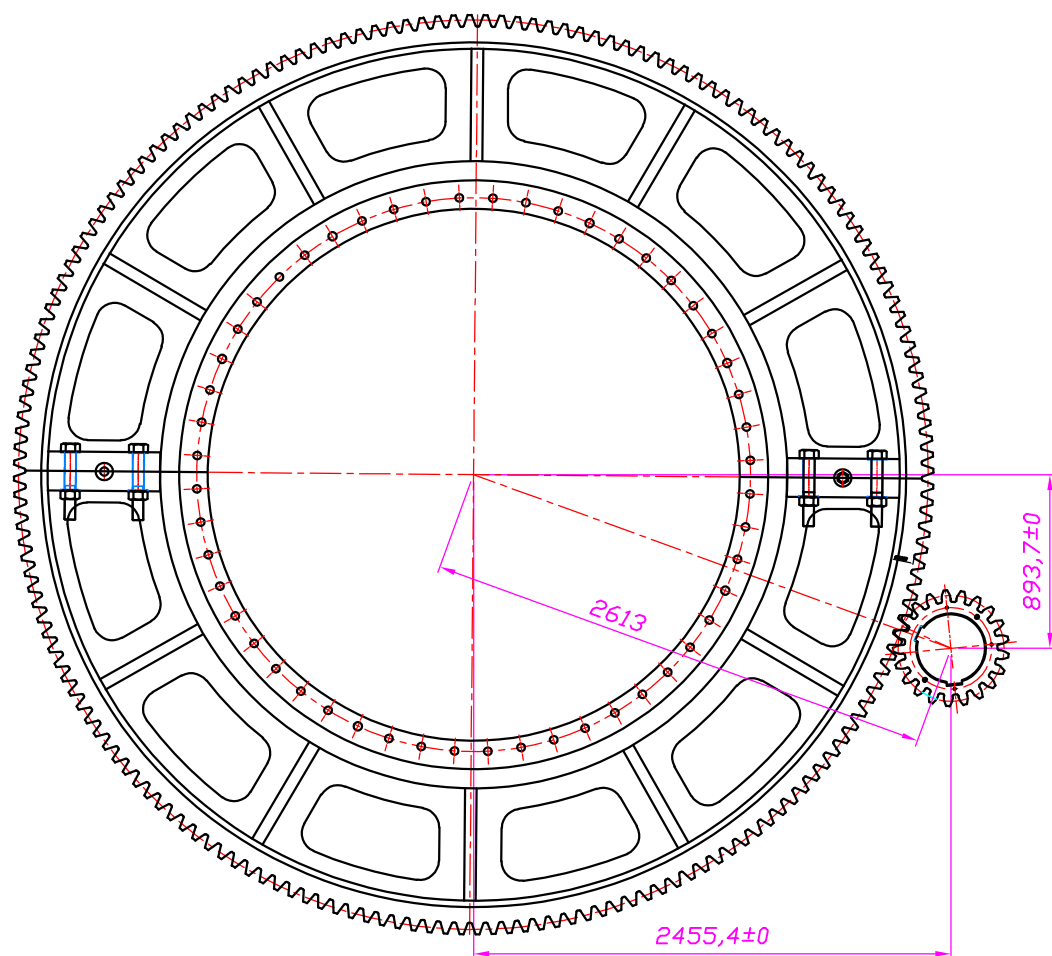


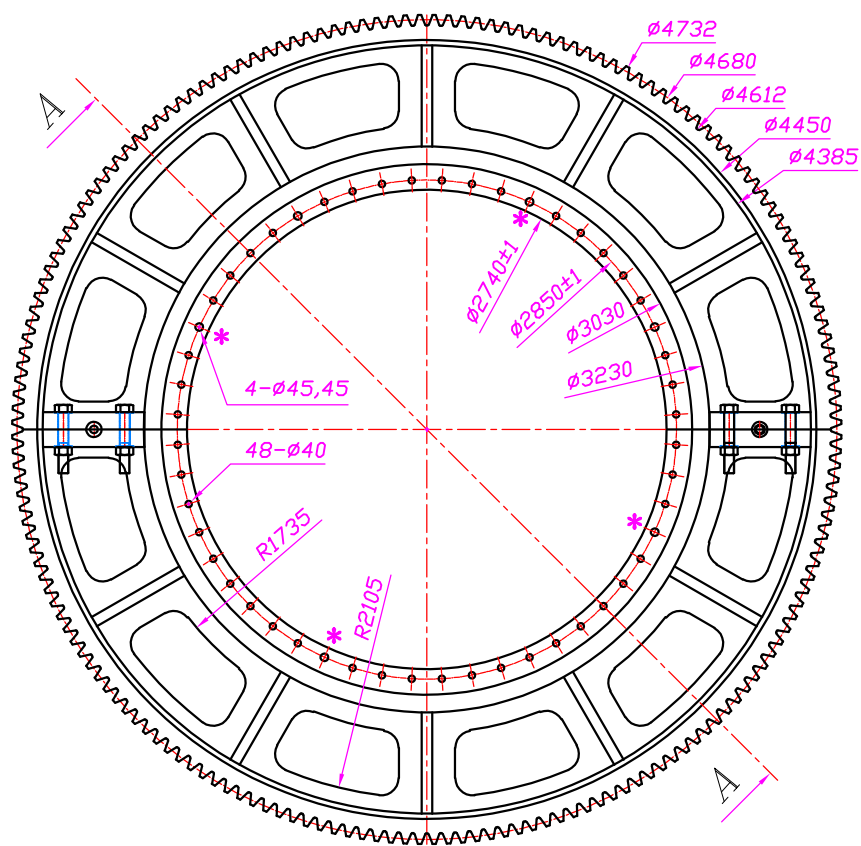


ساخت مجموعه شامل:
 یک چرخ دنده بزرگ با پین، پیچ و مهره های
 اتصال دو فک
 دو عدد پینیون
 یک عدد شافت پینیون با مهره و خار قفل کن
 دو عدد خار شیدار پینیون

3	SHaft Pinion	1	1.6580	5212211114	
2	Pinion	1	1.6580	5212211112	
1	Gear	1	1.6579	5212211111	
No.	Name	QTY	Material	Drawing no	Weight(kg)
Rev: 1	Date: 22.10.92	Checked By: A.H.Ahmadi	YASUJ CEMENT COMPANY		
