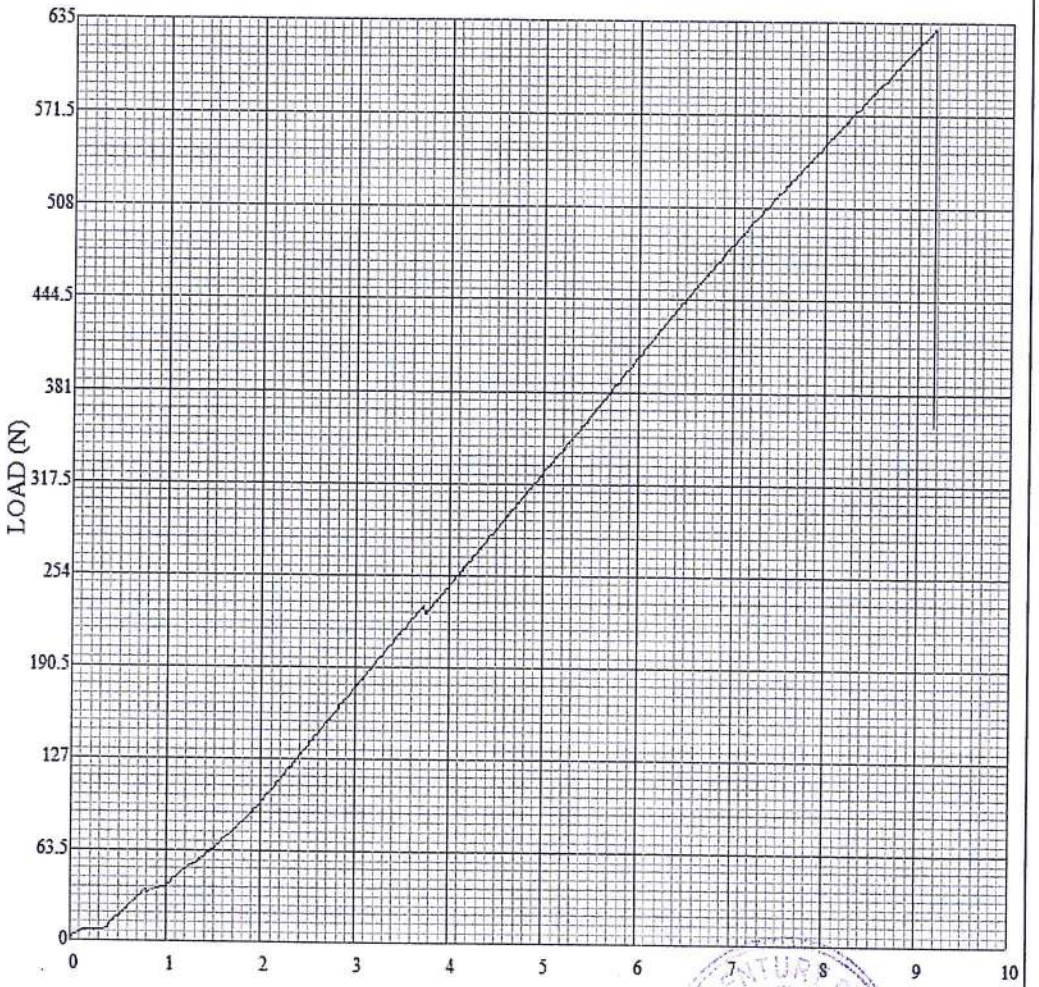
Date	Group	Batch	Operator	Specimen
07-Jan-21	12mm testing sample	33	12/G-28-9,10/ACROSS/3	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	12						

Peak Load (N)	630.59						
Load @ Break	357.95						
Elong @ Peak	9.16						
Elong @ Break	9.18						
Avg. Peak Force (N)	630.59						

M O R (N/mm²)	3783.54	37.83					
M O E	4747.97						
% Elongation	3						

Test Time (sec)	338.1						
Test Speed (mm/min)	1.72						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

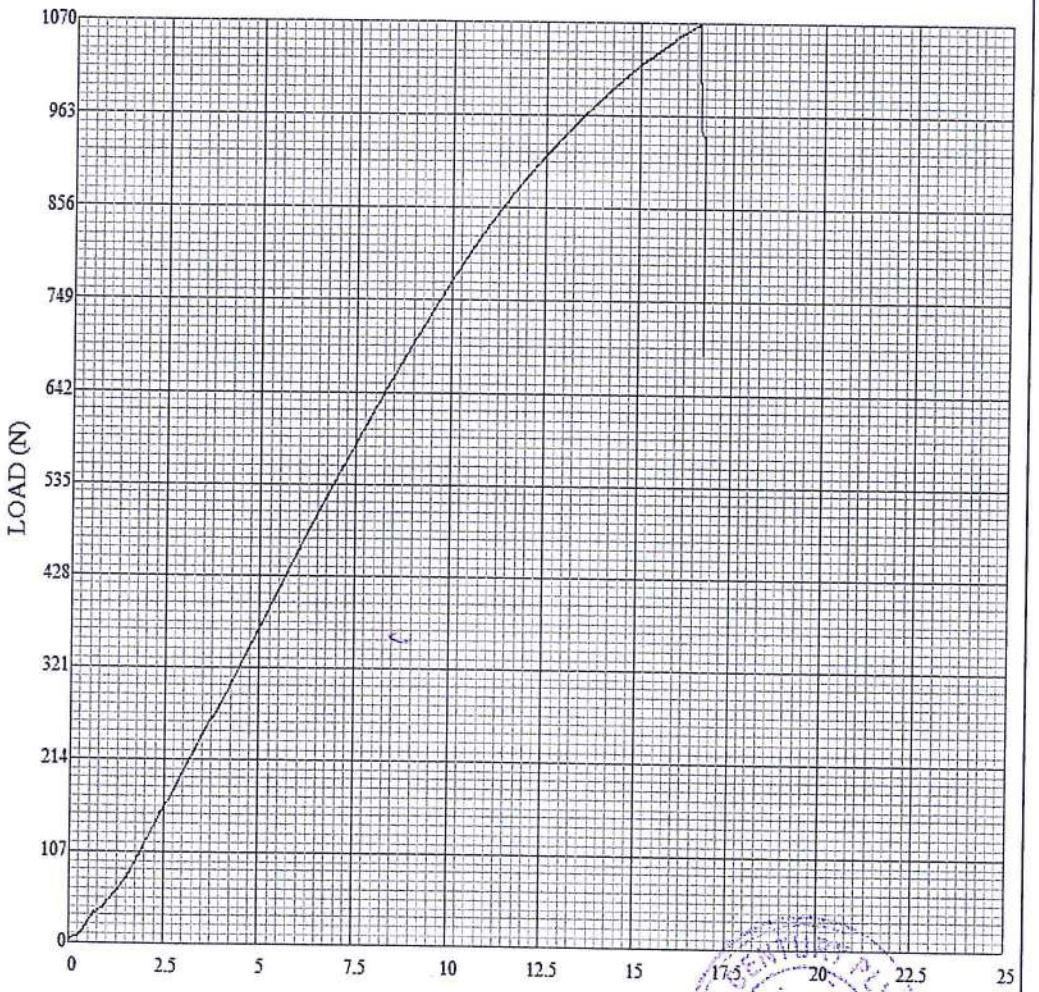
Date	Group	Batch	Operator	Specimen
07-Jan-21	12mm testing sample	34	12/O-25-9,10/ACROSS/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	12						

Peak Load (N)	1067.98						
Load @ Break	686.49						
Elong @ Peak	16.56						
Elong @ Break	16.76						
Avg. Peak Force (N)	1067.98						

M O R (N/mm²)	6407.88	64.07					
M O E	4404.46						
% Elongation	6						

Test Time (sec)	624.8						
Test Speed (mm/min)	1.72						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

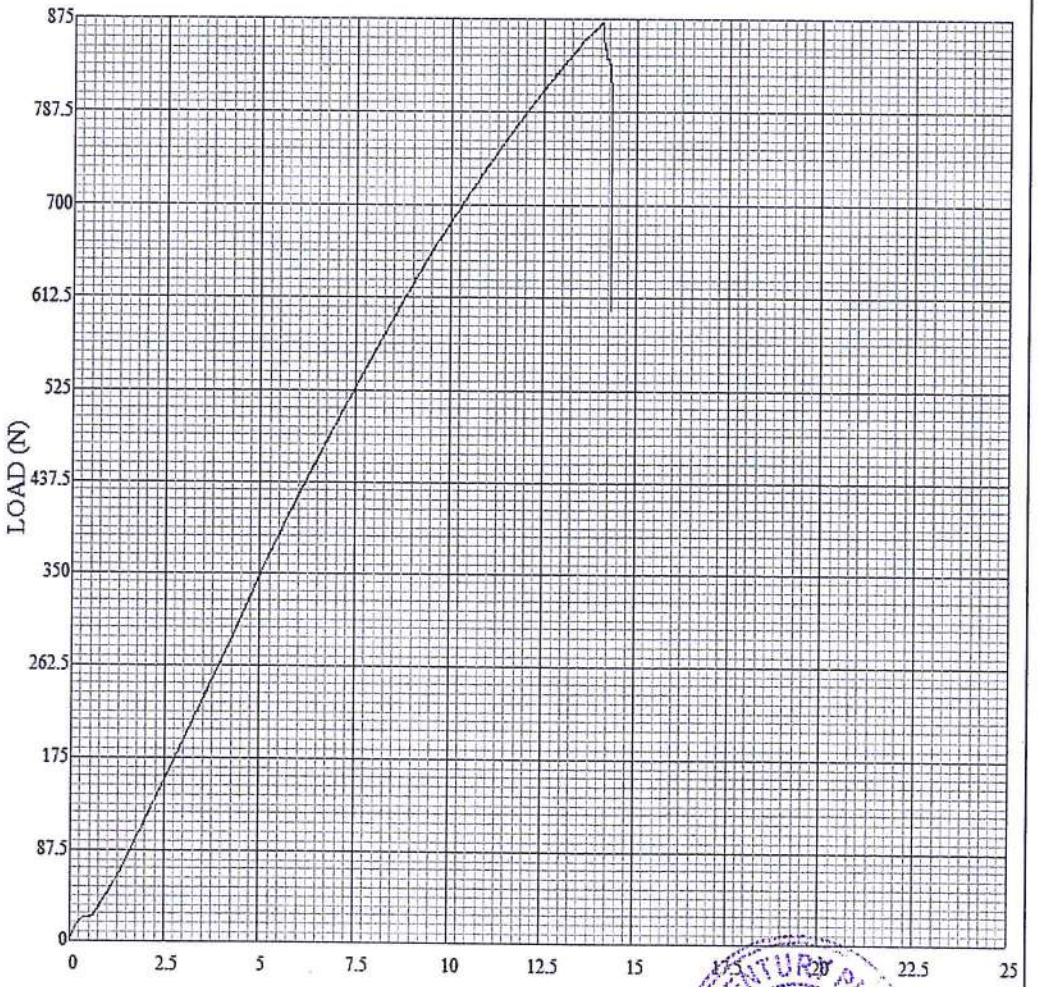
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
07-Jan-21	12mm testing sample	35	12/O-25-9,10/ACROSS/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	12						

Peak Load (N)	872.82						
Load @ Break	600.18						
Elong @ Peak	14.06						
Elong @ Break	14.33						
Avg. Peak Force (N)	872.82						
M O R (N/mm²)	5236.92	52.36					
M O E	4210						
% Elongation	5						

Test Time (sec)	501						
Test Speed (mm/min)	1.72						



Checked By : Mohit Lawhay

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

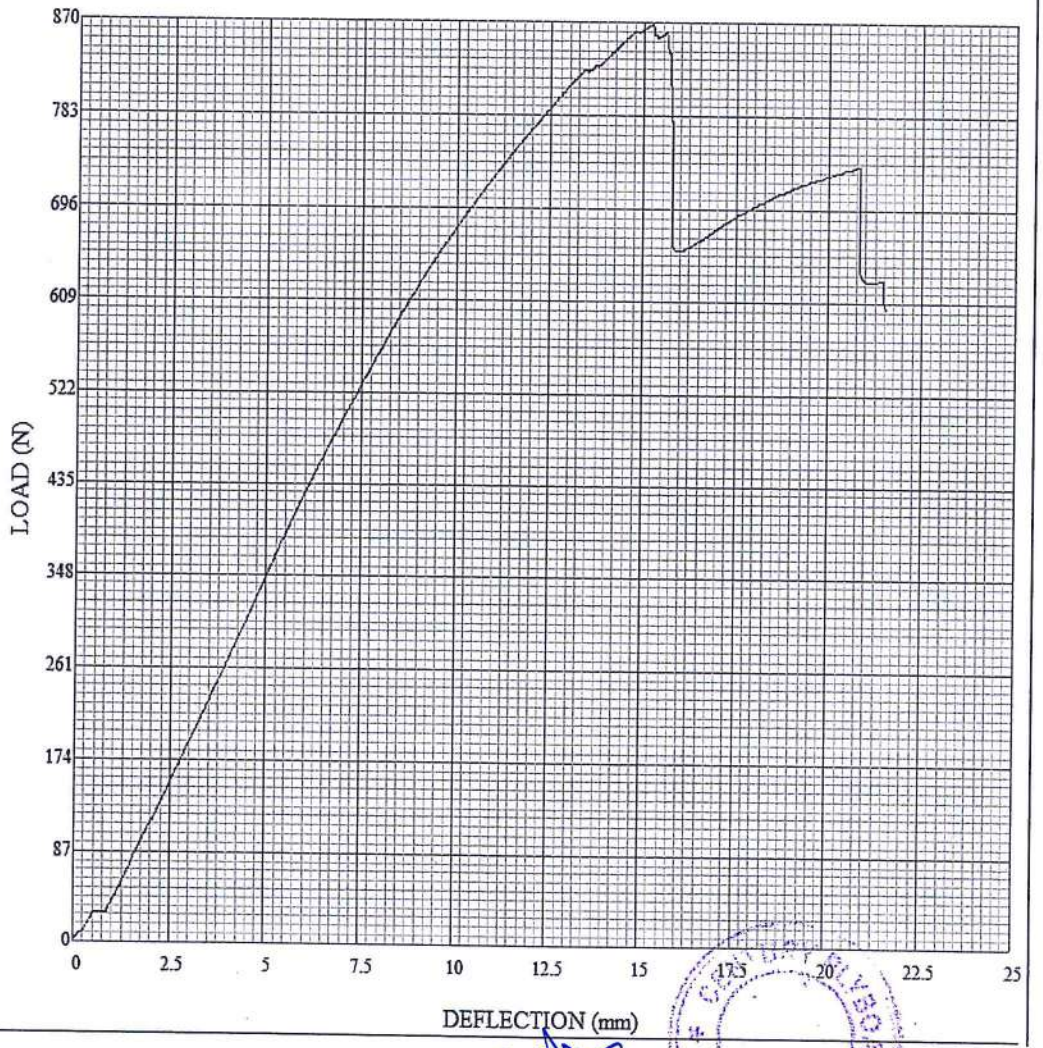
Date	Group	Batch	Operator	Specimen
07-Jan-21	12mm testing sample	36	12/O-25-9,10/ACROSS/3	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	19						

Peak Load (N)	868.9						
Load @ Break	602.14						
Elong @ Peak	15.22						
Elong @ Break	21.53						
Avg. Peak Force (N)	868.9						

M O R (N/mm²)	2079.58	20.79					
M O E	702.77						
% Elongation	7						

Test Time (sec)	767.7						
Test Speed (mm/min)	1.72						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

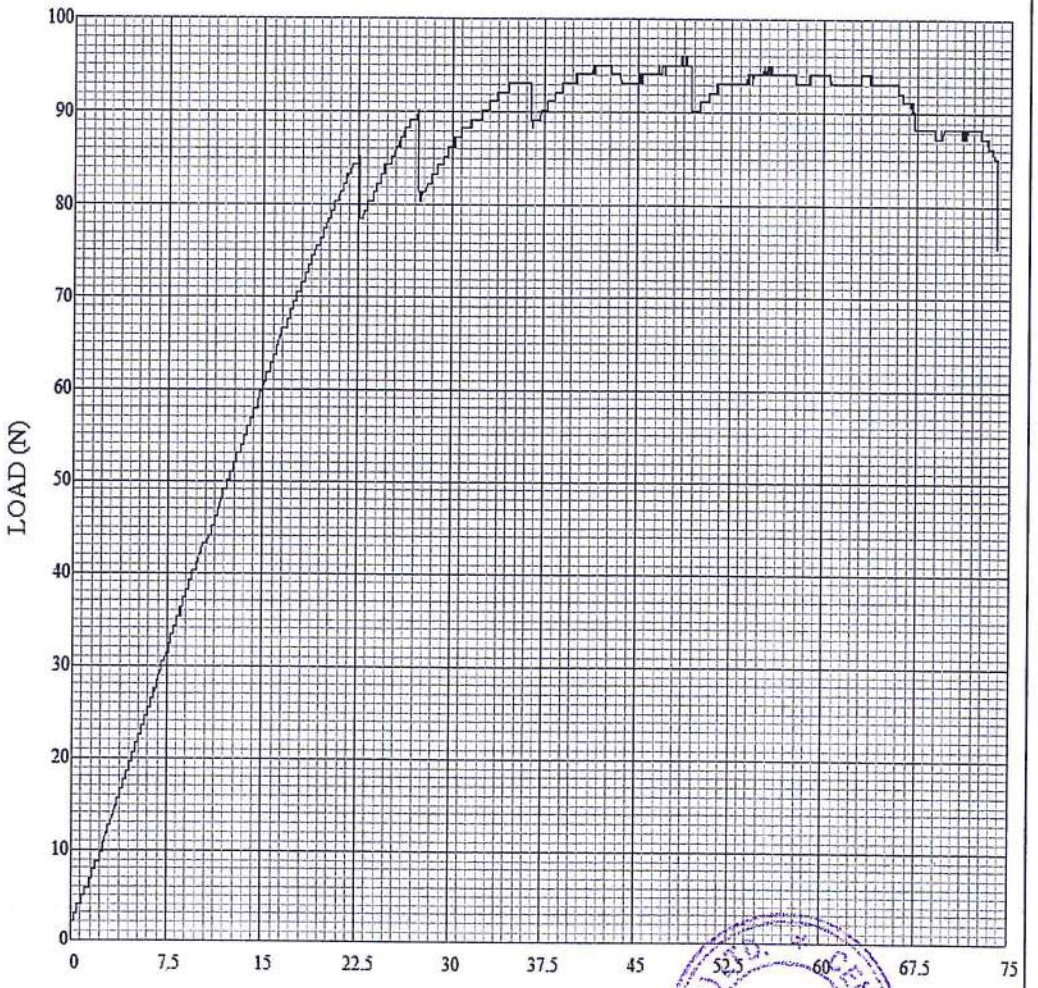
Date	Group	Batch	Operator	Specimen
07-Jan-21	~~12~~mm testing sample 6	37	6/O-30-7,8/ALONG/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	6						

Peak Load (N)	96.1						
Load @ Break	75.51						
Elong @ Peak	48.42						
Elong @ Break	74.01						
Avg. Peak Force (N)	96.1						

