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Reliability Improvement of EP-UHR Belt Joint

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I. BACKGROUND

This UHR based belt conveyor was installed in year 2012. Since commissioning this conveyor belt joint reliability was a concern in joint due to crack in channels or at 2nd step of splicing. Several UHR belts (EP or aramid fabric) with multiple manufacturers were tried but problem was not resolved. In year 2018, Capacity enhancement project of this circuit was taken by plant, wherein the drive pulley diameter was increased from 500 mm to 630 mm, but no improvement was observed in belt joint life.

This belt joint failure was holistically studied, including system analysis wrt transition distance, tension variation, belt construction & rating, validation of counterweight, troughability, temperature effect, minimum pulley diameter calculation, splicing & Jointing process.

Belt joint crack history (during FY12 to FY20) is shown in table-1 below:

Table-1

S	Jointing (New/ Re-joint) date	Joint life (month)	Reason of re-joint	Belt supplier	Joint making team
1	01.04.2012	8	Belt change	AA	A
	09.12.2012	3	Crack in joint area		C
2	06.03.2013	2	Belt change	BB	A
	05.05.2013	2	Crack in joint area		B
	03.07.2013 (Clip)	2	Crack in joint area		A
3	31.10.2013	2	Belt change	AA	D
	16.12.2013	6	Air pocket in joint		C
	25.06.2014	4	Crack in joint area		A
	14.7.2014	1	Crack in joint		B

4	08-10-2014	5	Belt change due to burning	CC	C
	24-03-2015	7	Joint open		B
	05.05.2015	2	Crack in joint-Repair		B
5	07-10-2015	5	Worn out belt		B
	17-03-2016	3	Side edge damaged		B
6	15-06-2016	5	Joint opened from top	History not available	B
	21.09.2016	3	Belt and joint burnt		B
7	23-11-2016	8	Belt tear		B
8	06-07-2017	7	Crack in joint		B
9	01-02-2018	7	Aramid belt installed	DD	B
	27.03.2018	1	Aramid joint overlap opened		B
	02.12.2018	1	Crack in joint area		C
	07-02-2019	2	Aramid joint failed		C
	28.04.2019	2	Aramid belt joint snapped		B
10	29-04-2019	3	EP fabric belt installed	DD	B
	02-07-2019	3	Crack in re-joint		A
	04-10-2019	0.5	Joint clipping due to crack in joint		
	15-10-2019	0.5	Joint clipping due to crack in joint		
	29-10-2019		Belt Snapped from joint		
11	05-11-2019	Running	Belt change with hot joint	DD	
	23-12-2019	Running	Air pocket formed & repaired		

Based on table-1, the belt joint life is observed max-09 months & min-02 months (outlier is one month, it was a special case where wrong selection of splicing kit of Aramid belt, this was accepted by splicing kit supplier).

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During belt jointing on dated 29.04.2019, the jointing team had not used long flat roller subsequently air pocket was formed in the joint and these air pockets were further moved out at top channel area in the form of crack, whereas ply-ply butt joints edge, but generally this type of air pocket and joint overlap separation starting from top channel appears within 1 to 2 weeks of jointing. After 2 months, due to crack in joint, on 02.07.2019 this belt was re-jointed by hot vulcanizing with supplier splicing kit.

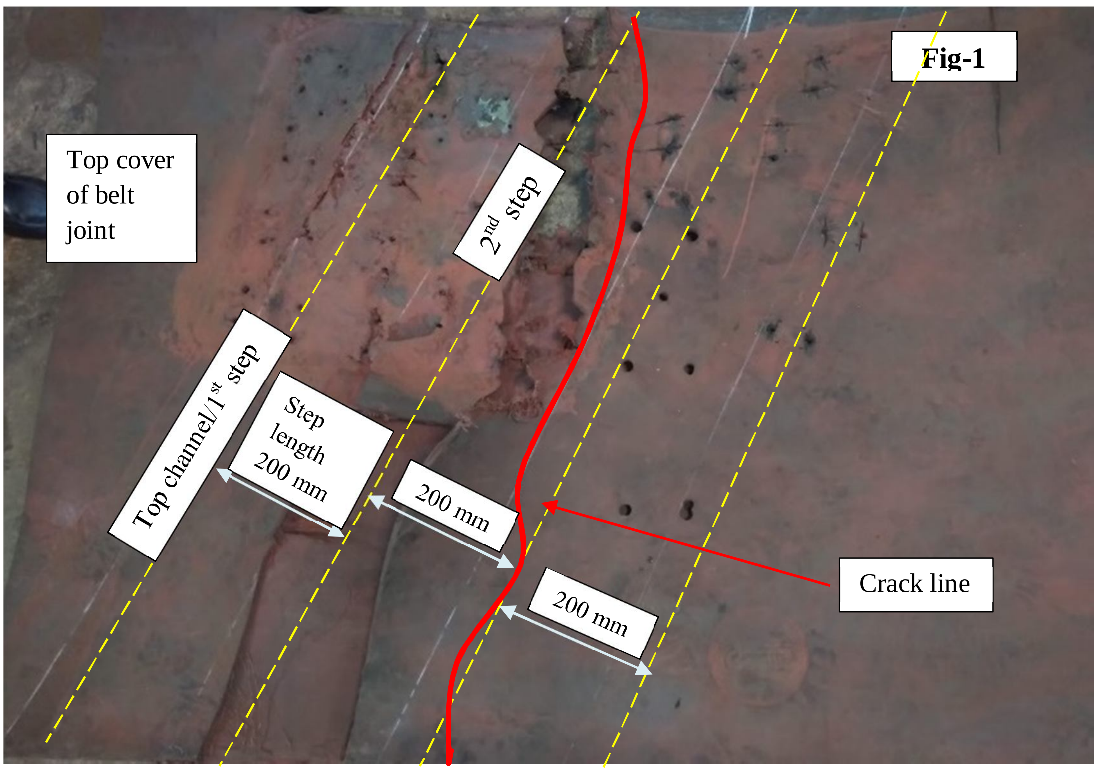
The belt hardness was checked after re-jointing & found 53-55 A shore (jointing zone) at channel area & 65-69 A shore in mother belt. After 3 months, this joint has again developed crack and it was fastened by mechanical clip on 04.10.2019. Then, On 15.10.2019, belt joint was again repaired by refastening of mechanical clips.

This repaired joint was snapped on dated 29.10.2019. The snapped joint piece has taken and sent to Lab for adhesion, tensile and abrasion tests. But due to several mechanical fasteners in joint zone, it is very difficult to get the observation which led to this situation however the analysis was based on the residual condition of joint.