Drawn By: J.Behrrouzpoor	Design By: _____	Approved By: Kh.Nikbakht			
Code:			Material:	Acc.to: 08.13/14	
Scale:	PART No:			Weight kg	
N.T.S	نقشه مونتاژی دنده و پینیون آسیاب سیمان			Drawing No:	
				Page: 1/5	

توجه:

- 1- تمامی ابعاد بر حسب میلی متر می باشد .
- 2- تلرانس سایر اندازه ها طبق نرم DIN 7168 T2(7.86) میباشد.



Assembly

Sec.A-A

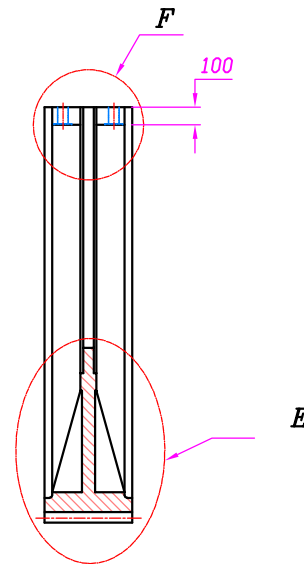
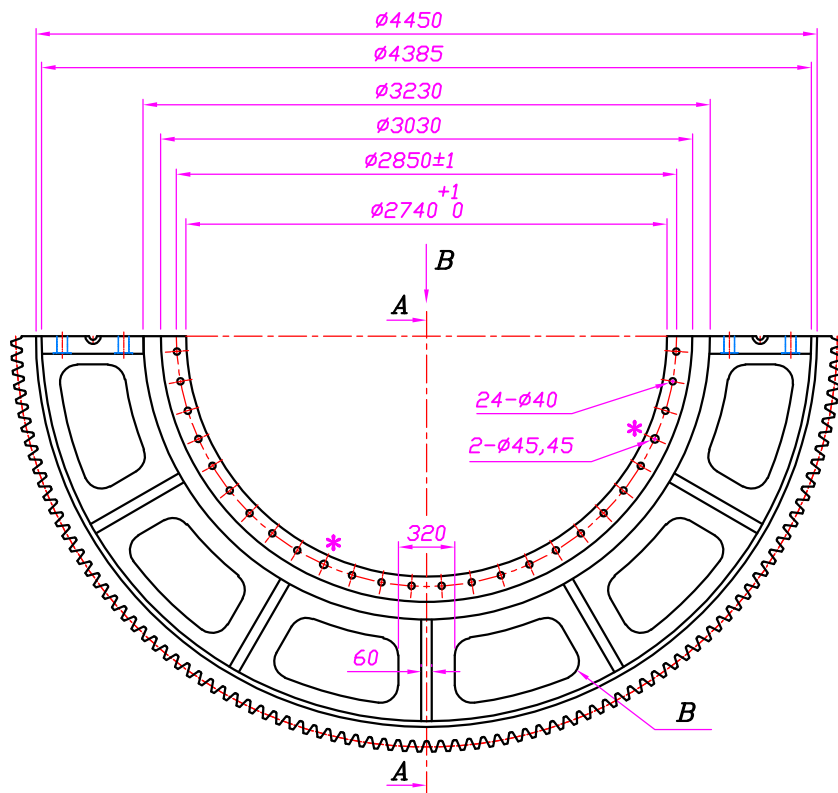
توجه :