M O R (N/mm²)	2306.4	23.06					
M O E	718						
% Elongation	26						

Test Time (sec)	1462						
Test Speed (mm/min)	3.45						



Checked By : Mahitchauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

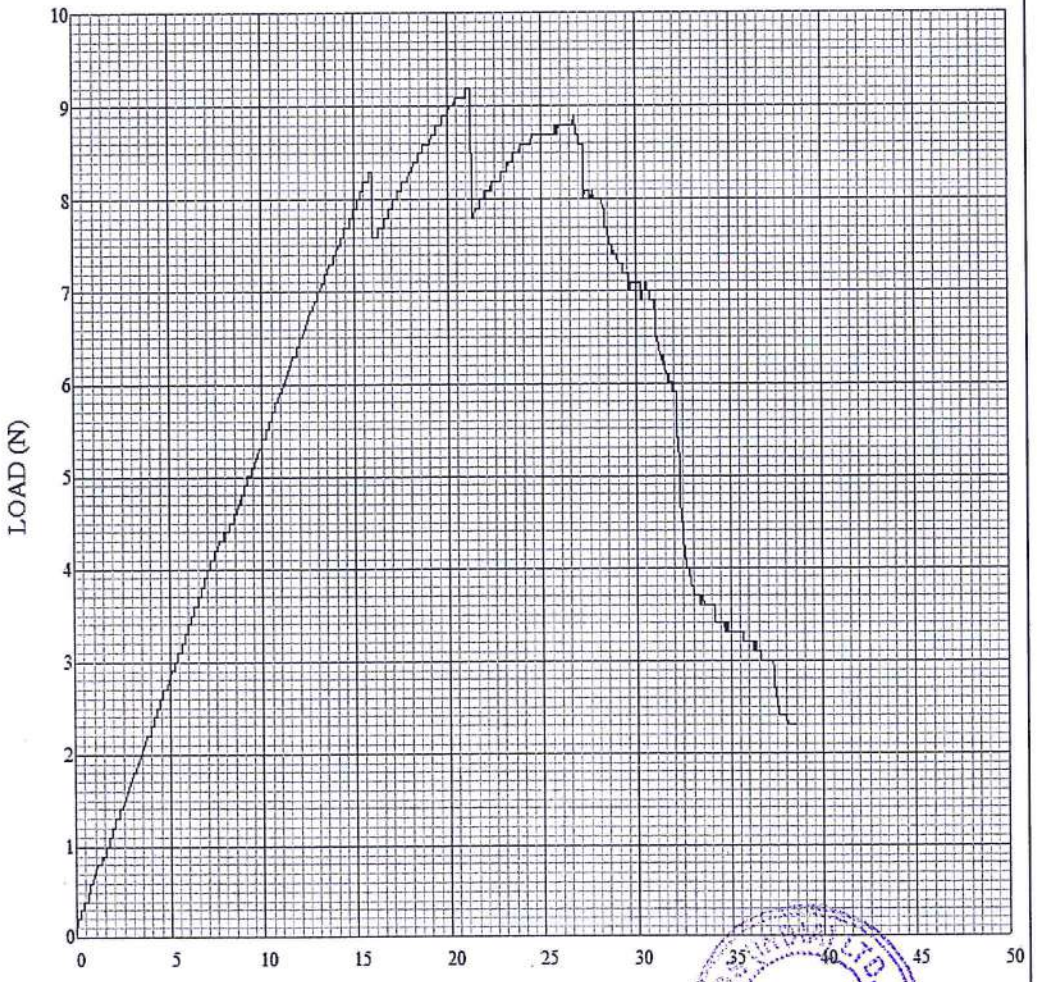
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	R/ 37	6/O-30-7,8/ALONG/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	6						

Peak Load (N)	9.2						
Load @ Break	2.3						
Elong @ Peak	20.97						
Elong @ Break	38.5						
Avg. Peak Force (N)	9.2						
M O R (N/mm²)	2165.39						
M O E	1295.86						
% Elongation	13						

Test Time (sec)	710.2						
Test Speed (mm/min)	3.45						



Checked By : Mohit Chaudhary

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

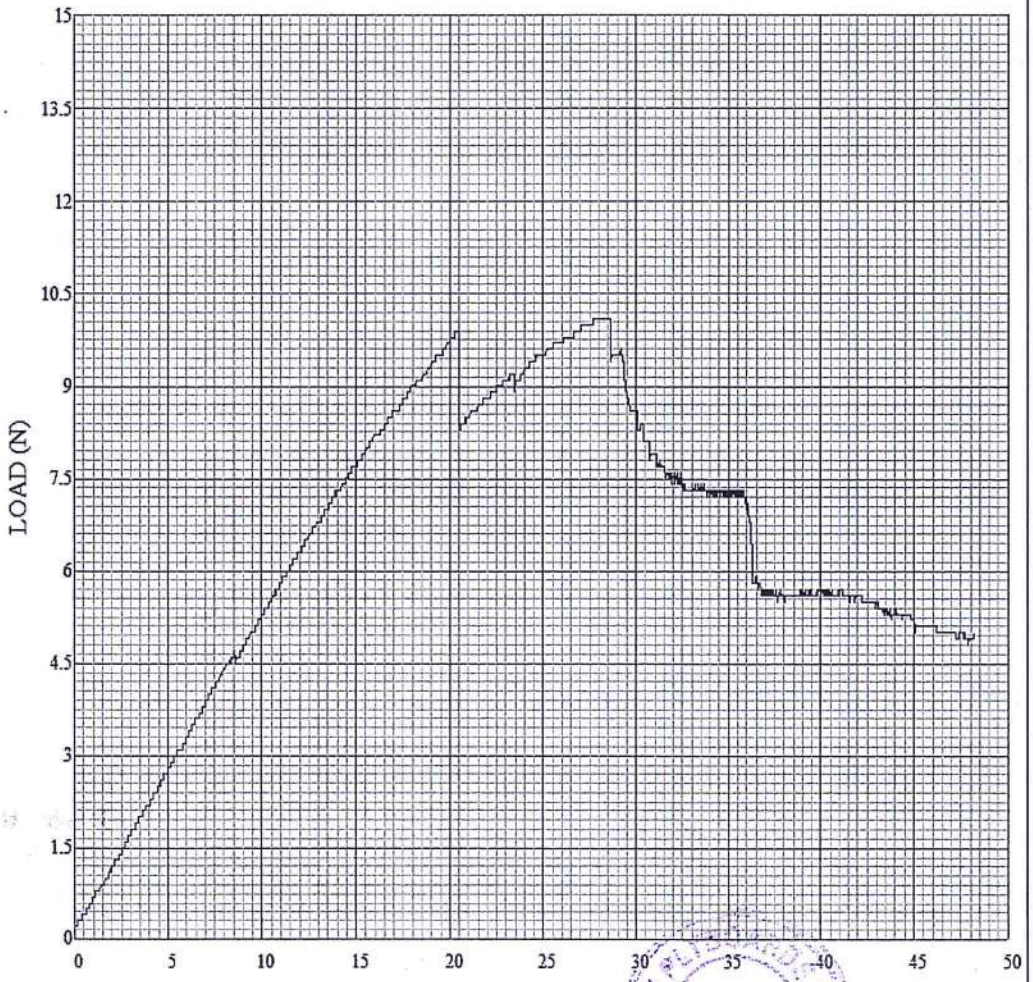
R/

Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	38	6/O-30-7,8/ALONG/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	6						

Peak Load (N)	10.1						
Load @ Break	5						
Elong @ Peak	27.72						
Elong @ Break	48.21						
Avg. Peak Force (N)	10.1						
M O R (N/mm²)	2377.22						
M O E	1136.09						
% Elongation	17						

Test Time (sec)	865.4						
Test Speed (mm/min)	3.45						



Checked By : Mohitchauley

Remarks : .....

Verified By: .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

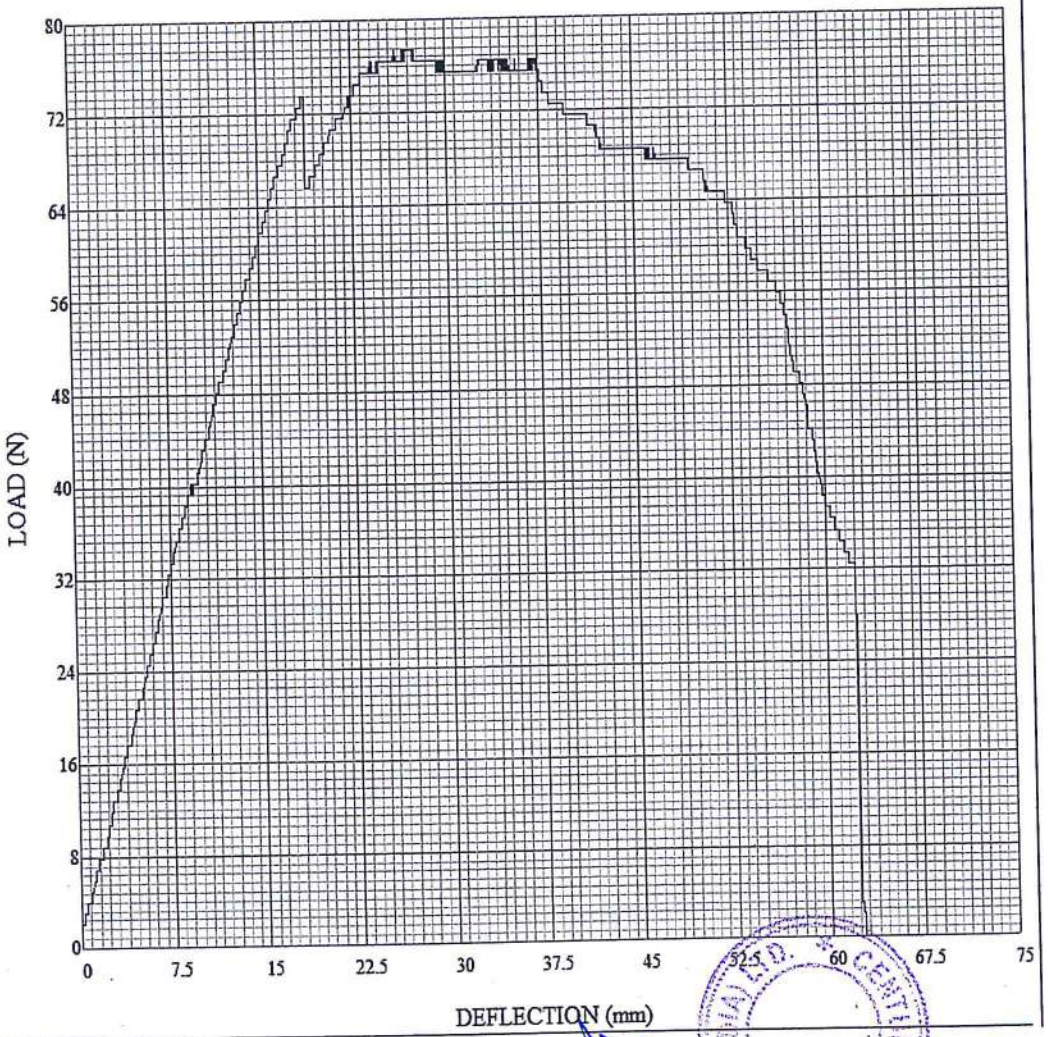
Date	Group	Batch	Operator	Specimen
07-Jan-21	~~12~~mm testing sample 6	38	6/O-30-7,8/ALONG/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	6						

Peak Load (N)	77.47						
Load @ Break	0						
Elong @ Peak	25.91						
Elong @ Break	68.19						
Avg. Peak Force (N)	77.47						

M O R (N/mm²)	1859.28	18.59					
M O E	628.21						
% Elongation	24						

Test Time (sec)	1203.6						
Test Speed (mm/min)	3.45						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	~~12~~mm testing sample 6	39	6/O-30-7,8/ALONG/3	PLYWOOD

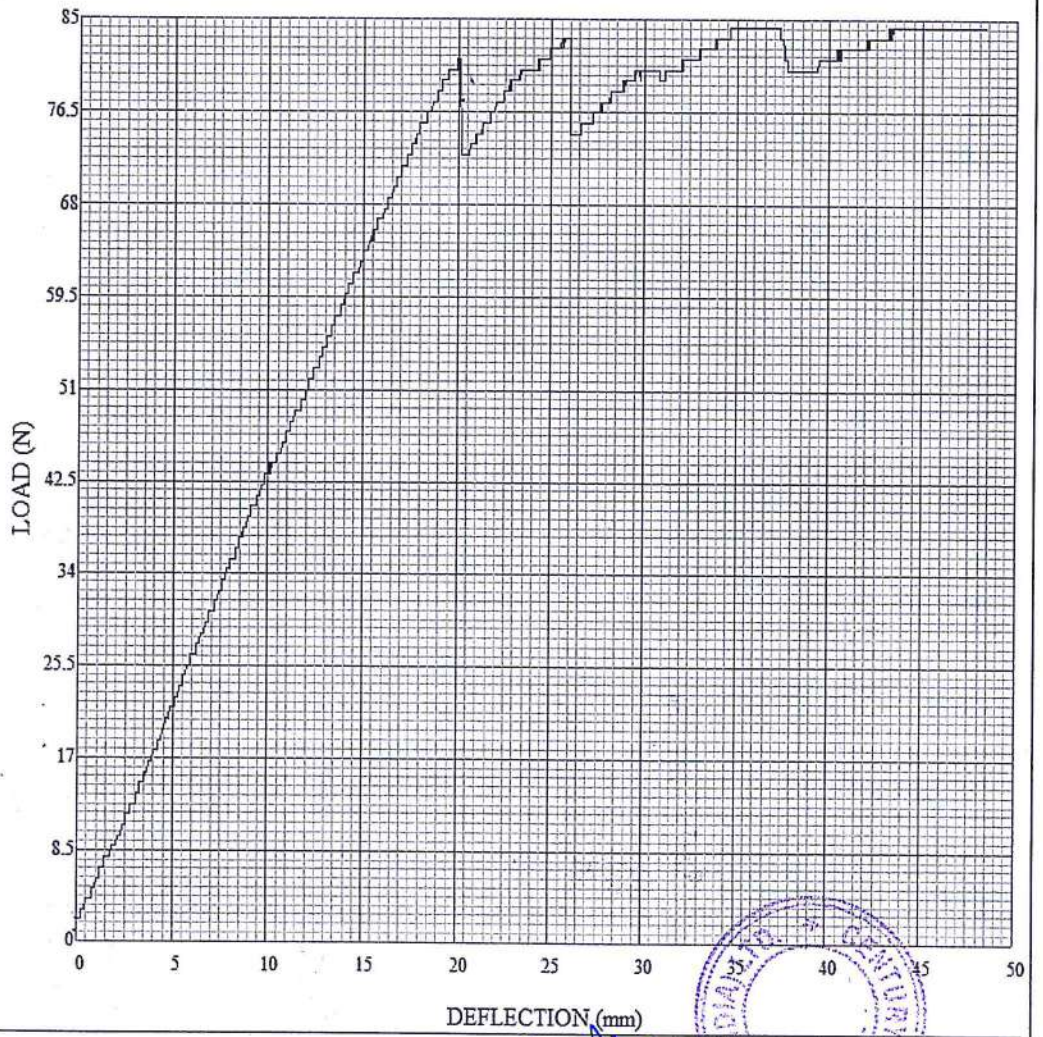
Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	6						

Peak Load (N)	84.34						
Load @ Break	84.34						
Elong @ Peak	34.63						
Elong @ Break	48.32						

Avg. Peak Force (N) 84.34

M O R (N/mm²)	2024.16						
M O E	965.16						
% Elongation	17						

Test Time (sec)	858						
Test Speed (mm/min)	3.45						



Checked By : Mohit Chouhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

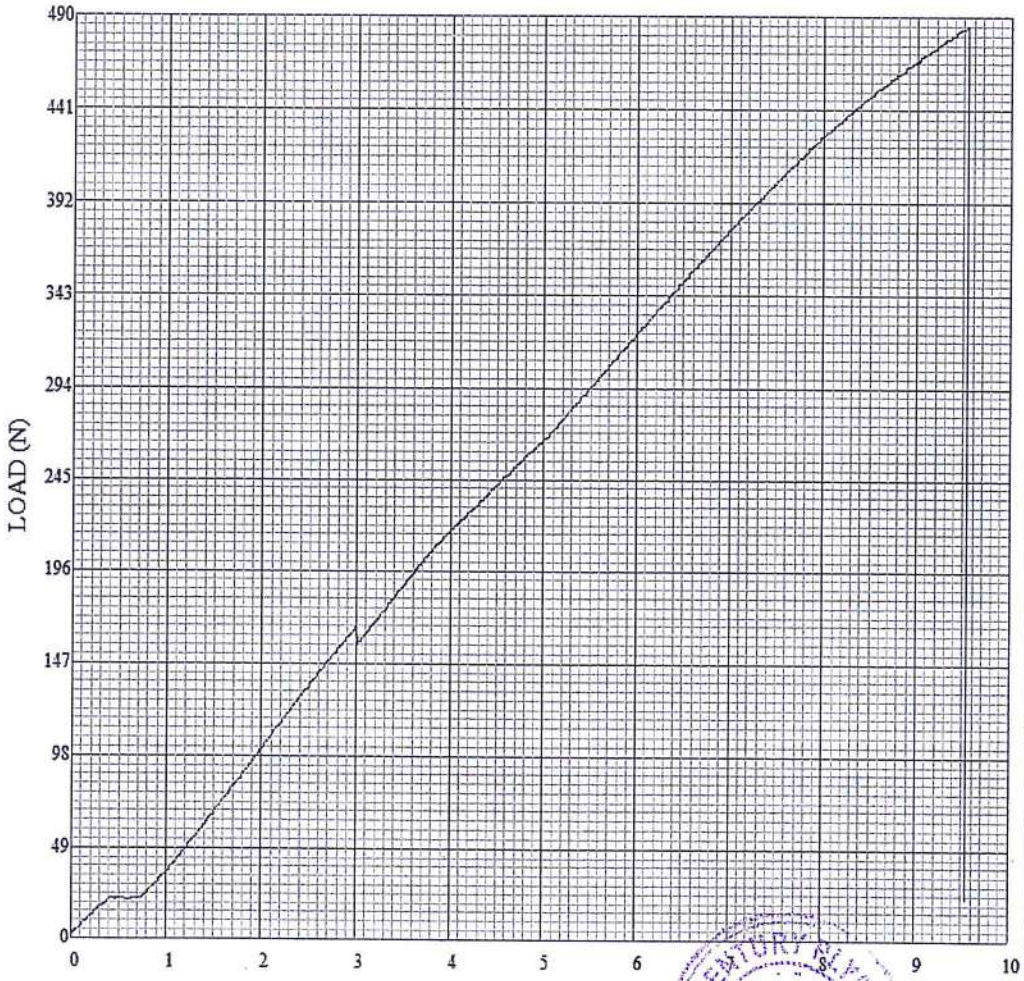
Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm ~~maxima~~ply	40	6/O-30-7,8/ACROSS/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	144						
Thickness (mm)	6						

Peak Load (N)	485.44						
Load @ Break	21.57						
Elong @ Peak	9.53						
Elong @ Break	9.55						
Avg. Peak Force (N)	485.44						

M O R (N/mm²)	5825.28	58.25					
M O E	3513.47						
% Elongation	7						

Test Time (sec)	704.2						
Test Speed (mm/min)	0.864						



Checked By : Mohit Chauhan

Remarks : .....