II. OBSERVATION

Belt was snapped from 2nd step of splice joint and multiple patch plates (coverage area was 1st step, 2nd step and 3rd step of joint) were found which was fixed by mechanical fasteners because the top channel was opened in joint.

Snapped joint was checked after removal of mechanical fasteners & patched covers. The joint crack appeared at channel in cover rubber & tear in 2nd step of joint. The failed belt joint step length was found 200 mm.



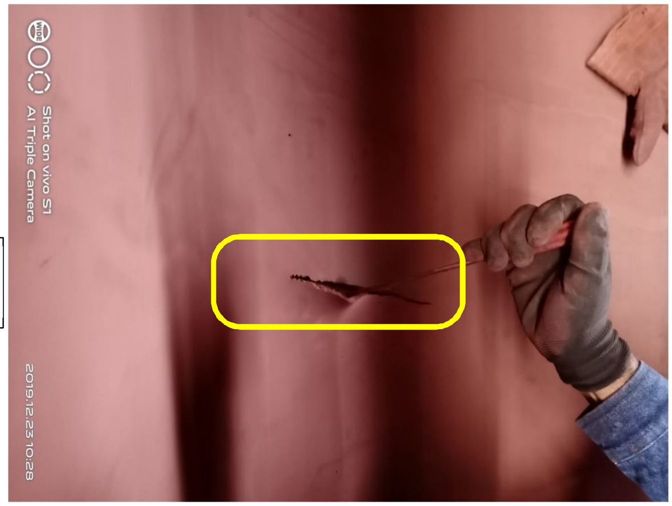
The peeling test of failed joint was done at lab and found min 6.5 Kg/25 mm (which is equivalent to 2.43 N/mm). Therefore, belt joint adhesion (ply to ply and ply to cover) was reduced drastically after 3 months of service. However, this joint peeling strength was found 20 Kg/25 mm in new joint.

Note: *Test as per IS 1891 Part-1, Table-5, Nominal minimum requirements are 4.5 N/mm between plies.*

The failed belt was replaced by new spare belt and its splicing kit (supplier-DD), the similar joint abnormality was also observed in this belt, like formation of air pocket at joint (fig-2). This was observed after 48 days of jointing. Air pocket cut to release the air.

Fig-2

Air releasing from air pocket at joint



On dated 17.06.2019, thermography of carrying material was done at site and found material temperature (161°C-230°C) more than bearing capacity of UHR grade belt. In such cases heat impression to be observed but not found visually.

Crack observed in top channel of the joint & subsequently increased and appeared as pocket. Also crack observed in the joint area .

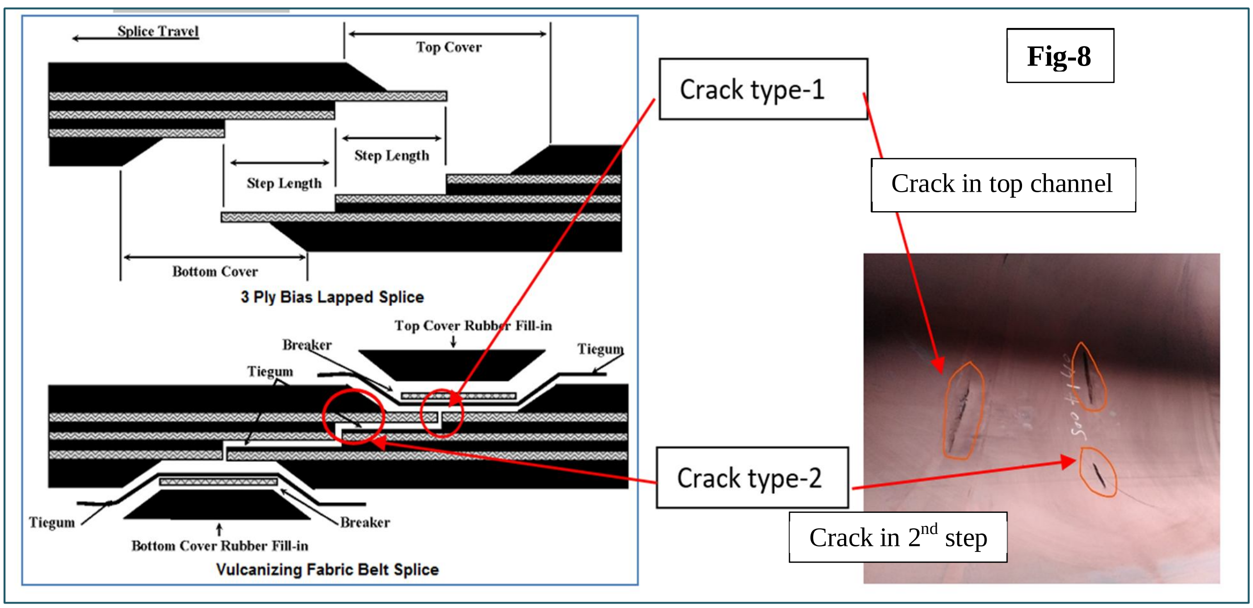


Fig-8

1) *Crack Type-1:* Long flat roller was not used by jointing agency subsequently air pocket was formed in the joint and this air pocket moved out in the form of crack at top channel area, whereas ply-ply butt joints edge (fig-1).
2) *Crack Type-2:* This crack was found in non-channel area where one ply was cracked and appeared in top side of belt (fig-1).

Based on the earlier belt joint failure, more numbers of crack observed in carrying side than return side. All process followed as per SOP except one that was long and flat roller usage implemented by jointing team in Aug'2016 to remove air pocket during insulation compound laying and overlapping.

Material temperature of upstream conveyors were found below 150°C in DCS temperature trend (fig-3). The pyrometers (temperature RTD) are installed just after receiving chute and before water spray system. The temperature was found within the belt max surface temperature rating 220°C as per belt datasheet.