- 1- تمامی ابعاد بر حسب میلی متر می باشد .
- 2- تلرانس سایر اندازه ها طبق نرم DIN 7168 T2(7.86) میباشد.
- 3- تعداد سوراخها 52 عدد است که از هر 13 سوراخ یک سوراخ جای فیت بولت می باشد که با علامت ستاره * مشخص شده است و باید دقیقاً در مکانهای مشخص شده روی نقشه تعبیه شوند.
- 4- سطح دنده ها به عمق 4 تا 5 میلیمتر بین 30 تا 33 راکول سی عملیات حرارتی القایی شوند .
- 5 - اثر دایره گام در دو طرف چرخ دنده ایجاد شود

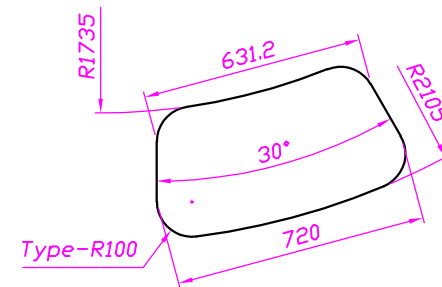
مدول	m	26
تعداد دنده ها	z	180
نوع دنده ها	type	ساده دندانه راست
زاویه دندانه	Angle	0°
گام	P	81.68
ارتفاع سر دندانه	ha	26
ارتفاع پای دندانه	hf	34
ارتفاع دندانه	h	60
قطر دایره سر	da	4732
قطر دایره پا	df	4612
قطر دایره گام	d	4680
لقی	C	8
فاصله بین دو محور	a	2613

7	Washer A42	2				
6	Nut M42*4.5	2	CK45			
5	FitBolt M42*4.5*511*b=120	2	M040			
4	Washer A56	8				
3	Nut M56*5.5	8	CK45			
2	Bolt M56*5.5*350*b=75	8	M040 (1.7225)			
1	Gear	1	(1.6759)			
No.	Name		QTY	Material	Drawing no	Weight(kg)
Rev: 1	Date: 22.10.92	Checked By: A.H.Ahmadi		YASUJ CEMENT COMPANY		
Drawn By: J.Behrouzpoor	Design By: _____	Approved By: Kh.Nikbakht				
Code:	521-22-11-111		Material: Assembly		Acc.to: 08.13/14	
Scale:	PART No: چرخ دنده اصلی آسیاب سیمان					Weight: 11667 kg
N.T.S	Girth Gear Of Cement Mill Ø2.6*13					Drawing No:
						Page: 2/5