Verified By .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

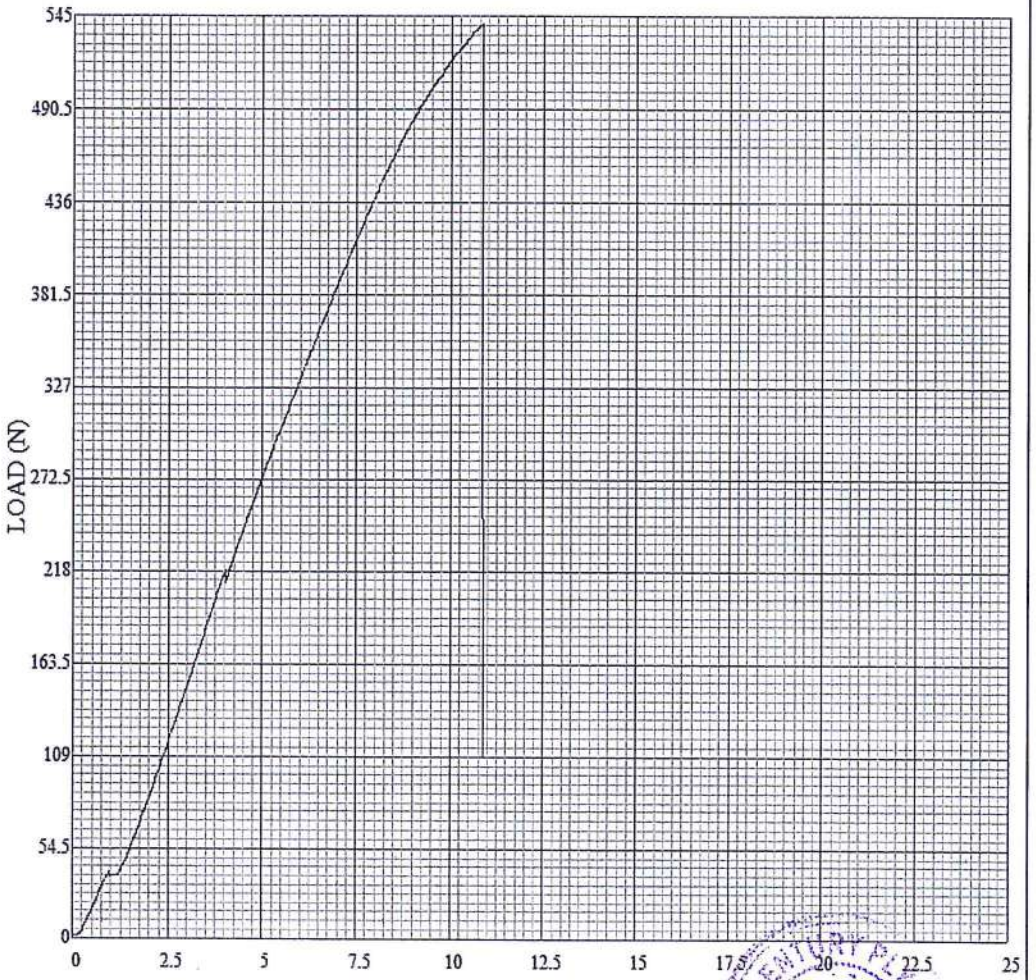
Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm ~~maintaply~~	41	6/O-30-7,8/ACROSS/2	PLYWOOD

Specimen No.	0					
Width (mm)	6					
Length (mm)	144					
Thickness (mm)	6					

Peak Load (N)	540.36					
Load @ Break	108.85					
Elong @ Peak	10.83					
Elong @ Break	10.87					
Avg. Peak Force (N)	540.36					

M O R (N/mm²)	54036	54.03				
M O E	28633.61					
% Elongation	8					

Test Time (sec)	833					
Test Speed (mm/min)	0.864					



Checked By : Mahitchauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

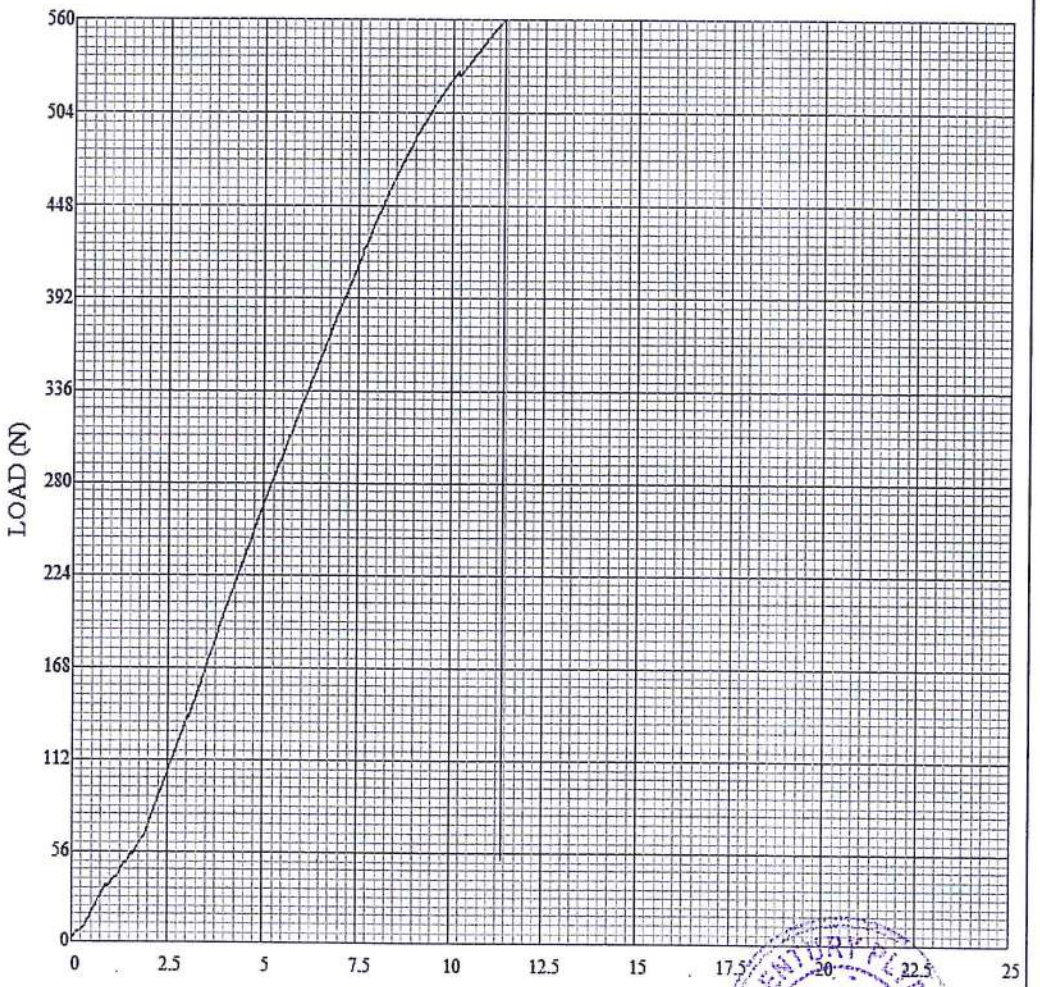
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm ~~marine~~ply	42	6/O-30-7,8/ACROSS/3	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	144						
Thickness (mm)	6						

Peak Load (N)	558.99						
Load @ Break	50.99						
Elong @ Peak	11.35						
Elong @ Break	11.4						
Avg. Peak Force (N)	558.99						
M O R (N/mm²)	6707.88	67.07					
M O E	3389.24						
% Elongation	8						

Test Time (sec)	896.8						
Test Speed (mm/min)	0.864						



Checked By : Mahitchaahan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

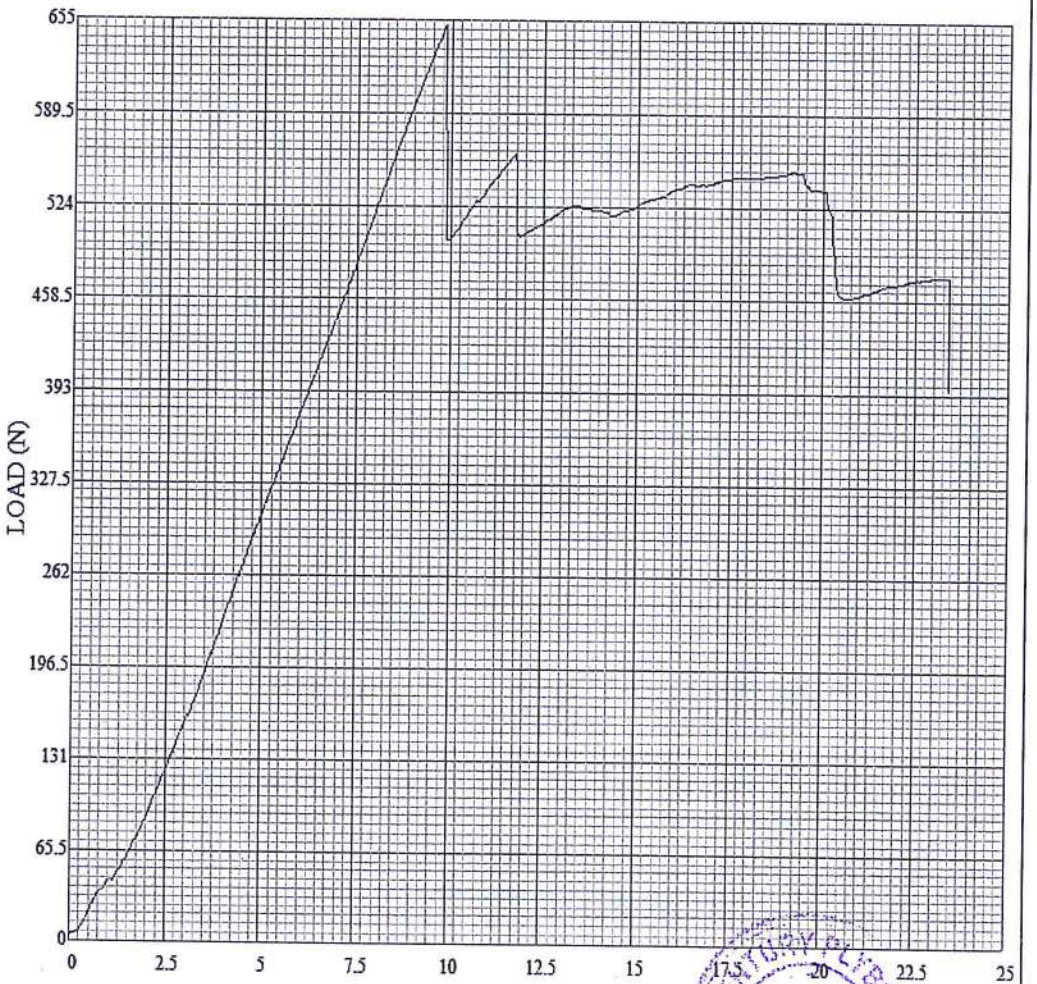
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	19mm plywood	43	19/G-28-7,8/ACROSS/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	456						
Thickness (mm)	19						

Peak Load (N)	652.16						
Load @ Break	395.22						
Elong @ Peak	9.85						
Elong @ Break	23.43						
Avg. Peak Force (N)	652.16						
M O R (N/mm²)	2471.34	24.71					
M O E	1923.91						
% Elongation	5						

Test Time (sec)	573						
Test Speed (mm/min)	2.736						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

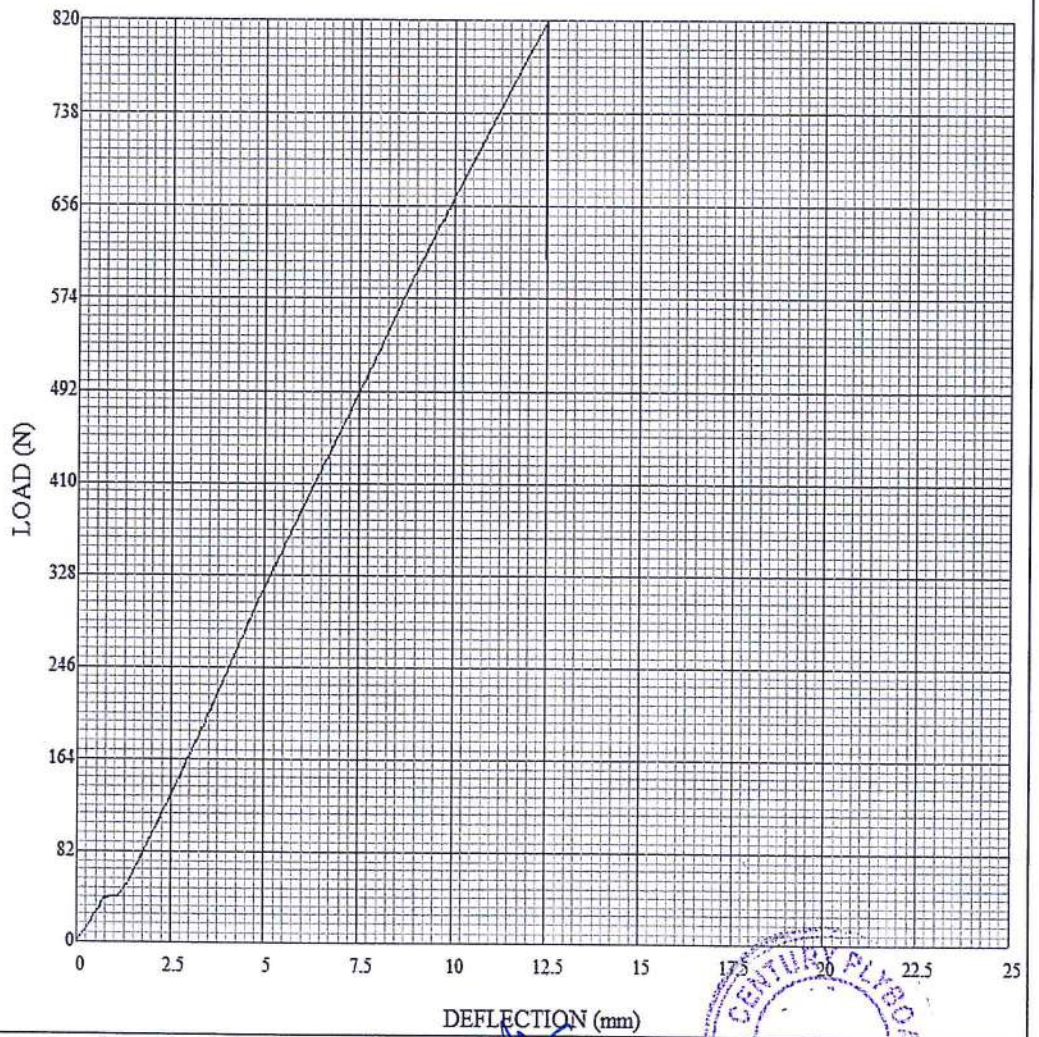
Date	Group	Batch	Operator	Specimen
08-Jan-21	19mm plywood	44	19/G-28-7,8/ACROSS/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	456						
Thickness (mm)	19						

Peak Load (N)	818.88						
Load @ Break	400.12						
Elong @ Peak	12.46						
Elong @ Break	12.48						
Avg. Peak Force (N)	818.88						

M O R (N/mm²)	3103.12	31.03					
M O E	4535.34						
% Elongation	3						

Test Time (sec)	292.5						
Test Speed (mm/min)	2.73						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

CENTURY PLYBOARDS (INDIA) LTD.

BENDING TEST REPORT

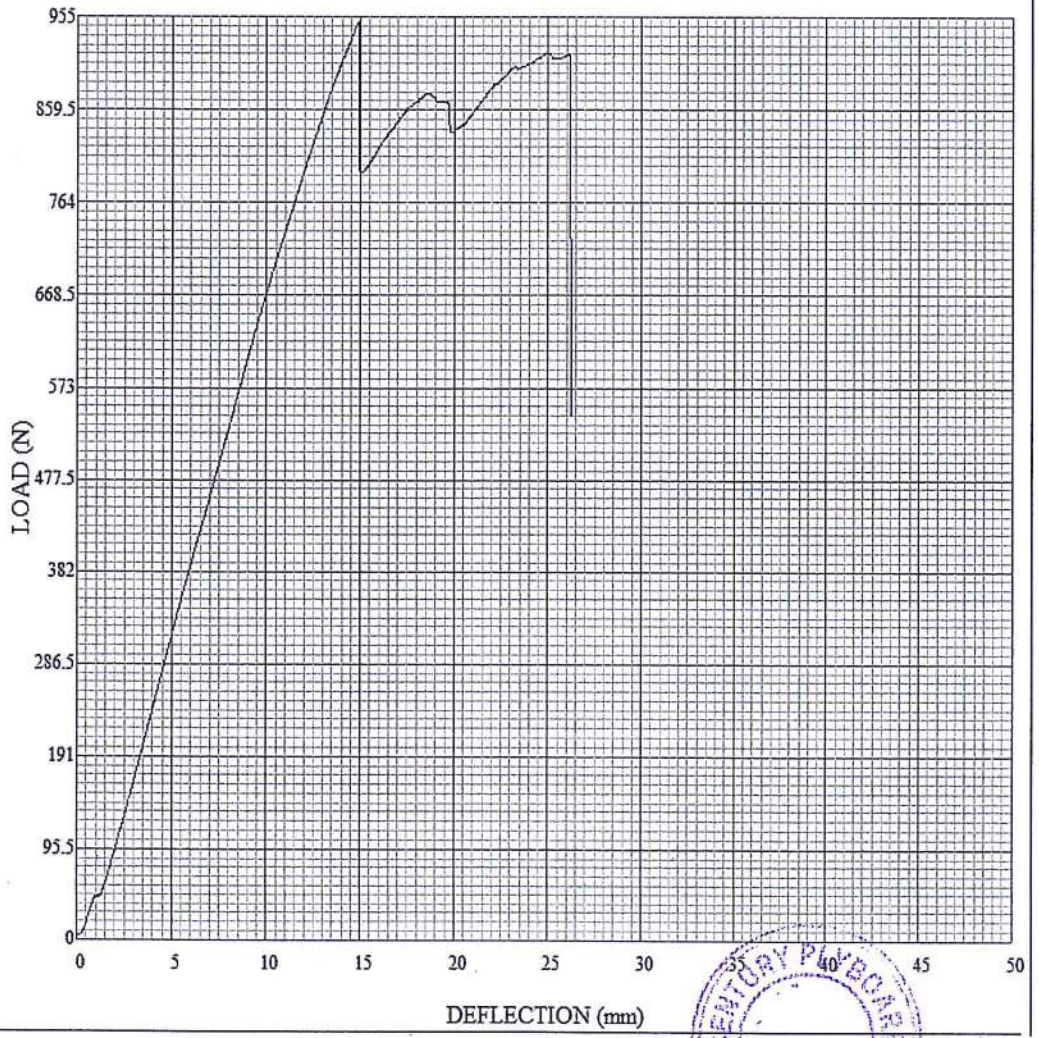
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	19mm plywood	45	19/G-28-7,8/ACROSS/3	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	456						
Thickness (mm)	19						

Peak Load (N)	950.29						
Load @ Break	542.32						
Elong @ Peak	14.88						
Elong @ Break	26.21						
Avg. Peak Force (N)	950.29						
M O R (N/mm²)	3601.1	36.01					
M O E	2506.07						
% Elongation	6						

Test Time (sec)	607.2						
Test Speed (mm/min)	2.73						



Checked By : Mohit chauhan

Remarks : .....