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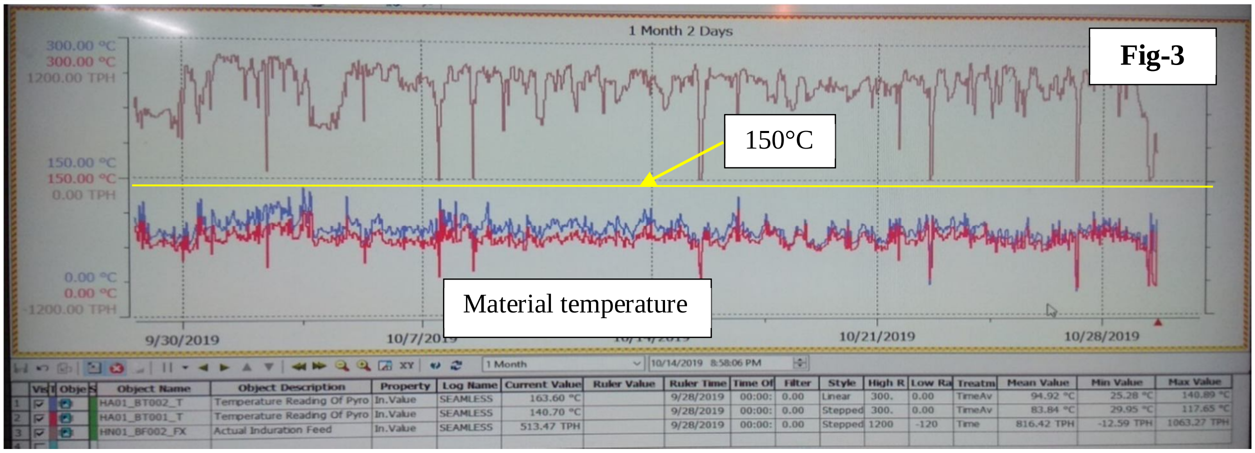
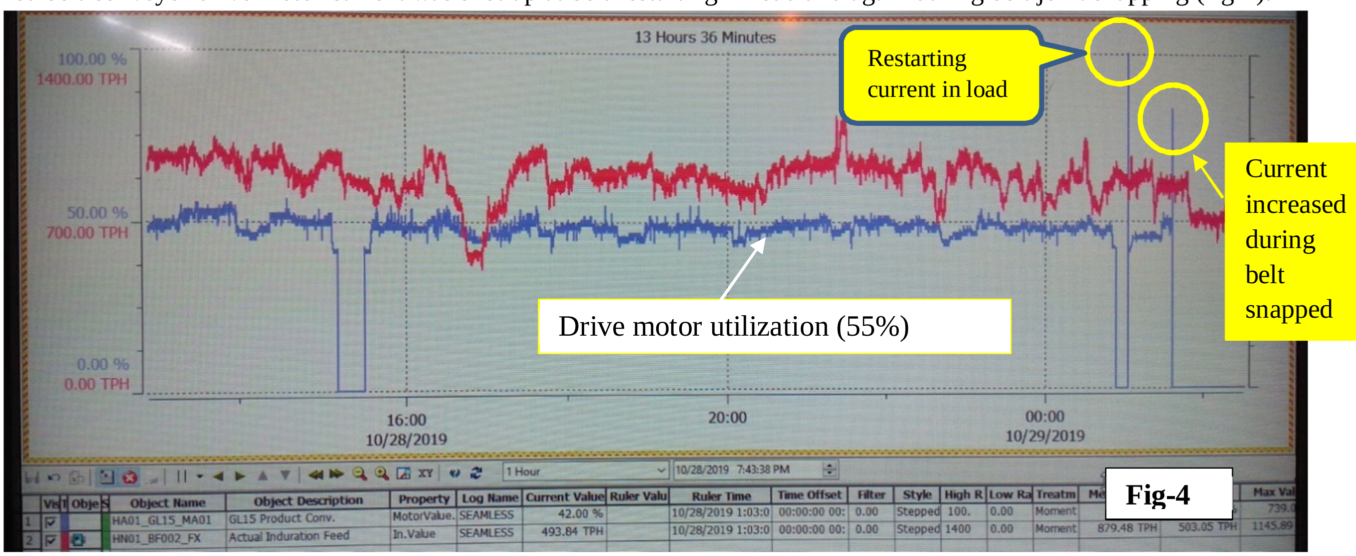
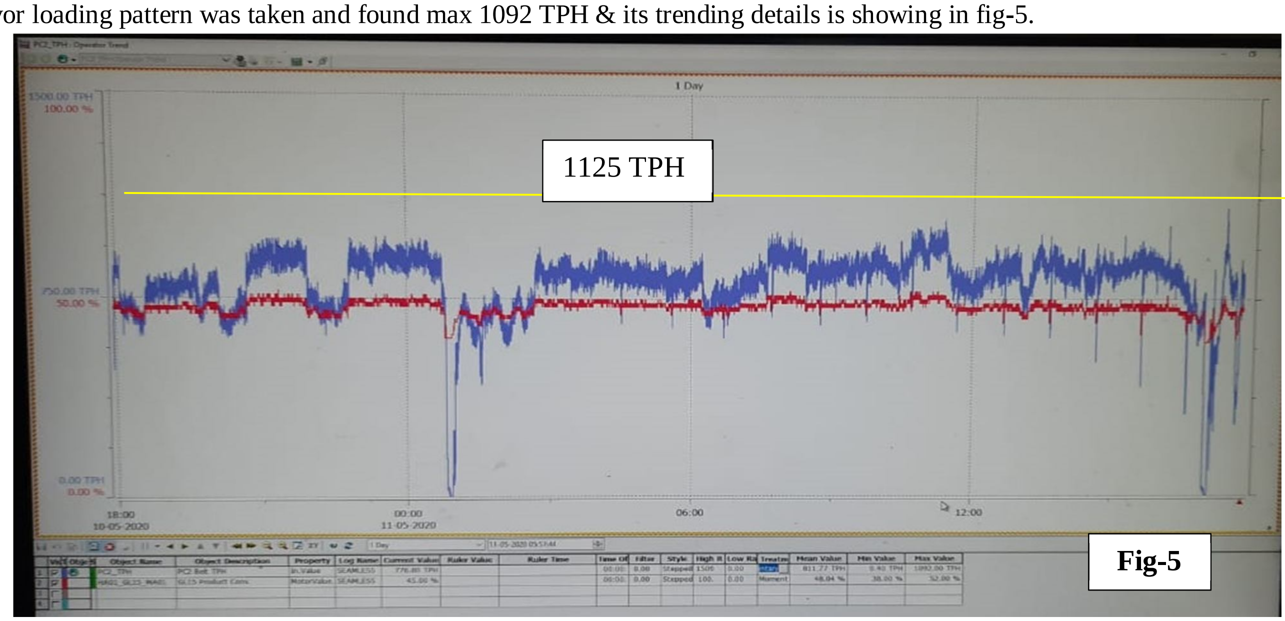


The water spray system is installed in upstream conveyors and these were found in working condition. The water spray valves operate when RTD reading cross 150 deg centigrade.

The failed belt conveyor drive motor current was shot up at belt restarting in load and again during belt joint snapping (fig-4).