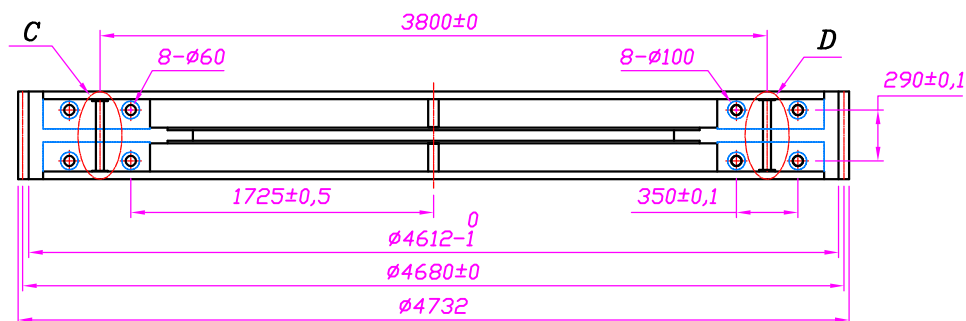




Sec.A-A



Det.B



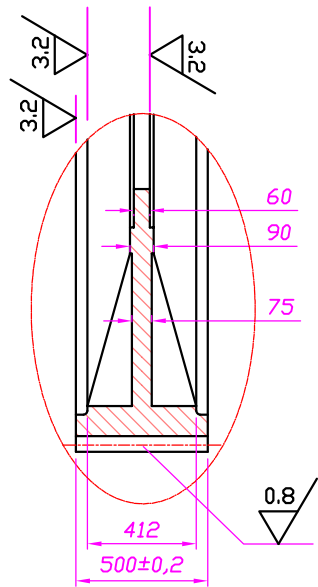
View B

توجه :

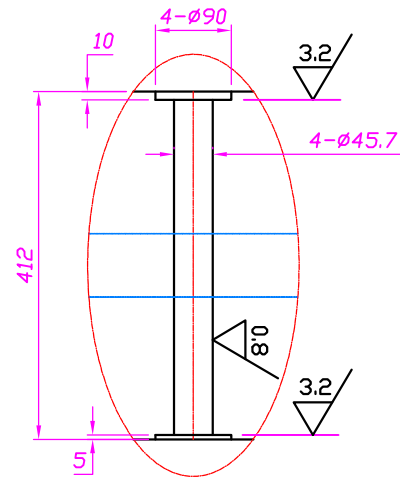
- 1- تمامی ابعاد بر حسب میلی متر می باشد .
- 2- تلرانس سایر اندازه ها طبق نرم *DIN 7168 T2(7.86)* میباشد.
- 3- علامت * در کنار سوراخها مشخص کننده سوراخ جای فیت بولت به اندازه $\phi 45.45$ می باشد .
- 4- دقت شود که تلرانس دایره مرکزی سوراخهای جای فیت بولتها صفر باشد.
- 5- سطوح دنده ها به عمق 4-5 میلیمتر بین 30-33 راکول سی عملیات حرارتی القایی شود .
- 6 - اثر دایره گام در دو طرف چرخ دنده ایجاد شود

Rev: 1	Date: 22.10.92	Checked By: A.H.Ahmadi	YASUJ CEMENT COMPANY
Drawn By: J.Behrouzpoor	Design By:	Approved By: Kh.Nikbakht	
Code:	Material: (1.6579)		Acc.to: 08.13/14
Scale: N.T.S	PART No: چرخ دنده اصلی آسیاب سیمان		Weight kg
	Girth Gear Of cement Mills $\phi 2.6 \times 13$		Drawing No:
			Page: 3/5