Verified By : .....

CENTURY PLY BOARDS (I) LTD.

BENDING TEST REPORT

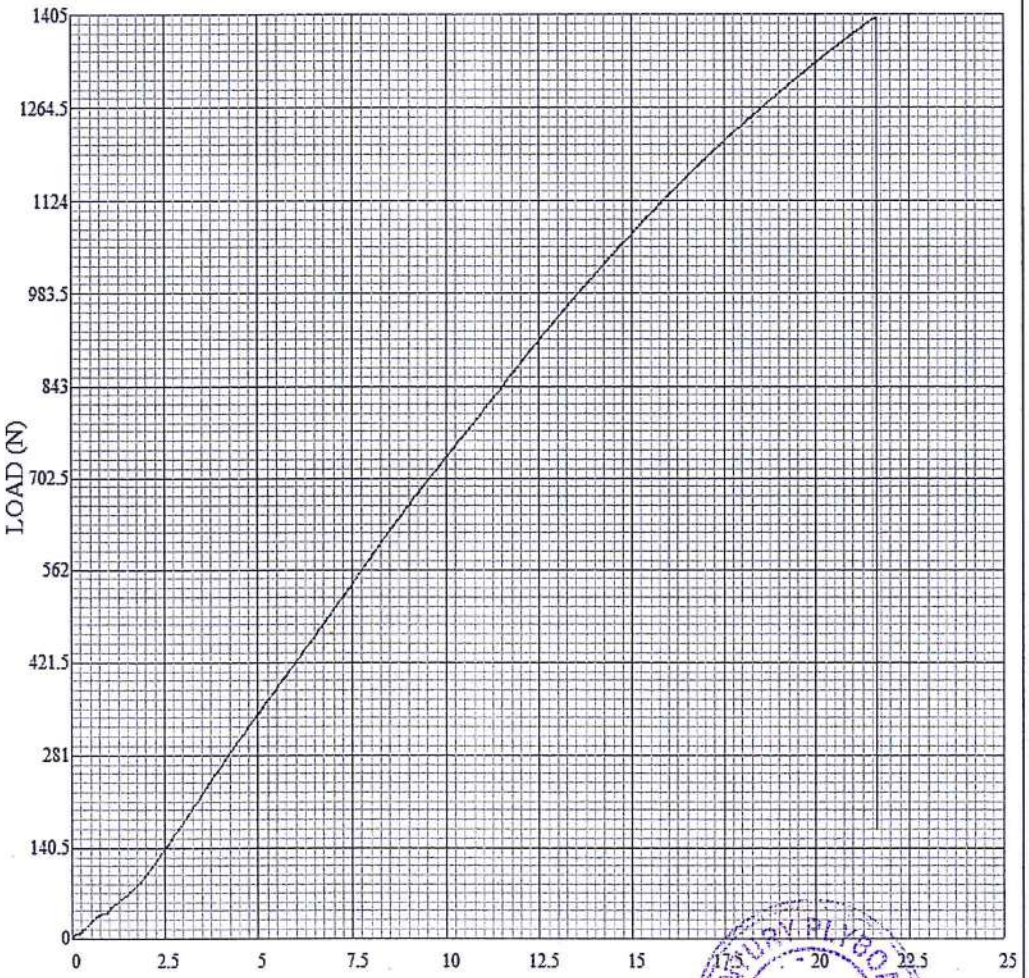
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	19mm plywood	46	19/O-25-7,8/ACROSS/1	PLYWOOD

Specimen No.	0					
Width (mm)	50					
Length (mm)	456					
Thickness (mm)	19					

Peak Load (N)	1401.42					
Load @ Break	166.71					
Elong @ Peak	21.59					
Elong @ Break	21.63					
Avg. Peak Force (N)	1401.42					
M O R (N/mm²)	5310.64	53.10				
M O E	4478.32					
% Elongation	5					

Test Time (sec)	527					
Test Speed (mm/min)	2.73					



Checked By : Mahtchaeben

Remarks : .....

Verified By : .....

BENDING TEST REPORT

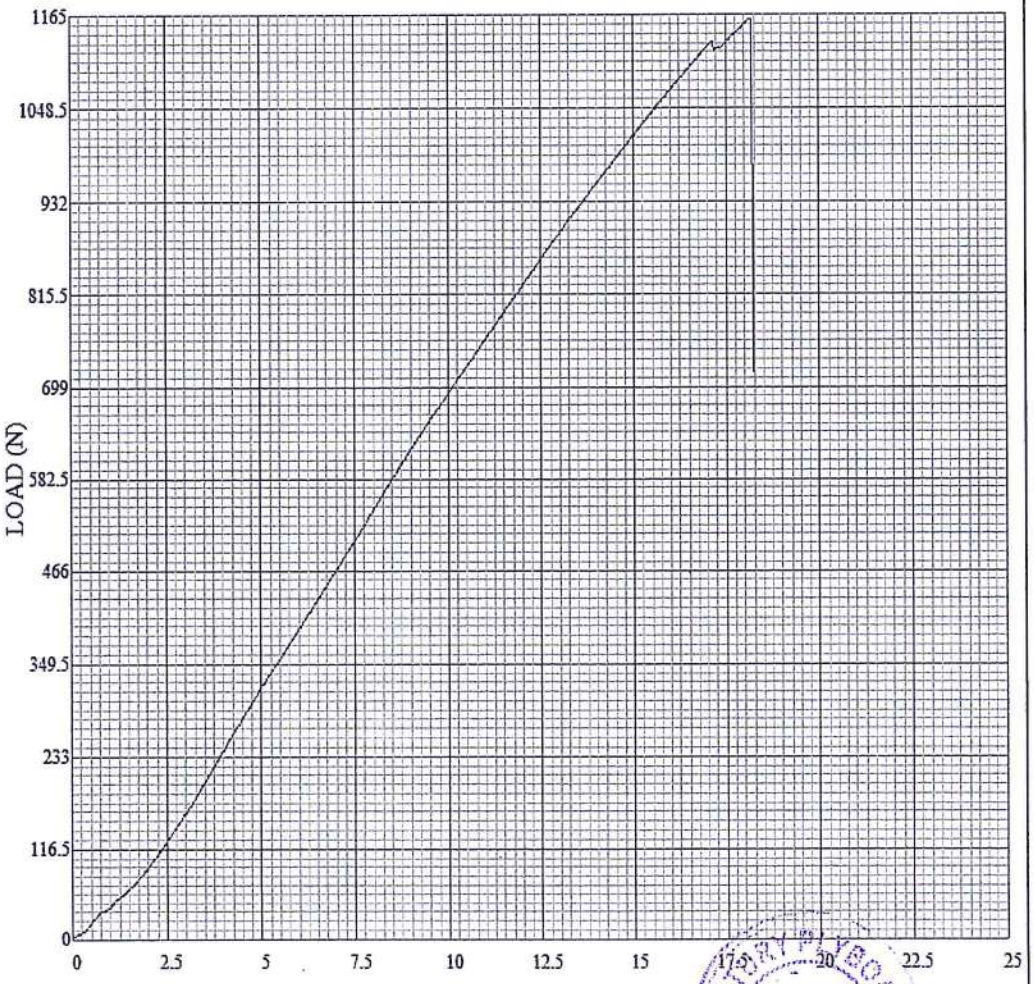
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	19mm plywood	47	19/O-25-7,8/ACROSS/2	PLYWOOD

Specimen No.	0					
Width (mm)	50					
Length (mm)	456					
Thickness (mm)	19					

Peak Load (N)	1160.16					
Load @ Break	715.91					
Elong @ Peak	18.15					
Elong @ Break	18.23					
Avg. Peak Force (N)	1160.16					
M O R (N/mm²)	4396.4	43.96				
M O E	4398.81					
% Elongation	4					

Test Time (sec)	423.4					
Test Speed (mm/min)	2.73					



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

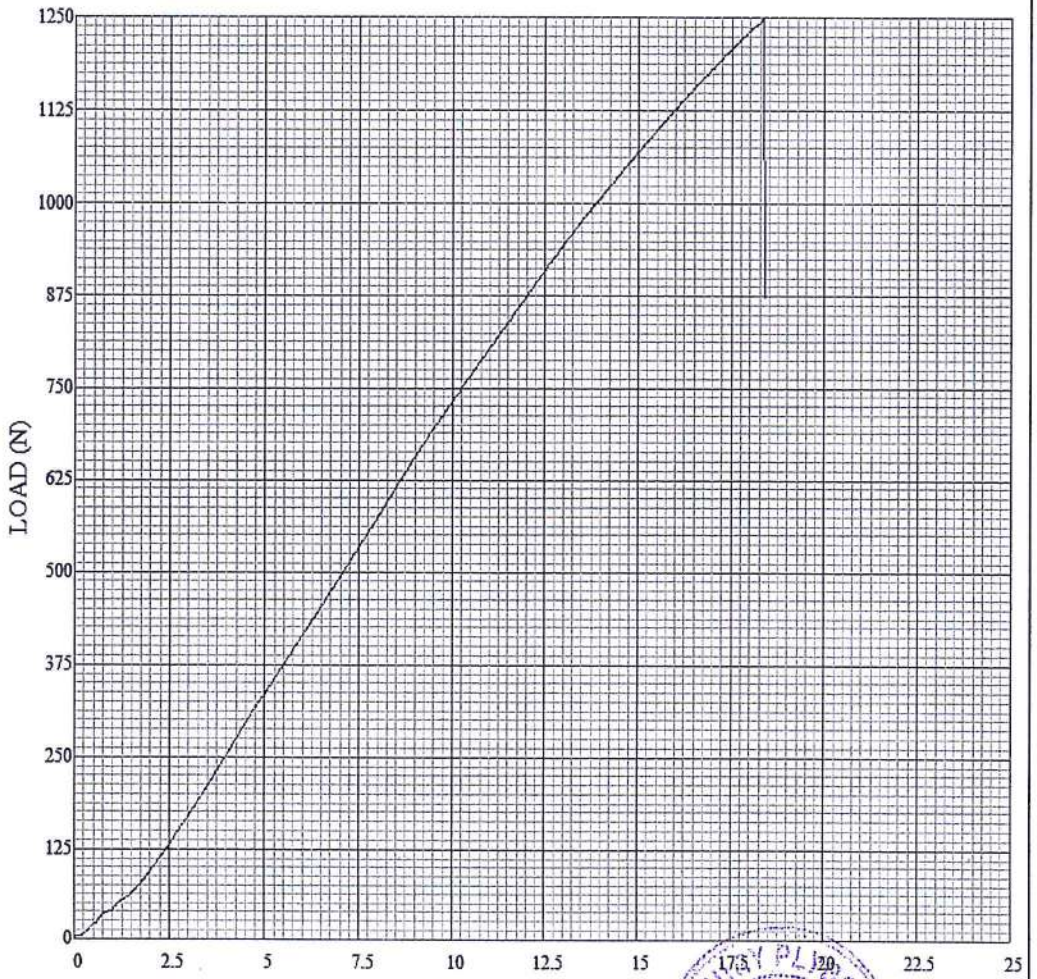
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	19mm plywood	48	19/O-25-7,8/ACROSS/3	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	456						
Thickness (mm)	19						

Peak Load (N)	1248.43						
Load @ Break	871.84						
Elong @ Peak	18.33						
Elong @ Break	18.38						
Avg. Peak Force (N)	1248.43						
M O R (N/mm²)	4730.89	47.30					
M O E	4694.86						
% Elongation	4						

Test Time (sec)	427.4						
Test Speed (mm/min)	2.73						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

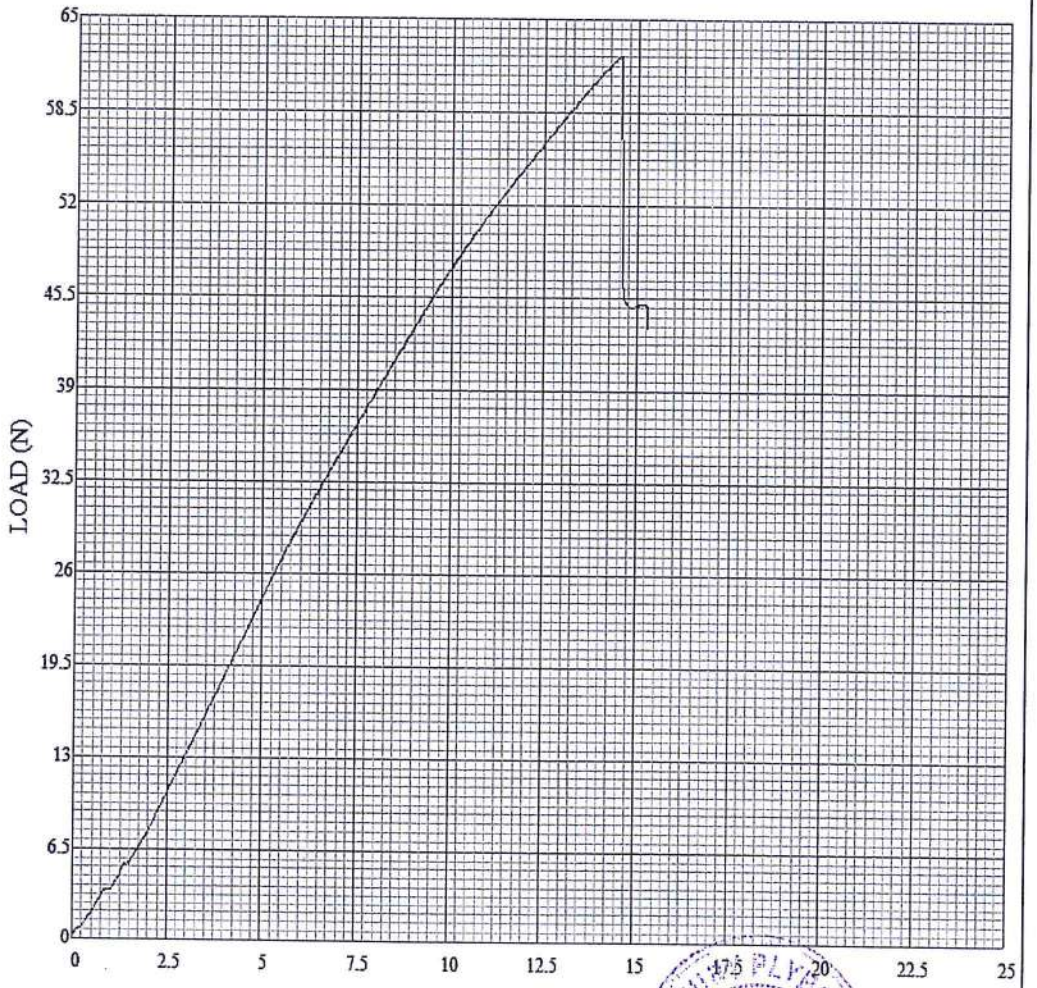
Date	Group	Batch	Operator	Specimen
08-Jan-21	12 mm testing sample	49	12/G-25-9,10/ACROSS/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	12						

Peak Load (N)	62.5						
Load @ Break	43.3						
Elong @ Peak	14.5						
Elong @ Break	15.29						
Avg. Peak Force (N)	62.5						

M O R (N/mm²)	3677.62	36.77					
M O E	2770.85						
% Elongation	5						

Test Time (sec)	822.6						
Test Speed (mm/min)	1.72						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

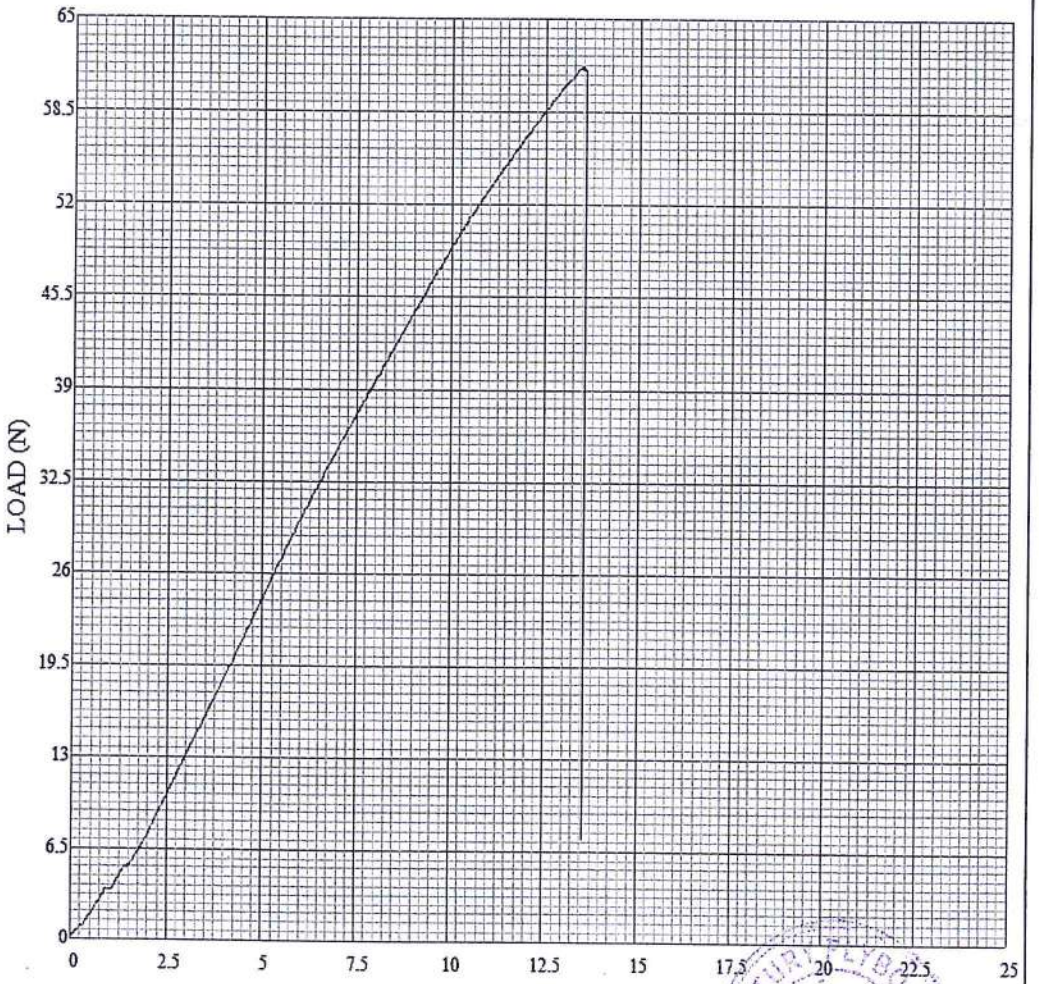
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	12 mm testing sample	50	12/G-25-9,10/ACROSS/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	12						

Peak Load (N)	61.7						
Load @ Break	7.3						
Elong @ Peak	13.44						
Elong @ Break	13.58						
Avg. Peak Force (N)	61.7						
M O R (N/mm²)	3630.55	36.30					
M O E	3079.82						
% Elongation	5						