Conveyor loading pattern was taken and found max 1092 TPH & its trending details is showing in fig-5.



Drive motor overload trip setting was checked and found as per norms.

Belt conveyor alarm history was checked and found that alarm on object BC_MA01 has been requested several times & these had been acknowledged by operator.

Comment by lab: Tested and valid splicing kit was used for joint making. Test joint piece was tested at lab and got result 15 kg/25mm against minimum requirement of 11.5 kg/25mm. Earlier in Oct'2018 same type splicing kit was used in same type of belt and found result 15 kg/25mm. Same lot splicing kits were also used at jointing team separately and got result 20 kg/25mm. No issue with splicing kit and adhesion.

Comparison of UHR belt performance with other loactions: Similar belt cracking problem happens, but the surface cracks appear in entire belt due to heat instead of joint.

Plant Maintenance Status: Compliance is checked and found more than 95%.

III. DETAIL ANALYSIS

A. Improper belt Jointing

1) A.1: Splicing kit: As per jointing team, Test joint was made with belt and splicing kit of supplier-DD as per SOP, further the joint peeling strength was checked & found 14 Kg/25 mm. The previous belts joints were also failed but their peeling strength were more than 18 Kg/25 mm. Hence joints peeling strength were found OK.
2) A.2: Jointing SOP & joint step length was checked and found as per OEM recommended.
3) A.4: Poor workmanship during jointing: Probable issues with workmanship are tackled as overlapping of insulation compound, non-standard tools and tackles, inadequate skill for jointing of workmen/untrained jointer (workmen), violation of belt jointing SOP, jointing time might not be maintained as per SOP, moisture ingression in joint during jointing and improper vulcanizing pressure or curing temperatures during the joining process. These conditions might be the causes but these workmen (team) are jointing UHR belts (similar grade) in other loaction and nowhere this type of joint failure has been observed.

B. Material High Temperature

1) During Belt Running

On dated 17.06.2019, Thermography of loaded material on belt was done by central monitoring team at site in running condition & found maximum average temperature 230°C, whereas 285°C by area maintenance, which is more than maximum bearing continuous temperature (180°C) capacity of UHR grade belt. During dated 29.09.2019 to 29.10.2019 (belt snapped date), as per online material temperature trend (fig-10), the loaded material temperature was found below the 150°C. As per central monitoring team report, the thermal crack in belt normally generates at edge of 2nd step in joint zone, where one ply present in top. Belt should not be stopped with hot material because this affects the joint. Hence material temperature variations were observed based on above two measurements. The edge re-straining idlers (2 nos.) were installed just before the hood of discharge pulleys to maintain the required trough shape of belt. This failed belt was not found permanent deformation in shape due to heat because of lesser service of life. Hence belt shape changes due to heat sensing by hot material.

2) Water Spray System

The water spray systems at up stream conveyors are spraying water for reducing the material temperature. Due to quenching effect, cover rubber hardness got increased & supported in creep strain in butt joint at channel (1st step) or 2nd step of belt jointing area. Further water vapour (steam) ingression through air pocket pin holes/cut and delaminate the splice of joint. Subsequently crack was generated in path of vapour flow.

3) During belt Stopped in Load

The failed belt top cover was found free from localize heat damage (hot patch, heat sensed impression etc.) by visually due to heat insertion by carrying hot material because of very short period of belt service life.

C. Inadequate Belt Selection

1) *Low Heat Resistance Cover Rubber:* As based on the belt failure history as per table-1, the failed belts were supplied by the various manufacturers (Indian & Overseas) but the all belts failure mode is almost similar (only joint failure). As per fig-3, the material temperature trend was found below 150°C but as per the central monitoring team thermography report, the material temperature was found max. 230°C however, this belt could have taken care of max. belt surface temperature 220°C as per the belt datasheet. Hence the selection of cover rubber grade (heat resistance) is not inadequate.

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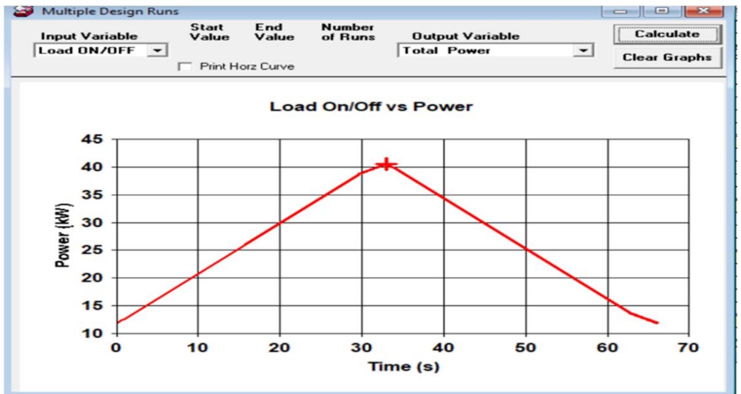
2) *High Belt Modulus:* As per supplier-DD belt data sheet, the failed belt was belt modulus 6300 KN/m (10 times of EP fabric belt rating). However further supplied belts have belt modulus 6490 KN/m as per supplier-DD. which is higher and might be affected the belt troughability. Hence belt rating should be selected as per CEMA standard.
3) *Belt Selection Error: High tensile strength*

- Drive motor max power consumption @ 55% = 41.60 kW (as per fig-4 & 5)
  Maximum running TPH=1500 x 5.5/8 = 1031.25 ~1032 TPH
  As per belt stat software, drive motor max power consumption is also 41 kW. Shown in table -2.

Table-2:



Available power 75 kW, hence no case of overload on motor.

- Belt max tension (T1) as per drawing =45.67 kN
  Required belt tensile strength =45.67 x FOS / (belt width in m)
  =45.67 x 10 / (1.2)
  =380.58 kN/m

But, as per belt static calculation by belt simulation software the factor of safety is high, that is 16.88, subsequently belt modulus become higher 6490 KN/m. It affects the profiling of belt. From above calculation, it is evident that 630/4 failed belt which had over rating than the required 450/4 (500/4) belt. This was also cross-checked by belt stat simulation software.
The benefits of 450/4 (500/4) over 630/4 rating belt: Improved edge to centre tension differential & reduced centre tension (fig-6).