Test Time (sec)	487.8						
Test Speed (mm/min)	1.72						



Checked By : Mahitchauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

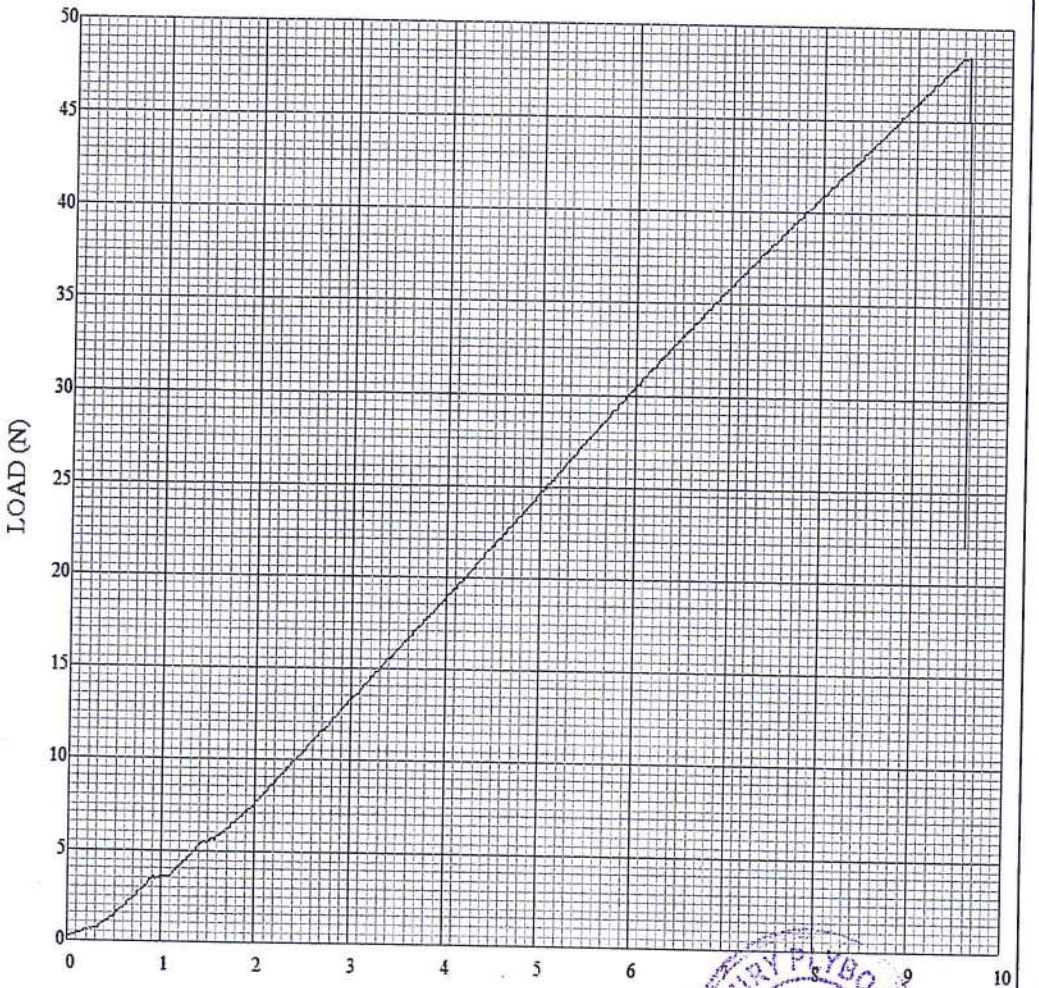
Date	Group	Batch	Operator	Specimen
08-Jan-21	12 mm testing sample	51	12/G-25-9,10/ACROSS/3	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	12						

Peak Load (N)	48.5						
Load @ Break	21.9						
Elong @ Peak	9.54						
Elong @ Break	9.57						
Avg. Peak Force (N)	48.5						

M O R (N/mm²)	2853.84	28.53					
M O E	3435.34						
% Elongation	3						

Test Time (sec)	354.4						
Test Speed (mm/min)	1.72						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

CENTURY PLYBOARDS (INDIA) LTD.

BENDING TEST REPORT

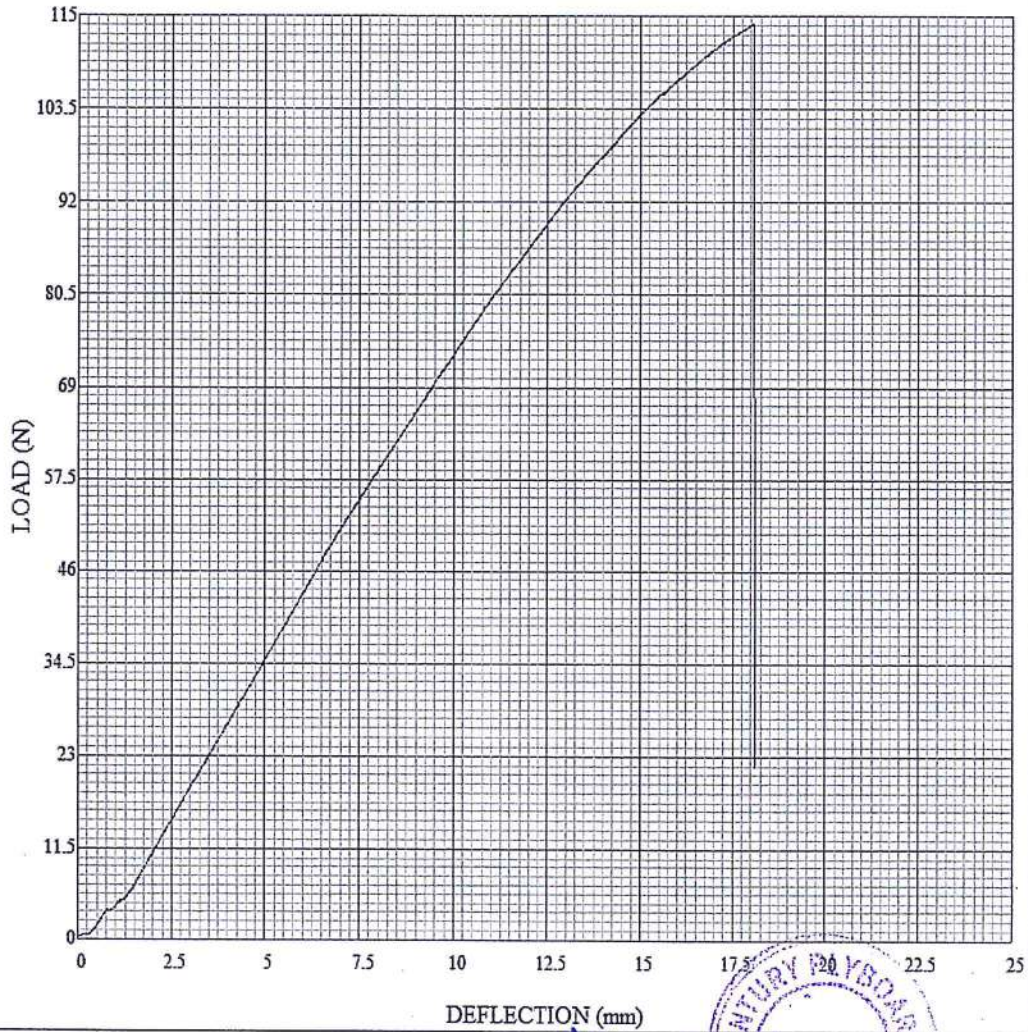
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	12 mm testing sample	52	12/O-30-9,10/ACROSS/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	12						

Peak Load (N)	114.1						
Load @ Break	21.5						
Elong @ Peak	18.07						
Elong @ Break	18.1						
Avg. Peak Force (N)	114.1						
M O R (N/mm²)	6713.87	67.13					
M O E	4273.14						
% Elongation	6						

Test Time (sec)	643.4						
Test Speed (mm/min)	1.72						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

CENTURY PLYBOARDS (INDIA) LTD.

BENDING TEST REPORT

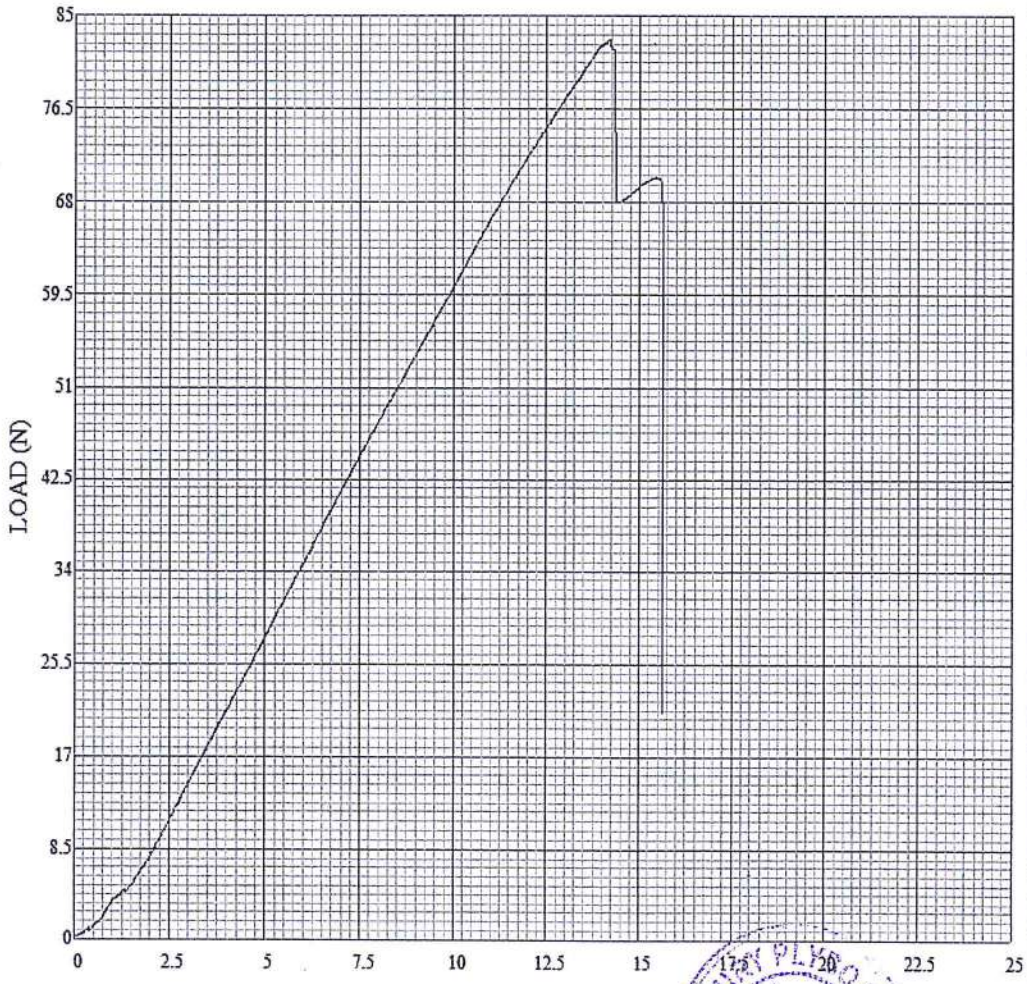
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	12 mm testing sample	53	12/O-30-9,10/ACROSS/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	12						

Peak Load (N)	82.9						
Load @ Break	20.9						
Elong @ Peak	14.17						
Elong @ Break	15.63						
Avg. Peak Force (N)	82.9						
M O R (N/mm²)	4878	48.78					
M O E	3595.3						
% Elongation	5						

Test Time (sec)	558.2						
Test Speed (mm/min)	1.72						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

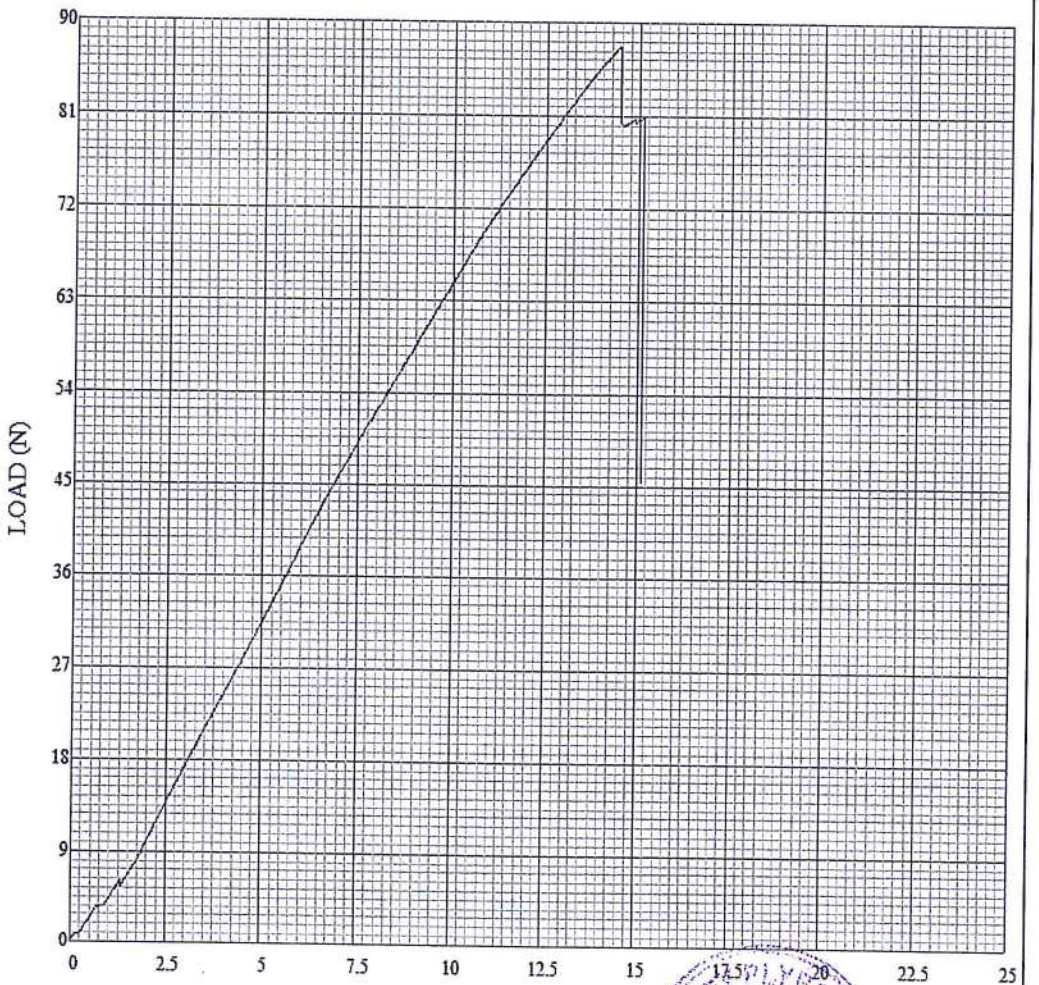
Date	Group	Batch	Operator	Specimen
08-Jan-21	12 mm testing sample	54	12/O-30-9,10/ACROSS/3	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	12						

Peak Load (N)	87.7						
Load @ Break	45.2						
Elong @ Peak	14.44						
Elong @ Break	15.11						
Avg. Peak Force (N)	87.7						

M O R (N/mm²)	5160.44	51.60					
M O E	3934.37						
% Elongation	5						

Test Time (sec)	560						
Test Speed (mm/min)	1.72						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	55	6/O-25-5,6/ALONG/1	PLYWOOD

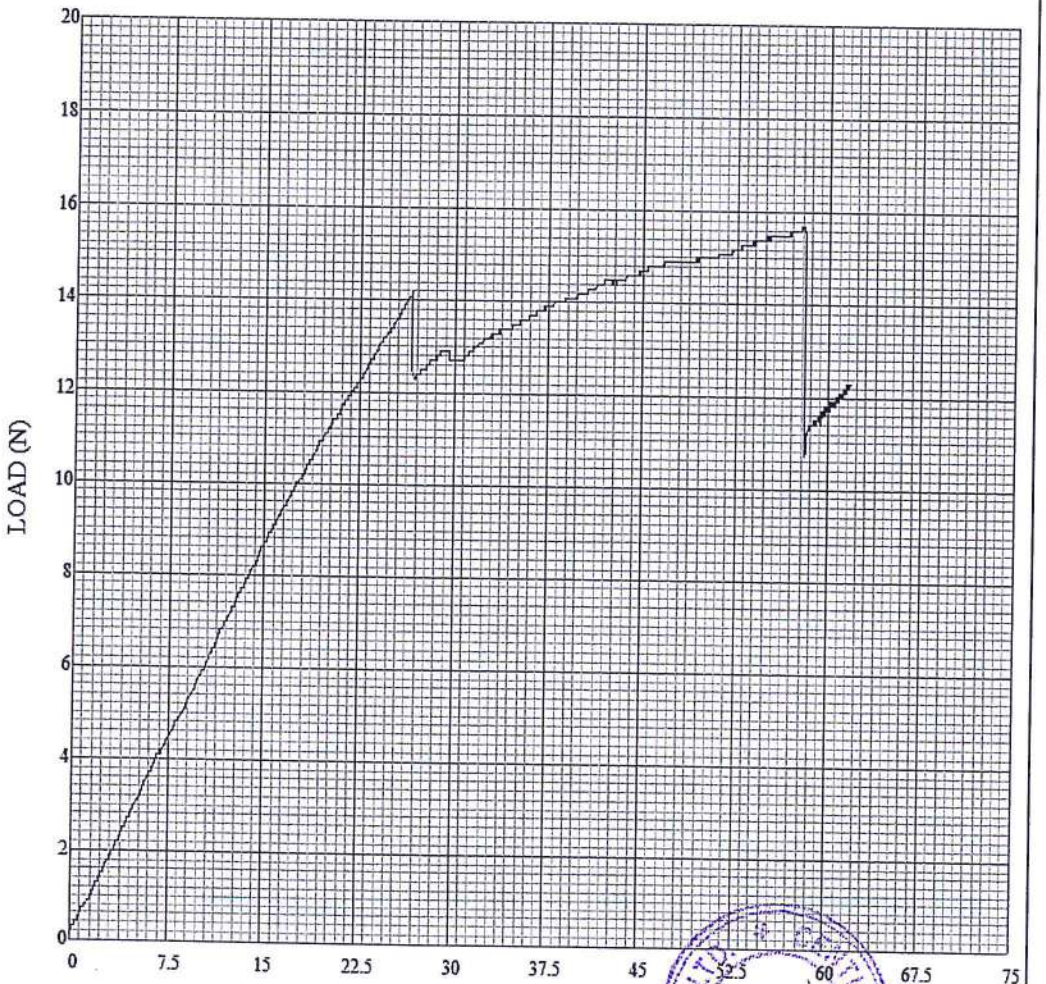
Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	6						

Peak Load (N)	15.7						
Load @ Break	12.3						
Elong @ Peak	57.71						
Elong @ Break	61.7						

Avg. Peak Force (N) 15.7

M O R (N/mm²)	3695.28						
M O E	1379.89						
% Elongation	21						

Test Time (sec)	1255.4						
Test Speed (mm/min)	3.45						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