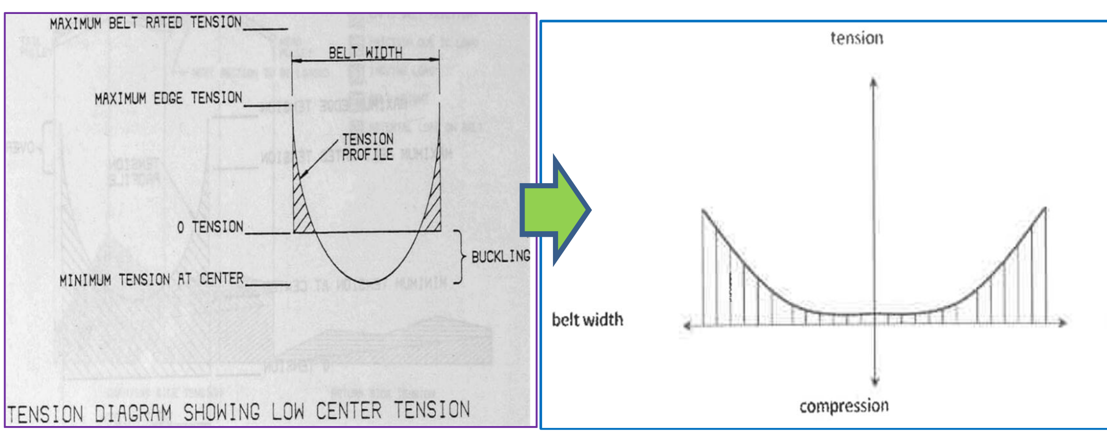


Fig-6

D. Belt Overload or Access Tension

1) *High running TPH*

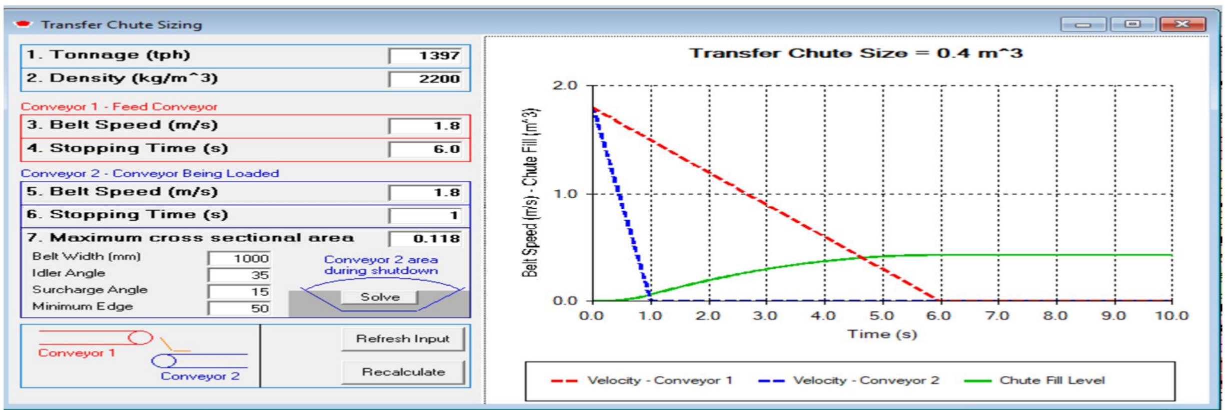
This conveyor runs at 1125 TPH which is within the rated capacity (1270 TPH), as per TPH trend (fig-5).

2) High Starting Tension Due to pile Formation at Receiving Chute

During stoppage of downstream conveyor in loaded condition, the excess material accommodates in receiving chute due to direct feeding by vibrating screen (when single screen is in operation), which affects the coveyor belt starting tension in every restart of circuit with load.

Receiving chute pile height calculation is done by belt simulation software (table-3).

Table-3



Motor current spike before belt snapped: The belt was sensed high current during re-starting in load (fig-4). This might be the reason of pile formation at the receiving chute of conveyor.

3) Inadequate Drive Pulley Diameter

The calculation of drive pulley diameter is done as per IS 1891 & ISO 3684 of EP belt (630/4 & carcass thickness 6.4 mm in belt datasheet).

Table-4

As per ISO 3684,

Min diameter of drive pulley = Belt factor x carcass thickness
= 108 x 6.4= **691.2 mm**

Carcass material	Belt factor *C*
Cotton	80
Nylon	90
Cotton / nylon	90
Cotton / polyester	98
Polyester	108
Rayon	118
Steel	145

Available drive pulley diameter is (630 mm after upgradation from 500 mm by Engineering team) still insufficient for 6.4 mm carcass thickness selected belt.

Where, the minimum pulley diameter recommended for a belt depends upon three factors:

1) Carcass Thickness

a) The overall thickness of all plies plus the rubber skims between plies in the case of ply type belts.

b) The overall thickness of the thick woven fabric separating the top and bottom covers in the case of solid- woven belts.

c) The wire rope diameter in the case of Steel Cord belts.

2) Operating Tension: The relationship of the operating tension of the belt at the pulley to the belt's allowable working tension.

3) Carcass Modulus: The relationship between elongation of the carcass and the resulting stress.

Note: Hence maximum permissible carcass thickness of belt =630/108=5.833 mm. Hence carcass thickness must be less than 5.833 mm.

Conveyor design parameter is changed by Engineering team during plant capacity upgradation as shown in table-5.

Table-5

Sl.No.	Conveyor design parameters	UOM	Existing	Upgraded
1	Belt speed	m/s	1.31	1.80
2	Troughing angle	°	45	45
3	Volumetric loading	%	80%	75%
4	Conveyor length (Horizontal)	M	66.60	66.60
5	Lift (Conveyor/tripper, if any)	M	6.90	6.90
6	Maximum working tension	kN	47.37	45.67
7	Inclination	°	7	7

Therefore, RMBT = (45.67x100)/63 = 72.49%

As per below table of IS 1891 (Part-1): 1994 The minimum pulley diameter.

IS 1891 (Part 1): 1994

Table 8 Recommended Minimum Pulley Diameters

(*Clause* J-2.3)

Carcass Thickness, in mm						Recommended Minimum Diameter in mm for Percentage of RMBT[1] Used								
Cotton		100 Percent Polyamide		Polyester Polyamide		Over 60 Up to 100 Percent Type of Pulley			Over 30 Up to 60 Percent Type of Pulley			Up to 30 Percent Type of Pulley		
From	To	From	To	From	To	A	B	C	A	B	C	A	B	C
—	1·2	—	1·1	—	0·9	100	—	—	—	—	—	—	—	—
1·3	1·5	1·2	1·3	1·0	1·1	125	100	—	100	—	—	—	—	—
1·6	2·0	1·4	1·7	1·2	1·4	160	125	100	125	100	—	100	100	—
2·1	2·5	1·8	2·2	1·5	1·8	200	160	125	160	125	100	125	125	100
2·6	3·1	2·3	2·7	1·9	2·3	250	200	160	200	160	125	150	160	125
3·2	3·9	2·8	3·5	2·4	2·9	315	250	200	250	200	160	200	200	160
4·0	5·0	3·6	4·4	3·0	3·7	400	315	250	315	250	200	250	250	200
5·1	6·2	4·5	5·5	3·8	4·6	500	400	315	400	315	250	315	315	250
6·3	7·8	5·6	7·0	4·7	5·8	630	500	400	500	400	315	400	400	315
7·9	10·0	7·1	8·8	5·9	7·4	800	630	500	630	500	400	500	500	400
10·1	12·5	8·9	11·1	7·5	9·2	1 000	800	630	800	630	500	630	630	500
12·6	15·6	11·2	13·8	9·3	11·5	1 250	1 000	800	1 000	800	630	800	800	630
15·7	17·5	13·9	15·5	11·6	12·9	1 400	1 250	1 000	1 250	1 000	800	1 000	1 000	800
17·6	20·0	15·6	17·7	13·0	14·8	1 600	1 250	1 000	1 250	1 000	800	1 000	1 000	800
		17·8	20·0	14·9	16·6	1 800	1 400	1 250	1 400	1 250	1 000	1 250	1 250	1 000
				16·7	18·5	2 000	1 600	1 250	1 600	1 250	1 000	1 250	1 250	1 000

[1] RMBT — Recommended maximum belt tension.

Available drive pulley diameter is (630 mm after upgradation from 500 mm by engineering team) still insufficient as per above table for 6.4 mm carcass thickness selected belt.

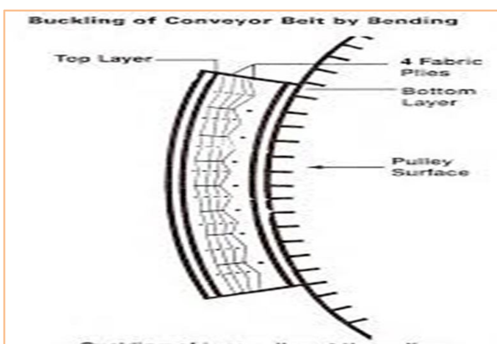


Fig-7: Carcass plies condition at drive pulley

This created buckling in belt by bending at inner ply at the pulley (fig-7).

4) Inadequate Transition Length (Non-standard Belt Laying)

Conveyor belt has full trough depth transition construction at tail & half trough depth transition construction at head end in carrying side. The calculated transition distance with consideration of various factors like belt rating, belt fabric type, multiply factor for belt modulus, TPH, Maximum working tension, % rated tension safety factor etc. is taken from belt datasheet by belt simulation software is shown in table-6:

Table-6: Comparative study & calculation of transition distance

PP GL-15 Belt tension & Transition length calculation												
Reference	Belt Rating	Belt (Fabric Type)	Multiplying factor	Belt Modulus	Load	Max working Tension	% rated Tension	Safety Factor	Head-TL(HT)	Head-TL (FT)	Tail-TL	Remarks
UOM	KN/m	EP		KN/m	TPH	KN			m	m	m	
As per drawing	630	EP	10	6300	1397	45.67	60.41	16.55	3.25		2.593	
As per CEMA	630	EP	10	6300	1397	45.67	60.41	16.55	1.92	3.84	3.84	% rated tension consider >60%
As per CEMA	630	EP	10	6300	1397	45.67	60.41	16.55	1.56	2.88	2.88	% rated tension consider =<60%
As per CEMA	630	EP	10	6300	1032	37.2	49.21	20.32	1.56	2.88	2.88	
As per CEMA	630	EP	10	6300	1032	37.2	49.21	20.32	1.56	2.88	2.88	
As per CEMA	800	EP	10	8000	1032	45.67	47.57	21.02	1.56	2.88	2.88	
Belt Stat	630	EP	6.7	4200	1032	37.2	49.21	20.32	2.04	2.46	2.81	
Belt Stat	630	EP	6.7	4200	1397	42.4	56.08	17.83	2.04	2.46	2.96	
Belt Stat	800	EP	Assume	6300	1032	37.2	38.75	25.84	2.5	3.01	3.44	
Belt Stat	800	EP	10	8000	1032	37.2	38.75	25.84	2.81	3.4	3.87	
Belt Stat	800	NN	6.4	5120	1032	37.2	38.75	25.84	2.25	2.72	3.1	4200
Belt Stat	630	EP	10	6300	1032	37.2	49.21	20.35	2.5	3.01	3.44	60
Belt Stat	630	NN	6.4	4032	1032	37.2	49.21	20.35	2	2.41	2.73	
Belt Stat	630	EP	Assume	5000	1032	37.2	49.21	20.35	2.22	2.69	3.06	
Belt Stat	630	EP	10	6300	1397	42.4	56.08	17.81	2.5	3.01	3.62	
Belt Stat	500	EP	10	5000	1032	37.2	62.00	16.15	2.22	2.69	3.06	
Belt Stat	500	NN	6.4	3200	1032	37.2	62.00	16.15	1.78	2.15	2.45	
Belt Stat	500	EP	10	5000	1397	42.4	70.67	14.14	2.22	2.69	3.23	
Belt Stat	500	EP	Assume	6300	1032	37.2	62.00	16.15	2.5	3.01	3.44	
Belt Stat	400	EP	10	4000	1032	37.2	77.50	12.92	1.95	2.4	2.74	
Belt Stat	400	NN	6.4	2560	1032	37.2	77.50	12.92	1.59	1.92	2.19	

As per standard transition distance of belt (FOS -10 for EP fabric), detail is shown in below figure-8,

Fig-8

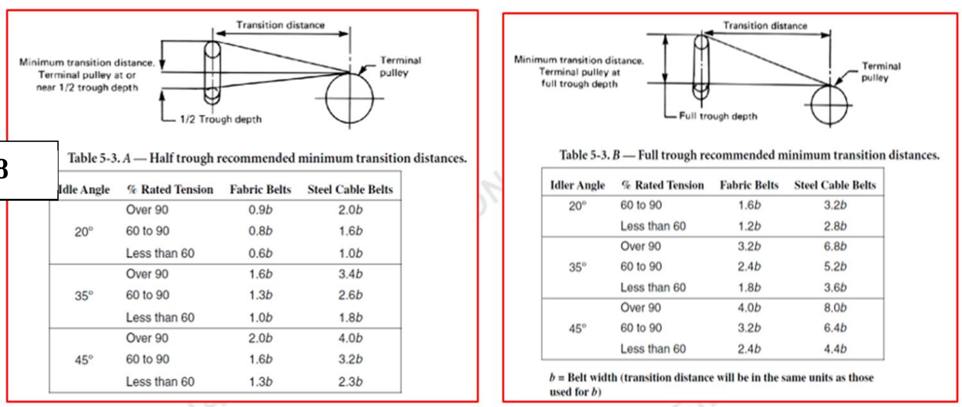


Table 5-3. *A* — Half trough recommended minimum transition distances.