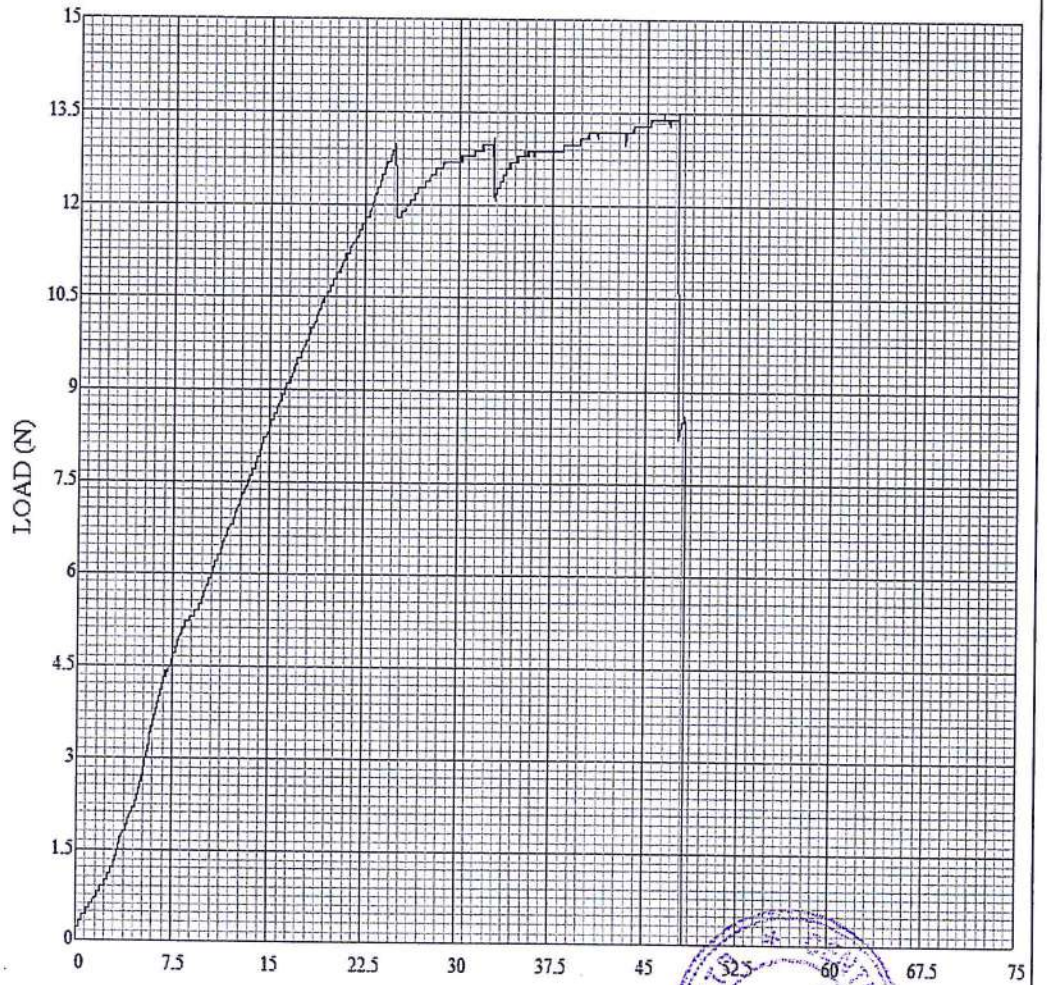
Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	56	6/O-25-5,6/ALONG/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	6						

Peak Load (N)	13.5						
Load @ Break	0						
Elong @ Peak	46.25						
Elong @ Break	50.14						
Avg. Peak Force (N)	13.5						

M O R (N/mm²)	3177.47						
M O E	1460.09						
% Elongation	17						

Test Time (sec)	914.6						
Test Speed (mm/min)	3.45						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

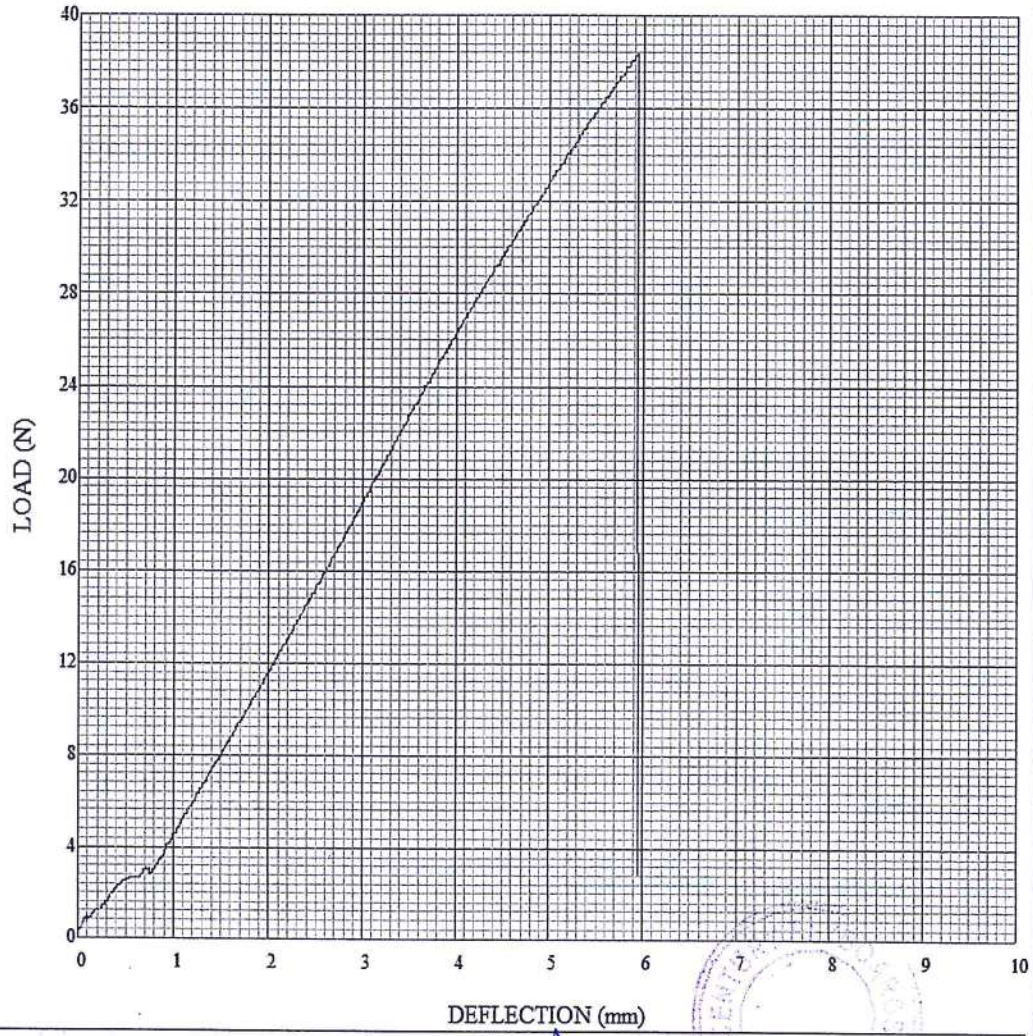
UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	57	6/O-25-5,6/ACROSS/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	144						
Thickness (mm)	6						

Peak Load (N)	38.4						
Load @ Break	2.8						
Elong @ Peak	5.94						
Elong @ Break	5.95						
Avg. Peak Force (N)	38.4						
M O R (N/mm²)	4519.07	45.19					
M O E	4374.76						
% Elongation	4						

Test Time (sec)	474.3						
Test Speed (mm/min)	0.864						



Checked By : Mohit Lavkan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	58	6/O-25-5,6/ACROSS/2	PLYWOOD

Specimen No.	0					
Width (mm)	50					
Length (mm)	144					
Thickness (mm)	6					

Peak Load (N)	29.8					
Load @ Break	8.4					
Elong @ Peak	5.97					
Elong @ Break	6.01					
Avg. Peak Force (N)	29.8					
M O R (N/mm²)	3506.98	35.06				
M O E	3361.1					
% Elongation	4					

Test Time (sec)	506.8					
Test Speed (mm/min)	0.864					

Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

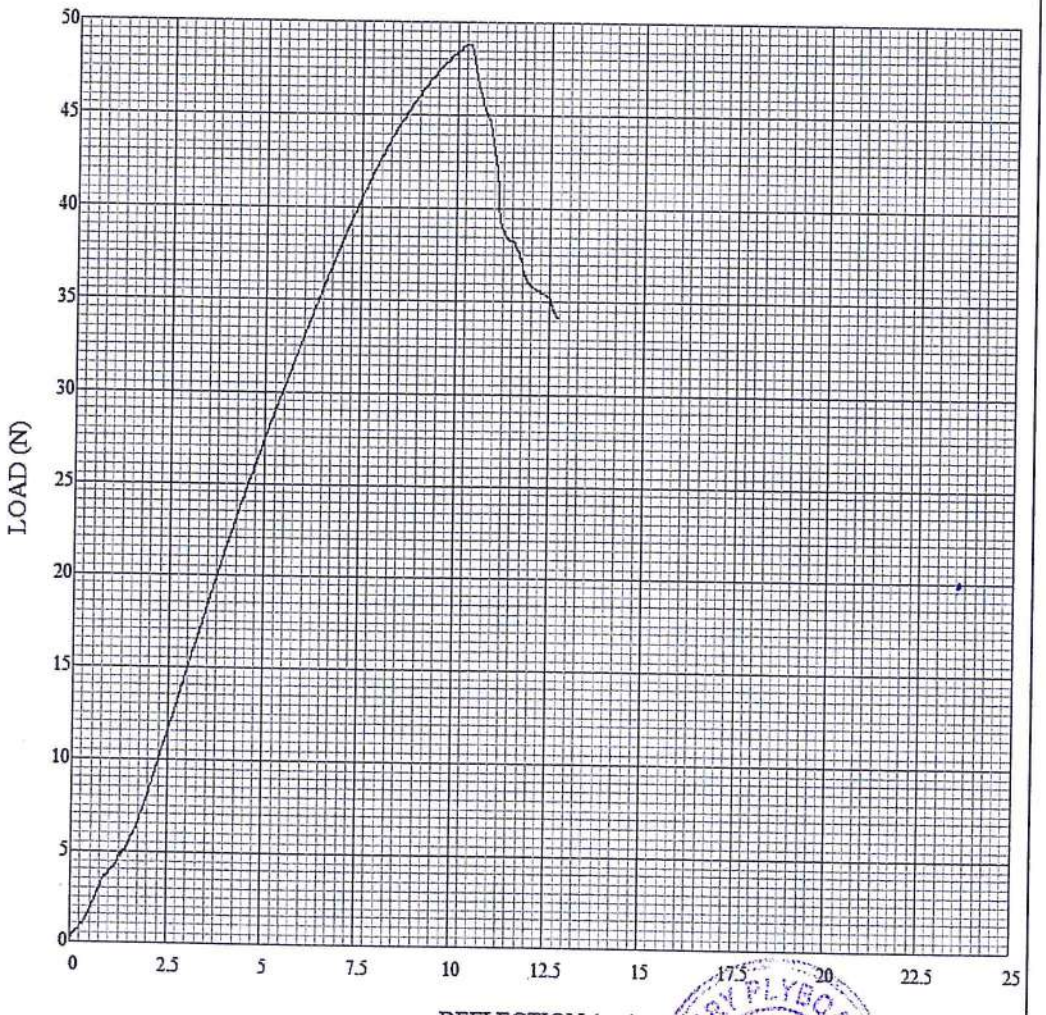
Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	59	6/O-25-5,6/ACROSS/3	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	144						
Thickness (mm)	6						

Peak Load (N)	48.8						
Load @ Break	34.1						
Elong @ Peak	10.21						
Elong @ Break	12.73						
Avg. Peak Force (N)	48.8						

M O R (N/mm²)	5742.98	57.42					
M O E	2598.55						
% Elongation	9						

Test Time (sec)	1088.1						
Test Speed (mm/min)	0.864						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

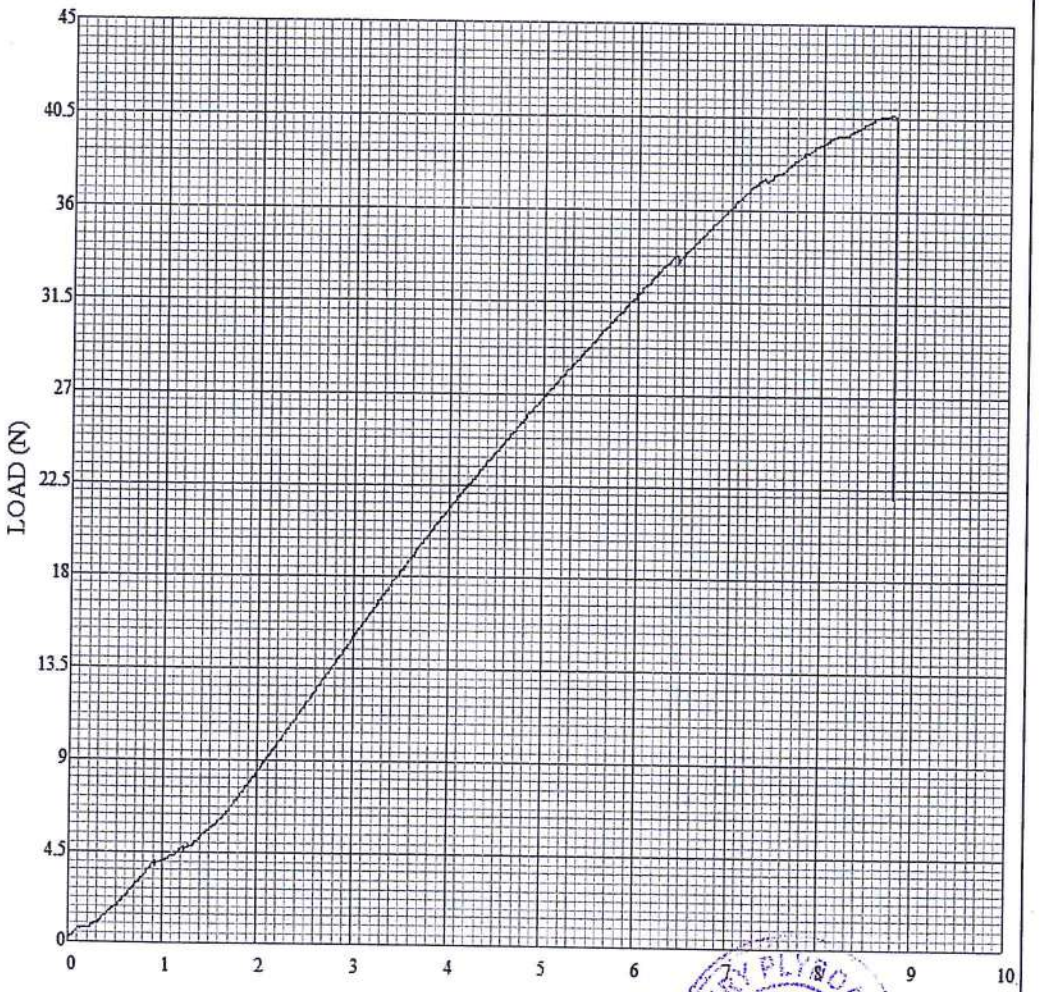
Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	60	6/G-25-5,6/ACROSS/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	144						
Thickness (mm)	6						

Peak Load (N)	40.7						
Load @ Break	21.9						
Elong @ Peak	8.72						
Elong @ Break	8.78						
Avg. Peak Force (N)	40.7						

M O R (N/mm²)	4789.74	47.89					
M O E	3142.24						
% Elongation	6						

Test Time (sec)	816.3						
Test Speed (mm/min)	0.864						



Checked By : Mohit Chauhan

Remarks : .....

Verified By

N. Singh

CENTURY PLYBOARDS (I) LTD.

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

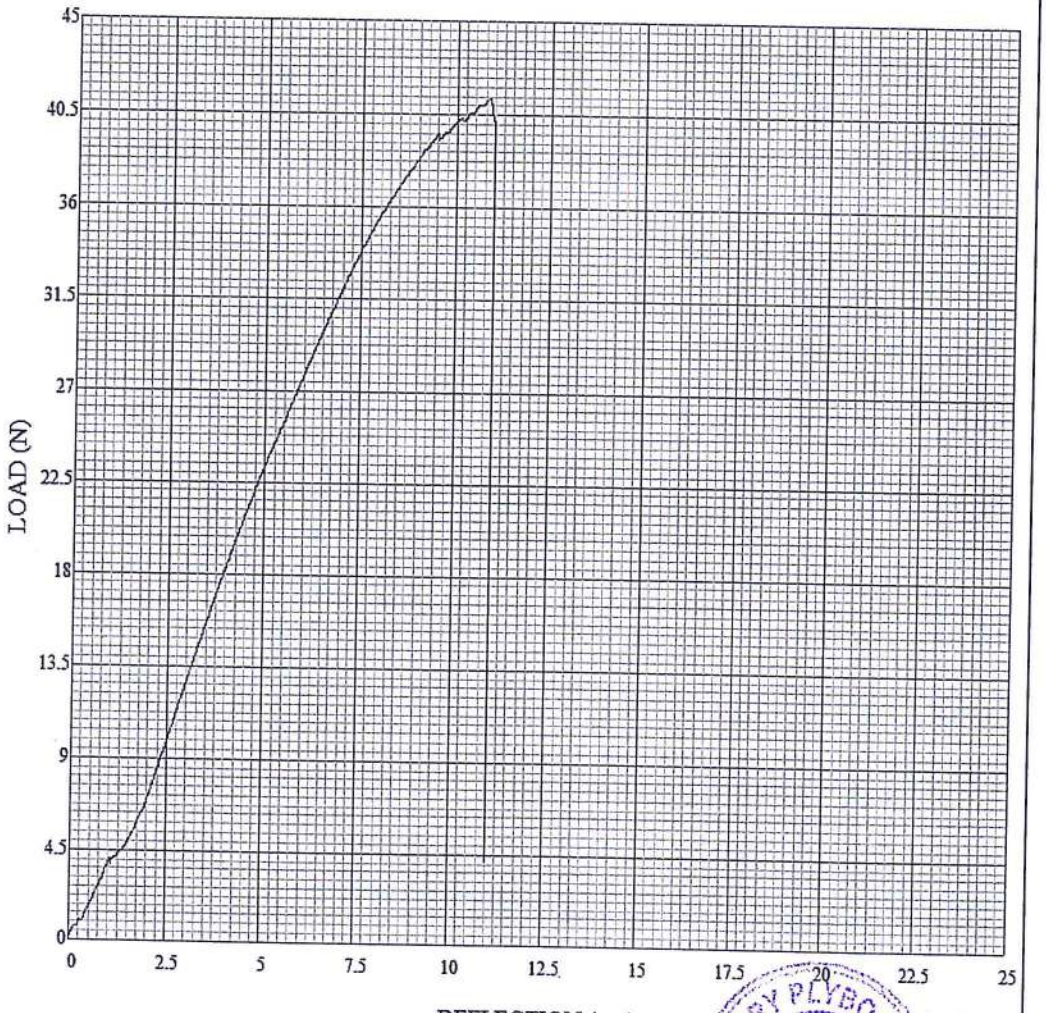
Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	61	6/G-25-5,6/ACROSS/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	144						
Thickness (mm)	6						

Peak Load (N)	41.3						
Load @ Break	4.1						
Elong @ Peak	10.83						
Elong @ Break	11.01						
Avg. Peak Force (N)	41.3						