Idle Angle	% Rated Tension	Fabric Belts	Steel Cable Belts
20°	Over 90	0.9*b*	2.0*b*
	60 to 90	0.8*b*	1.6*b*
	Less than 60	0.6*b*	1.0*b*
35°	Over 90	1.6*b*	3.4*b*
	60 to 90	1.3*b*	2.6*b*
	Less than 60	1.0*b*	1.8*b*
45°	Over 90	2.0*b*	4.0*b*
	60 to 90	1.6*b*	3.2*b*
	Less than 60	1.3*b*	2.3*b*

Table 5-3. *B* — Full trough recommended minimum transition distances.

Idler Angle	% Rated Tension	Fabric Belts	Steel Cable Belts
20°	60 to 90	1.6*b*	3.2*b*
	Less than 60	1.2*b*	2.8*b*
35°	Over 90	3.2*b*	6.8*b*
	60 to 90	2.4*b*	5.2*b*
	Less than 60	1.8*b*	3.6*b*
45°	Over 90	4.0*b*	8.0*b*
	60 to 90	3.2*b*	6.4*b*
	Less than 60	2.4*b*	4.4*b*

b = Belt width (transition distance will be in the same units as those used for *b*)

Hence recommended tail transition distance =3.2 x belt width=3.2x1.2=3.84 m

The comparison of conveyor transition length in between calculated, field measurement (actual) data and drawing data is shown below (table 7):

Table-7

Location	As per calculation	Actual	As per drawing	Lift
Head End	3140	3100 mm	3250 mm	141 mm
Tail End	3840	2600 mm	2593 mm	307 mm

hence the actual transition distance is lesser than the calculation (as per table-7) resulting negative tension at the centre of belt. Low transition distance is generated more tension at belt edge and less than zero at the centre of belt (fig-9). By this buckling effect, the belt lifted off at the centre idler roll. The continuous rotation of belt, this generate cyclic & repeatative condition and subsquently adhesion breakd own resulting delamination formation at splice edge (channel) in the centre of the belt, which led to joint failure.

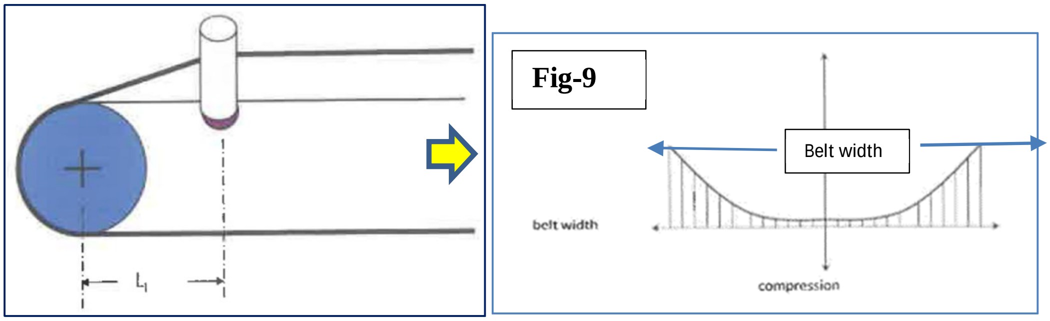


Fig-9

5) Excess Take up Weight

The conveyor counterweight condition was observed and found OK. The weight was also calculated and found within the design value. The weight calculation detail is given below.

Blocks (40 blocks @ 40 kgs) = 1600 Kg

Frame weight (approx.) = 700 Kg and Take up pulley weight = 500 Kg

Total = 2800 Kg

As per drawing take up weight is 3320 Kg

The calculated take up tension 2.72 T is nearly same as actual take up tension 2.8T.

IV. CONCLUSION

The calculated pulley diameter is less than the standard value (as per standard IS 1891(Part-1):1994 & ISO 3684) therefore carcass top ply had sensed higher tension & bottom ply higher compression. Also the higher belt rating 630/4 has higher belt modulus (6490 KN/m) which created higher differential tension in between top ply to bottom ply of carcass & subsequently generates Isolated cavities---→Oriented cavities---→Micro cracks---→Macro cracks---→Surface crack at channel or at 2nd step of splice in butt joint zone(fig. 10).

Water spray system in upstream conveyors generates steam (material temperature>100°C, sometimes more than 200°C, steam contact with top cover rubber resulting hot water or steam seeps into cracks and able to penetrate through the belt cover down to the actual carcass of the belt. In multi-ply belts, the fibre of the weft strands of the plies expand as they absorb the moisture or steam. Which in turn causes sections of the carcass to contract(shorten)as the weft strands pull of the wrap strands of the ply this phenomenon when repeatedly happens, the ply breaks. After that, this moisture vapour (steam) of pellet fines penetrated and reached up to the joint splice layers.

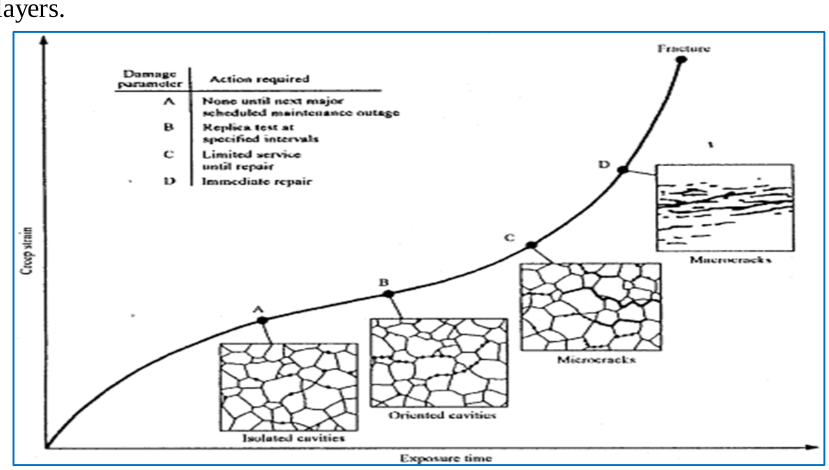


Fig-10

Low tail transition distance (2600 mm instead of 3840 mm at carrying side) is generated more tension at belt edge and lesser at the centre of belt. Existing belt 630/4 (high tensile rating as per maximum belt tension 47.5 KN at drive pulley as per design data sheet) has high belt modulus resulting low troughability in belt and demands high transition distance. Excessive stress cycle in the belt because of short conveyor length (~150 m) at butt joint of channel/2nd step resulting joint fatigue crack at splice edge (channel)/splices in the centre of the belt and finally led to break/separation/snapping of joint in shear mode.

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V. RECOMMENDATION

A. Corrective

1) Flat roller to be used in joint making process during insulation laying and overlapping.
2) Fabric breaker ply to be used over butt ply joint of top channel to prevent exposure of channel ply.
3) Existing and all old material code of conveyor belt to be blocked

B. Preventive

1) *Change in belt Specification: Modification in new belt Mareial Code*
   a) Belt carcass thickness to be reduced from 6.4 mm to thickness lower than 5.8 mm to accommodate existing drive pulley diameter (630 mm) of EP 630/4 rating belt as per standard IS 1891 (Part-1):1994 & ISO 3684
   b) Belt rating (tensile strength) 500/4 to be used instead of 630/4 to address the high belt modulus and minimize deferential tension between inner & outer surfaces of the carcass.
   c) Proposed belt to be selected with standard cover thickness ratio (≤3) to maintain the belt neutral axis.

2) *Change in System*
   a) Transition distance to be increased from 2600 mm to 3840 mm at tail end (carrying side)
   b) Water Spray system to be modified to automized water spray system for reducing/eliminating the quenching effect on belt (material temperature to be controlled and average temperature must not be more than 180°).
   c) Receiving chutes to be modified to minimize the material dead (pile) load on the belt during downstream conveyors tripped/stopped in load condition (when only one up stream screen in service)

C. Suggestive

a) The proposed belt maybe selected PP fabric instead of EP fabric to reduce the of belt modulus and subsequently increase the troughability.
b) Belt joint step length to be increased from 200 mm to 300 mm for improvement of joint efficiency
c) Pyrometers of up stream conveyors to be rechecked and re-calibrated.
d) UHR belt should not be stopped with hot material.

VI. NOMENCLATURE

1) UHR – Ultra heat resistance
2) AA/BB/CC/DD – Supplier name
3) A/B/C/D – Belt jointing team
4) SOP – Standard operative procedure
5) DCS – Distributed control system
6) RTD – Resistance temperature detector
7) TPH – Ton per hour
8) OEM – Original equipment manufacturer
9) EP – Polyester
10) RMBT - Recommended maximum belt tension
11) FOS – Factor of safety

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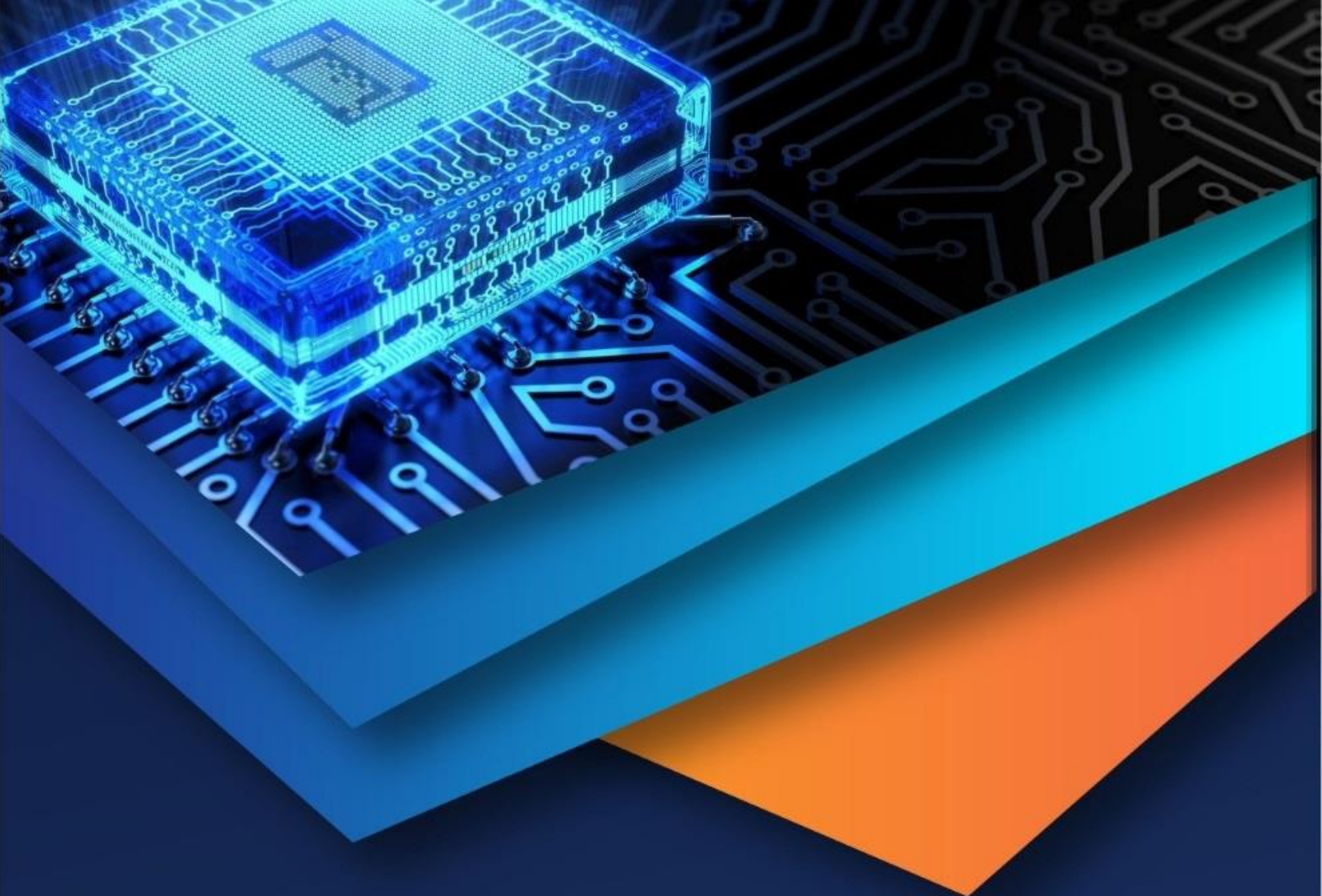

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