M O R (N/mm²)	4860.35	48.60					
M O E	2542.74						
% Elongation	8						

Test Time (sec)	857.6						
Test Speed (mm/min)	0.864						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

CENTURY PLYBOARDS (INDIA)

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	62	6/G-25-5,6/ACROSS/3	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	144						
Thickness (mm)	6						

Peak Load (N)	26.2						
Load @ Break	18.2						
Elong @ Peak	5.54						
Elong @ Break	5.75						
Avg. Peak Force (N)	26.2						
M O R (N/mm²)	3083.32	30.83					
M O E	3088.68						
% Elongation	4						

Test Time (sec)	457						
Test Speed (mm/min)	0.864						

Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

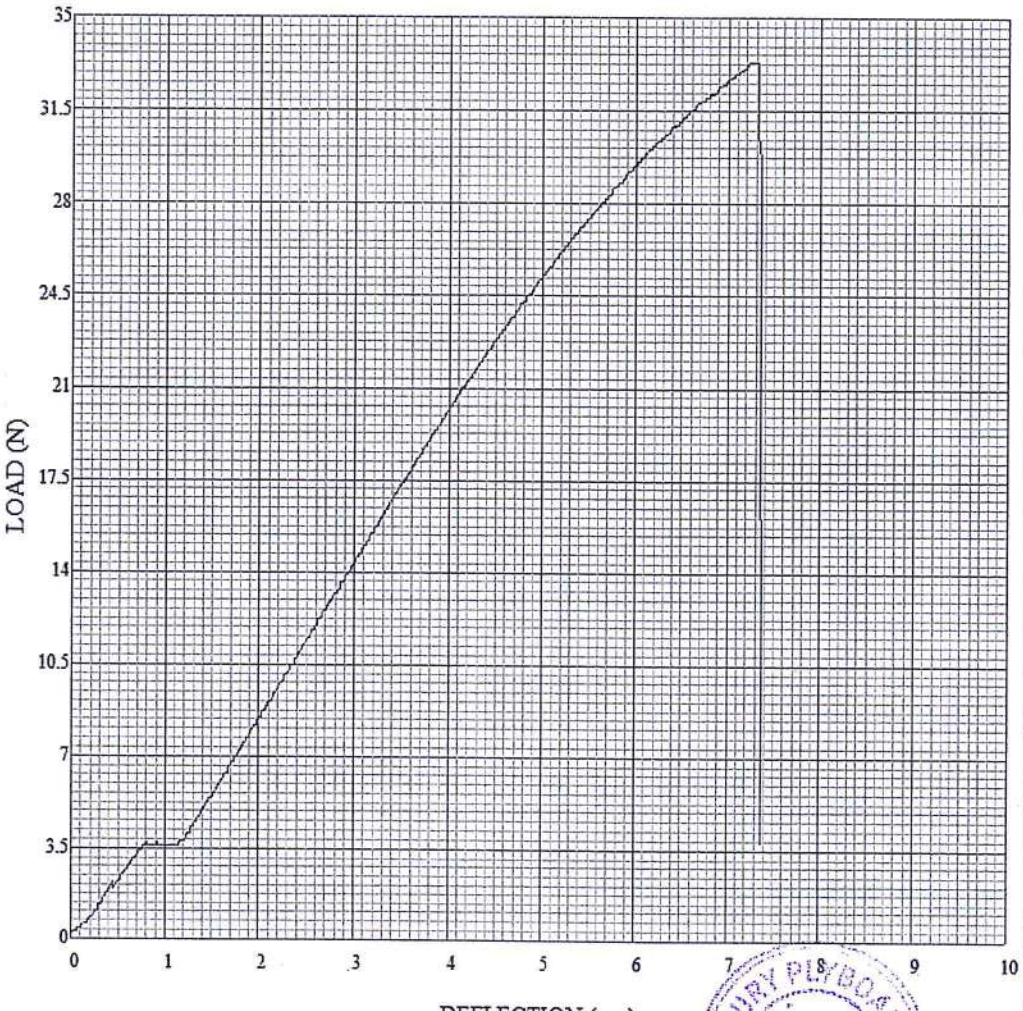
Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	63	6/G-28-5,6/ACROSS/1	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	144						
Thickness (mm)	6						

Peak Load (N)	33.3						
Load @ Break	3.7						
Elong @ Peak	7.23						
Elong @ Break	7.37						
Avg. Peak Force (N)	33.3						

M O R (N/mm²)	3918.88	39.18					
M O E	3062.79						
% Elongation	5						

Test Time (sec)	571.8						
Test Speed (mm/min)	0.864						



Checked By : Mohitchauhan

Remarks : .....

Verified By : .....

N. Singh

CENTURY PLYBOARDS (I) LTD.

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	64	6/G-28-5,6/ACROSS/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	144						
Thickness (mm)	6						

Peak Load (N)	38.2						
Load @ Break	2.7						
Elong @ Peak	6.97						
Elong @ Break	6.98						
Avg. Peak Force (N)	38.2						

M O R (N/mm²)	4495.53						
M O E	3709.78						
% Elongation	5						

Test Time (sec)	565.5						
Test Speed (mm/min)	0.864						

Checked By : Mohitchauhan

Remarks : .....

Verified By : .....

CENTURY PLYBOARDS (INDIA) LTD.

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

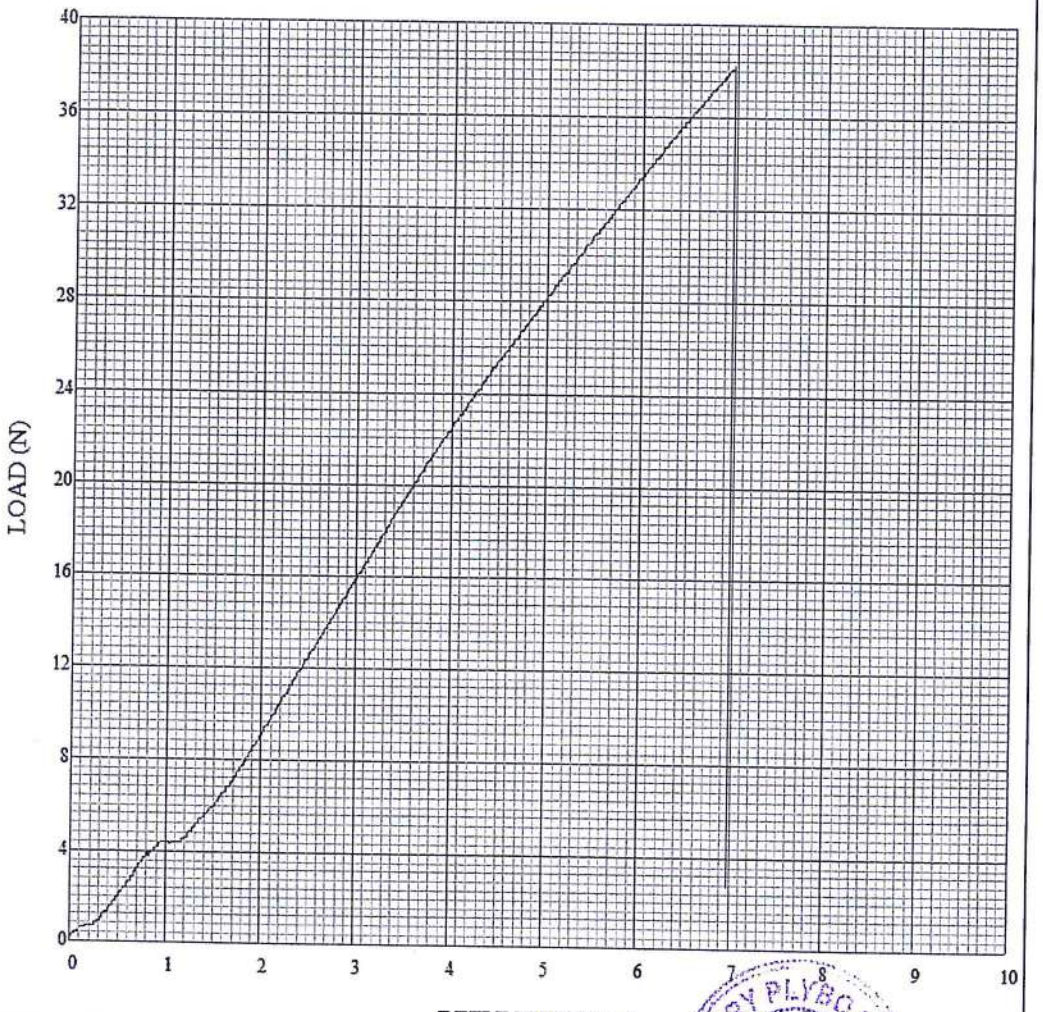
Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	64	6/G-28-5,6/ACROSS/2	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	144						
Thickness (mm)	6						

Peak Load (N)	38.2						
Load @ Break	2.7						
Elong @ Peak	6.97						
Elong @ Break	6.98						
Avg. Peak Force (N)	38.2						

M O R (N/mm²)	4495.53	44·95					
M O E	3709.78						
% Elongation	5						

Test Time (sec)	565.5						
Test Speed (mm/min)	0.864						



Checked By : Mohit chauhan

Remarks : .....

Verified By : .....

CENTURY PLYBOARDS (INDIA) LTD.

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

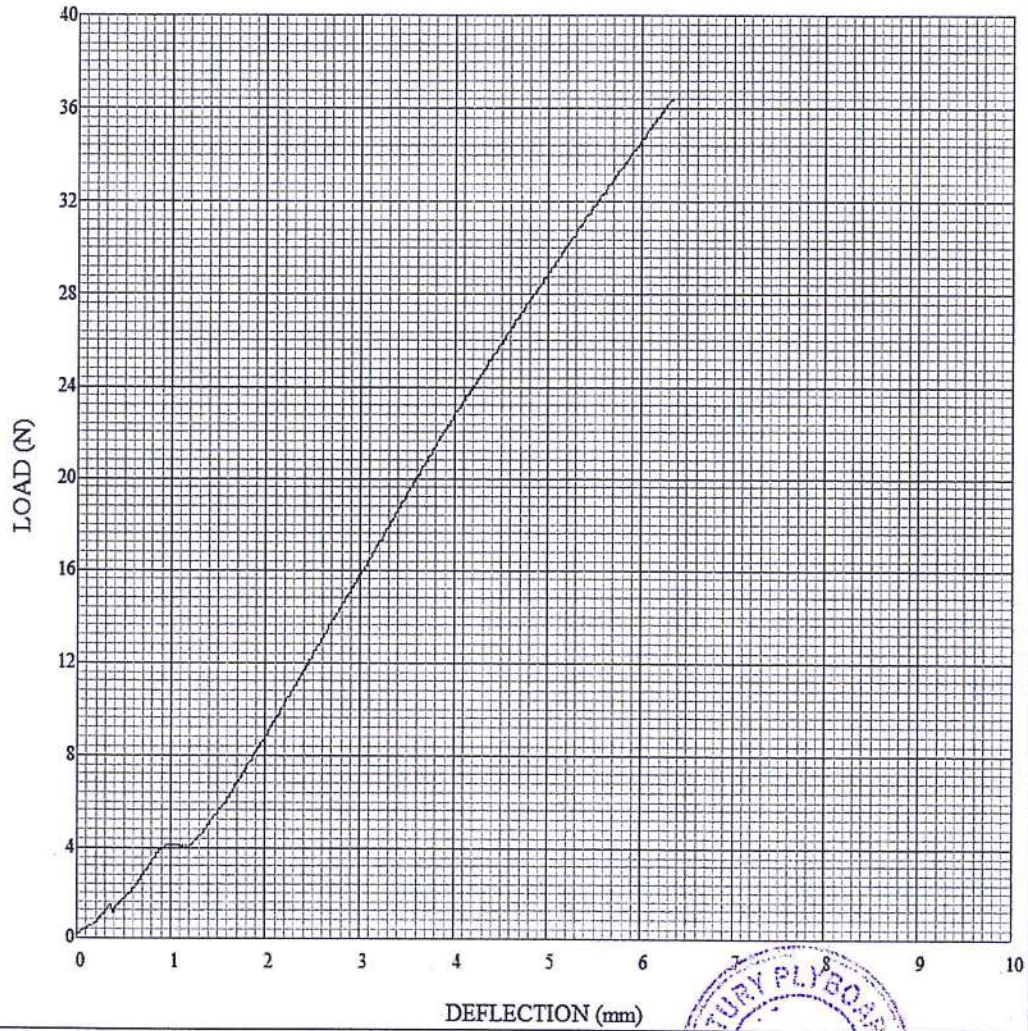
Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	65	6/G-28-5,6/ACROSS/3	PLYWOOD

Specimen No.	0						
Width (mm)	50						
Length (mm)	144						
Thickness (mm)	6						

Peak Load (N)	36.5						
Load @ Break	36.5						
Elong @ Peak	6.33						
Elong @ Break	6.33						
Avg. Peak Force (N)	36.5						

M O R (N/mm²)	4295.47	42.95					
M O E	3908.67						
% Elongation	4						

Test Time (sec)	500.1						
Test Speed (mm/min)	0.864						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

CENTURY PLYBOARDS (INDIA) LTD.

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

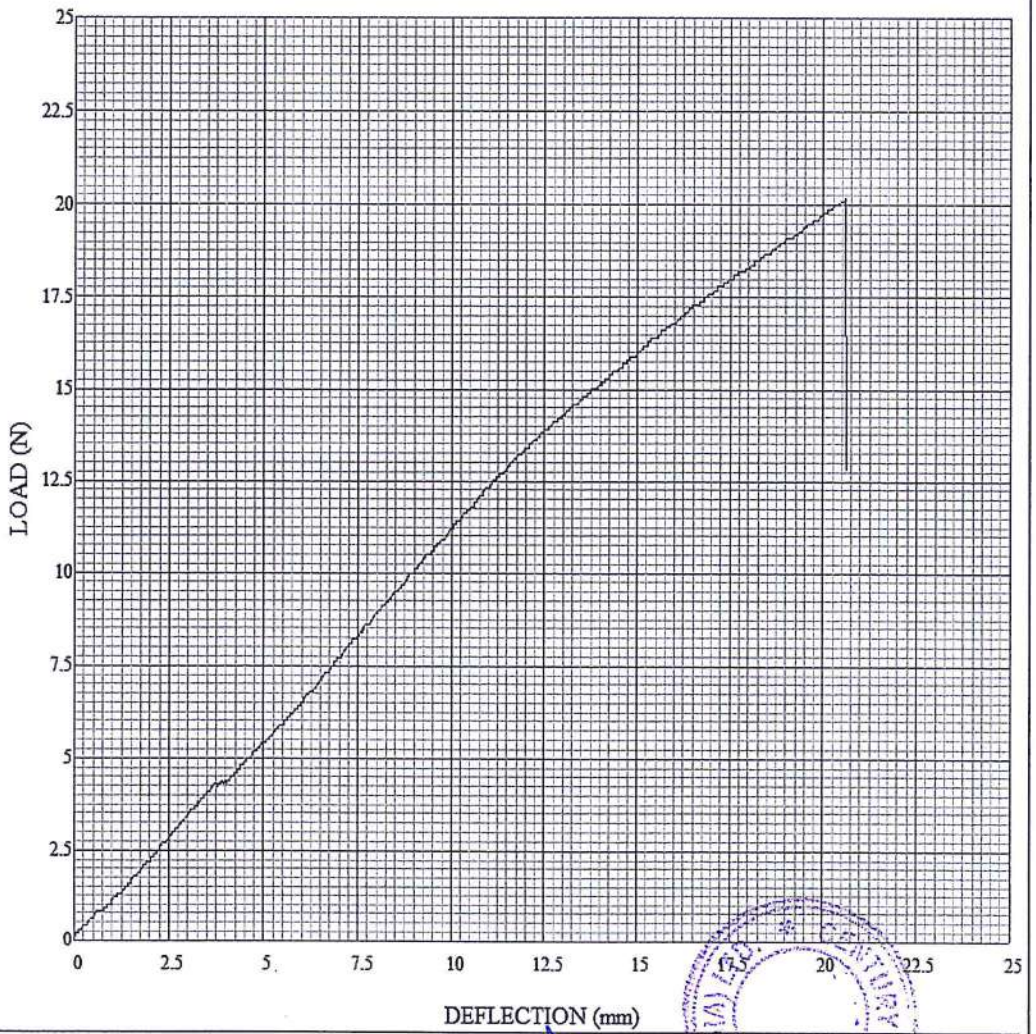
Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	66	6/G-28-5,6/ALONG/2	PLYWOOD

Specimen No.	0					
Width (mm)	50					
Length (mm)	288					
Thickness (mm)	6					

Peak Load (N)	20.2					
Load @ Break	12.8					
Elong @ Peak	20.58					
Elong @ Break	20.62					
Avg. Peak Force (N)	20.2					

M O R (N/mm²)	4754.43					
M O E	5312.42					
% Elongation	7					

Test Time (sec)	365.2					
Test Speed (mm/min)	3.45					



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

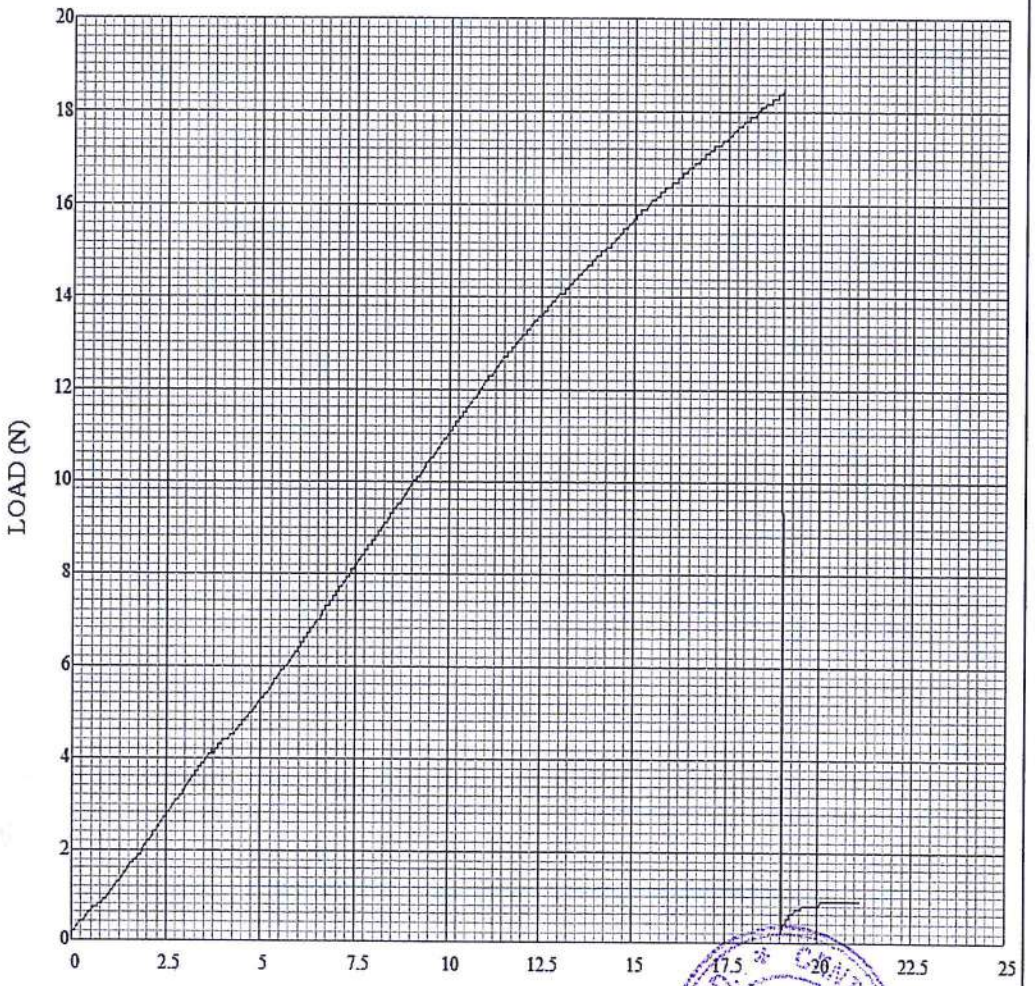
Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	67	6/G-28-5,6/ALONG/3	PLYWOOD

Specimen No.	0					
Width (mm)	50					
Length (mm)	288					
Thickness (mm)	6					

Peak Load (N)	18.5					
Load @ Break	0.9					
Elong @ Peak	18.99					
Elong @ Break	21.13					
Avg. Peak Force (N)	18.5					

M O R (N/mm²)	4354.31					
M O E	4747.91					
% Elongation	7					

Test Time (sec)	386.1					
Test Speed (mm/min)	3.45					



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

68

F/G-28-5,6/ALONG/1

→ Went for trial

→ Sample did not break at full elongation

Mohit Chauhan

N. Singh.

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	69	6/G-25-5,6/ALONG/2	PLYWOOD

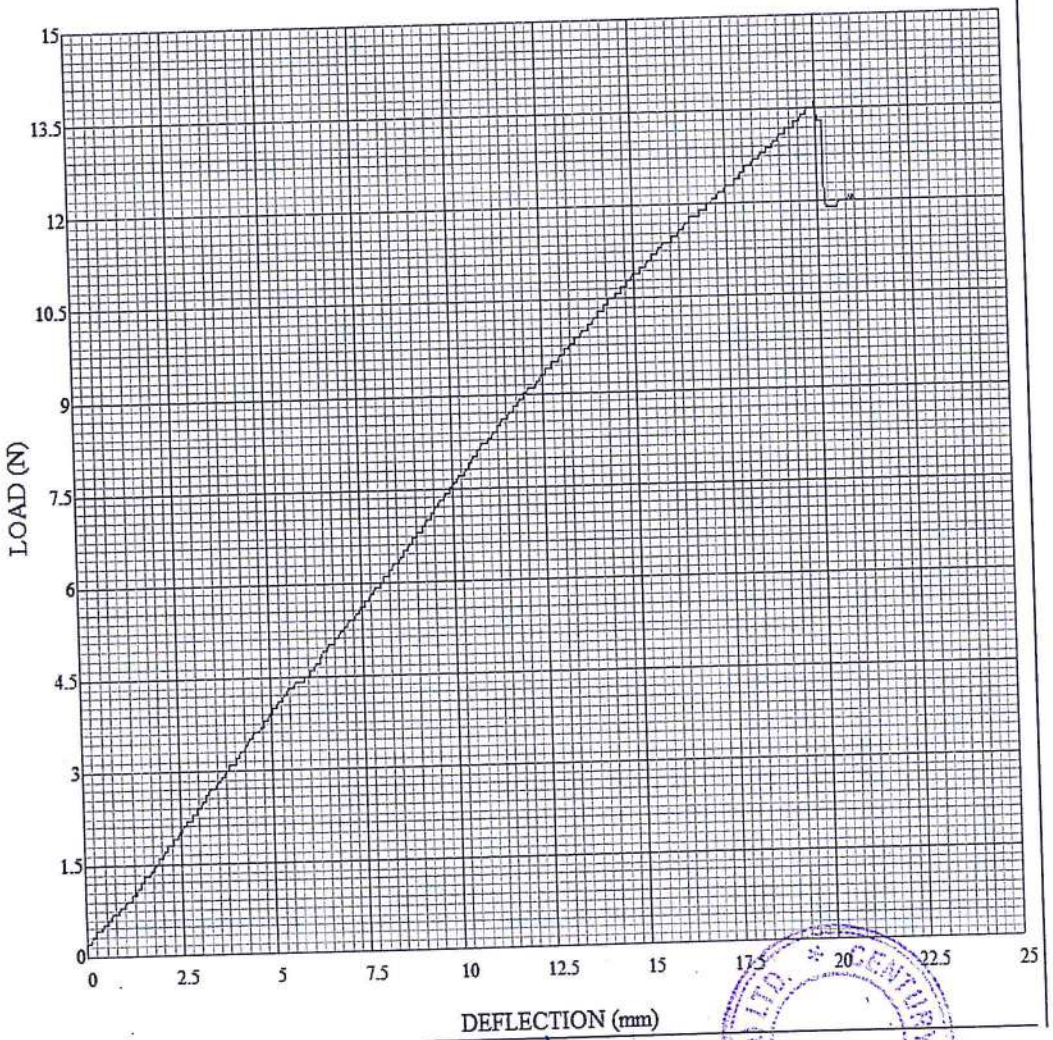
Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	6						

Peak Load (N)	13.6						
Load @ Break	12						
Elong @ Peak	19.95						
Elong @ Break	20.97						

Avg. Peak Force (N) 13.6

M O R (N/mm²)	3201	32.01					
M O E	3516.98						
% Elongation	7						

Test Time (sec)	408.4						
Test Speed (mm/min)	3.45						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	70	6/G-25-5,6/ALONG/3	PLYWOOD

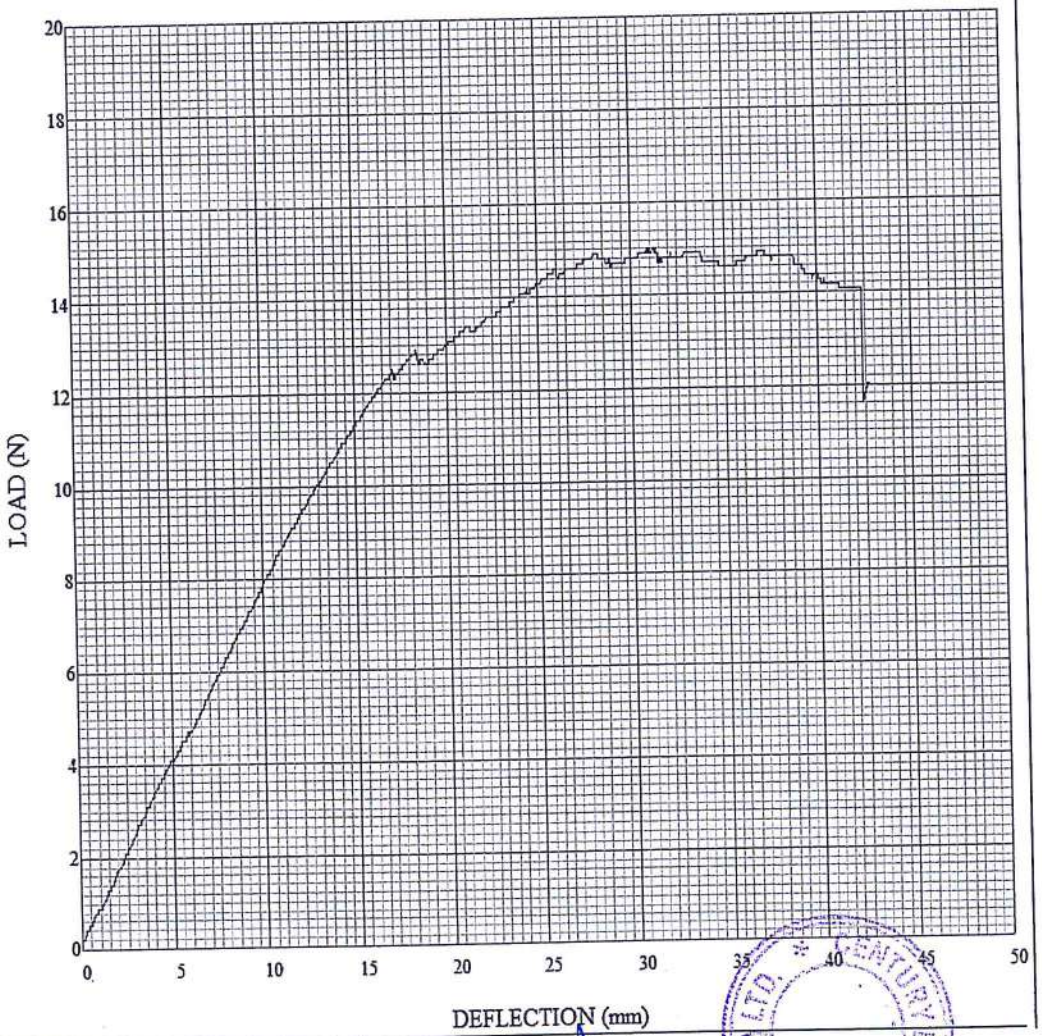
Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	6						

Peak Load (N)	15						
Load @ Break	12						
Elong @ Peak	30.85						
Elong @ Break	42.75						

Avg. Peak Force (N) 15

M O R (N/mm²)	3530.52						
M O E	1902.76						
% Elongation	15						

Test Time (sec)	774.9						
Test Speed (mm/min)	3.45						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

BENDING TEST REPORT

UNIVESAL TESTING MACHINE

Date	Group	Batch	Operator	Specimen
08-Jan-21	6 mm testing sample	71	6/G-25-5,6/ALONG/1	PLYWOOD

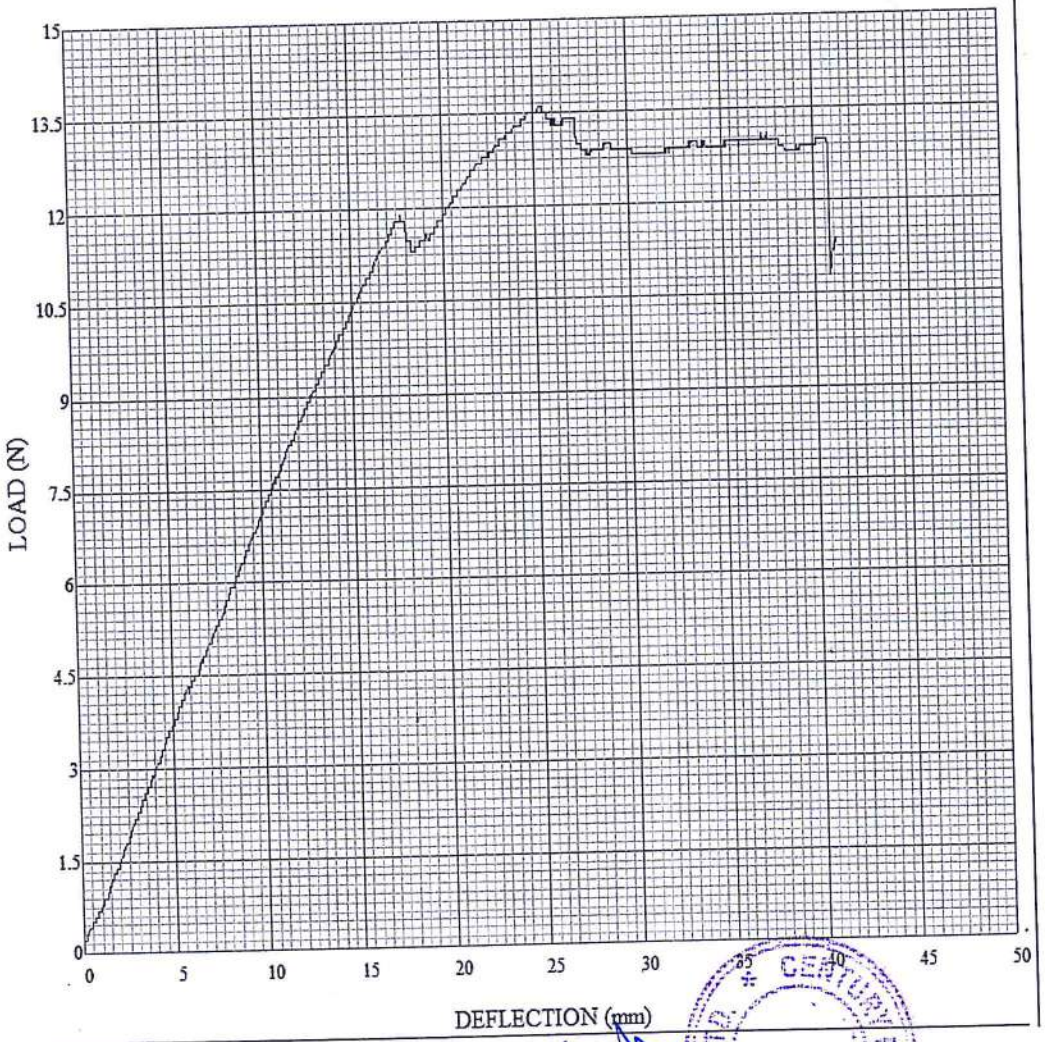
Specimen No.	0						
Width (mm)	50						
Length (mm)	288						
Thickness (mm)	6						

Peak Load (N)	13.6						
Load @ Break	11.4						
Elong @ Peak	25.28						
Elong @ Break	41.16						

Avg. Peak Force (N) 13.6

M O R (N/mm²)	3201						
M O E	1791.82						
% Elongation	14						

Test Time (sec)	740						
Test Speed (mm/min)	3.45						



Checked By : Mohit Chauhan

Remarks : .....

Verified By : .....

From the above result, it is reflecting that 6 mm ALONG the grain plywood sample is not meeting the requirements mostly. It is to inform that particularly in case of these samples, the observation of Central loading method was different. When the load was acting at the centre of the specimen, the specimen underwent deflection, which was the case with all other samples but only upto a point where other samples failed, 6mm plywood samples continued to form an ARC and thus deflection kept on increasing. There came a point where the sample ARC formation touched the base of the platform and thus, no further load could be applied. It can be complemented from the fact that elongation in all such cases is very high in comparison to all other samples, hence to call it a failure may NOT BE TRUE. Another probability is slipping action may have occurred during testing, thereby giving faulty results.

CONCLUSION:

Available Face Veneer Varieties: Gurjan (0.25 mm, 0.28 mm), Okume (0.25 mm, 0.30 mm)
Thickness: 6mm, 12mm & 19 mm
Grain Directions: ALONG, ACROSS
Now with above available options the possible combinations are

(a) Gurjan-0.25 mm-6 mm-ALONG- MOE-F, MOR-F
(b) Gurjan-0.25 mm-6 mm-ACROSS- MOE-P, MOR-P
(c) Gurjan-0.25 mm-12 mm-ALONG- MOE-F, MOR-P
(d) Gurjan-0.25 mm-12 mm-ACROSS- MOE-P, MOR-P
(e) Gurjan-0.25 mm-19 mm-ALONG- MOE-P, MOR-P
(f) Gurjan-0.25 mm-19 mm-ACROSS- MOE-P, MOR-P
(g) Gurjan-0.28 mm-6 mm-ALONG- MOE-P, MOR-P
(h) Gurjan-0.28 mm-6 mm-ACROSS- MOE-P, MOR-F
(i) Gurjan-0.28 mm-12 mm-ALONG- MOE-P, MOR-P
(j) Gurjan-0.28 mm-12 mm-ACROSS- MOE-P, MOR-P
(k) Gurjan-0.28 mm-19 mm-ALONG: MOE-P, MOR-P
(l) Gurjan-0.28 mm-19 mm-ACROSS- MOE-P, MOR-P
(m) Okume-0.25 mm-6 mm-ALONG- MOE-F, MOR-P
(n) Okume-0.25 mm-6 mm-ACROSS- MOE-P, MOR-P
(o) Okume-0.25 mm-12 mm-ALONG- MOE-F, MOR-F
(p) Okume-0.25 mm-12 mm-ACROSS- MOE-P, MOR-P
(q) Okume-0.25 mm-19 mm-ALONG- MOE-P, MOR-P
(r) Okume-0.25 mm-19 mm-ACROSS- MOE-P, MOR-P
(s) Okume-0.30 mm-6 mm-ALONG- MOE-F, MOR-F
(t) Okume-0.30 mm-6 mm-ACROSS- MOE-P, MOR-P
(u) Okume-0.30 mm-12 mm-ALONG- MOE-F, MOR-P
(v) Okume-0.30 mm-12 mm-ACROSS- MOE-P, MOR-P
(w) Okume-0.30 mm-19 mm-ALONG: MOE-P, MOR-P
(x) Okume-0.30 mm-19 mm-ACROSS- MOE-P, MOR-P

***P means PASS and F means FAIL**

From above, it can be concluded that:

(i) For 19mm plywood, sample is passing for every combination.

(ii) For 12 mm plywood, sample passes in 0.28 mm Gurjan completely. Sample fails in Gurjan and Okume 0.25 mm combinations. With Okume 0.30 mm, Sample fails marginally in MOE by 14%.

(iii) For 6 mm plywood, all samples for all combinations passes ACROSS the grain direction. When we test ALONG the grain direction, sample passes for Gurjan-0.28 mm.
However in most of the cases with 6mm sample, the specimen did not break even after deformation, thus letting the specimen to form an ARC and touching the base of UTM fixtures. Thus gradually load reduces beyond this so the values obtained are appearing as FAIL, but the material did not fail during testing.

SUMMARY:

With the above observations, it is concluded that the MOR/MOE values can be mostly achieved with the lower face veneer thicknesses provided the manufacturing process and raw material controls are exercised properly.
The above trial was conducted on general plywood, BWR grade as per IS 303 with all amendments assuming market practice of using 0.5mm face veneers, only for getting BIS license and thereby using lesser thickness face veneers during operation of the license.

Similarly, as we know the market practice of using 0.25-0.30mm and even less thickness face veneers for all kinds of plywood, hence, to meet the face veneer thickness requirements as per ISS is difficult. The face veneer requirements as per ISS are as below:

- IS 303- 0.5 mm (min)- regular practice
- IS 4990- 1.2 mm (min)
- IS 2202(P-1)- 0.5 mm (min)
- IS 1659- 0.5 mm

Therefore, such trials shall also be conducted on different plywood for analyzing the strength parameters with lower face veneer thicknesses.

Also some manufacturers are doing double/triple facing to meet the thickness requirements for various ISS of plywood. The manufacturers adopt double/triple facing method so that the samples pass in testing but the normal practice is still questionable. However the method is also no where documented in the standard.

Hence, as per above trial on general plywood, lower face veneer thickness may be permitted and Standard for General Plywood and related products may be amended by the Technical Committee.

References:

- **Indian standards for Plywood and related products**

- **ISO standards**

ISO 12465, Plywood- Specifications
ISO 1954, Plywood — Tolerances on dimensions
ISO 16978, Wood-based panels — Determination of modulus of elasticity in bending and of bending strength
ISO 2426-1:2000
Plywood — Classification by surface appearance — Part 1: General
ISO 2426-2:2000
Plywood — Classification by surface appearance — Part 2: Hardwood
ISO 2426-3:2000
Plywood — Classification by surface appearance — Part 3: Softwood

- **Indian Plywood Industries Research and Training Institute** (**IPIRTI**)

- **PlyReorter YouTube videos- For understanding Crisis and market Situation of Face veneers**