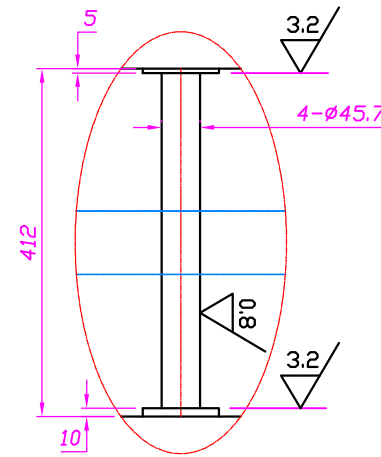




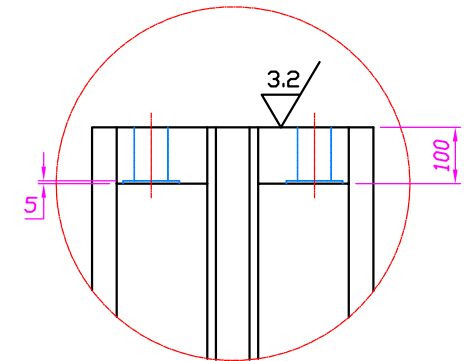
Det. E



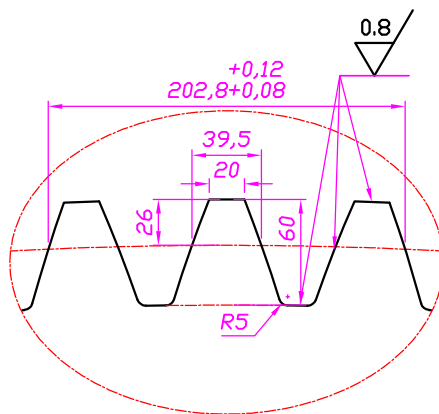
Det. C



Det. D



Det. F

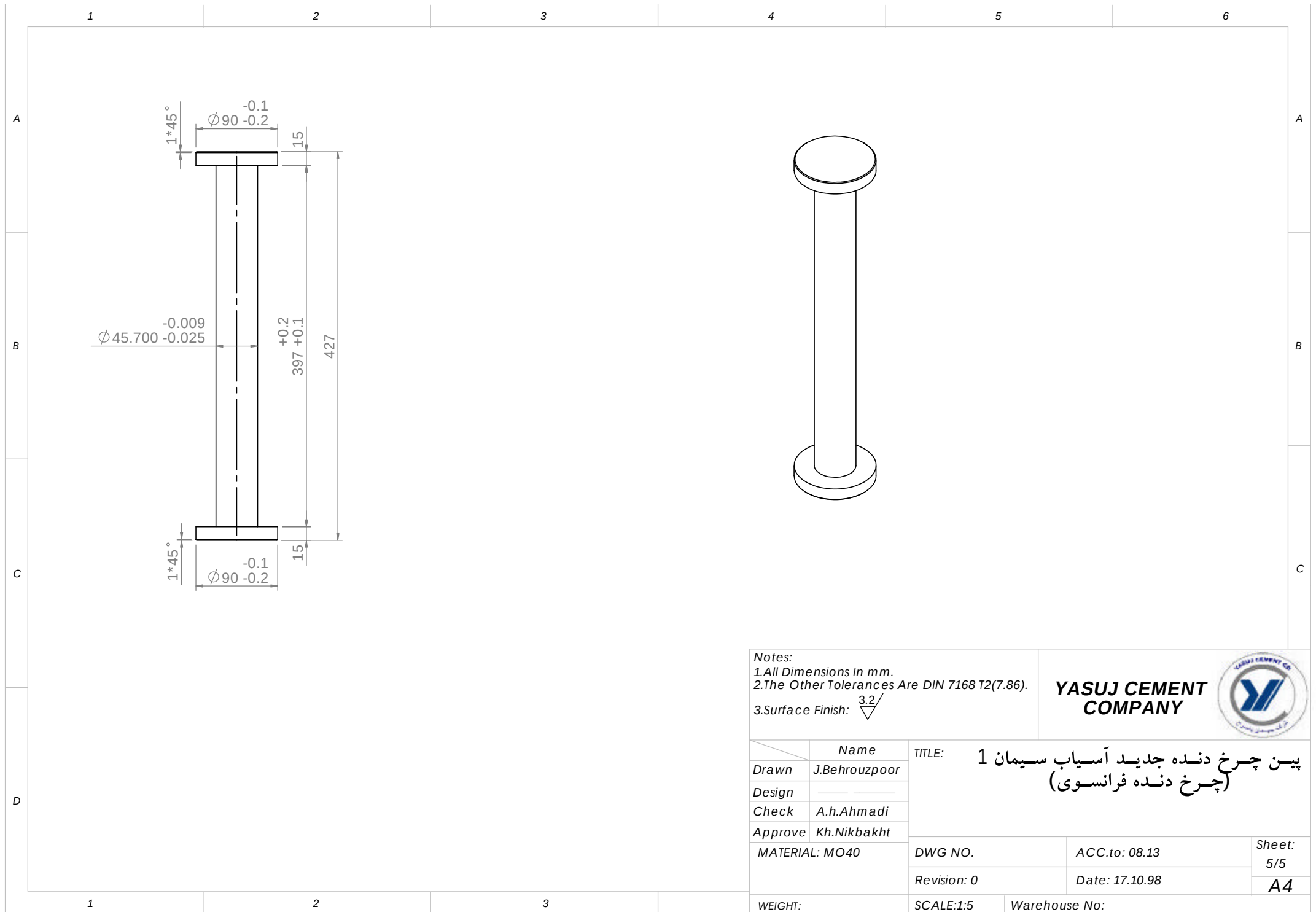


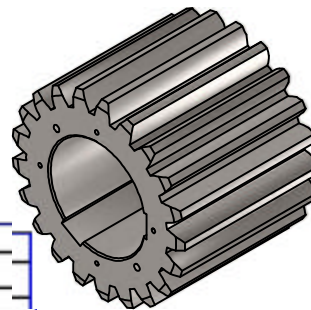
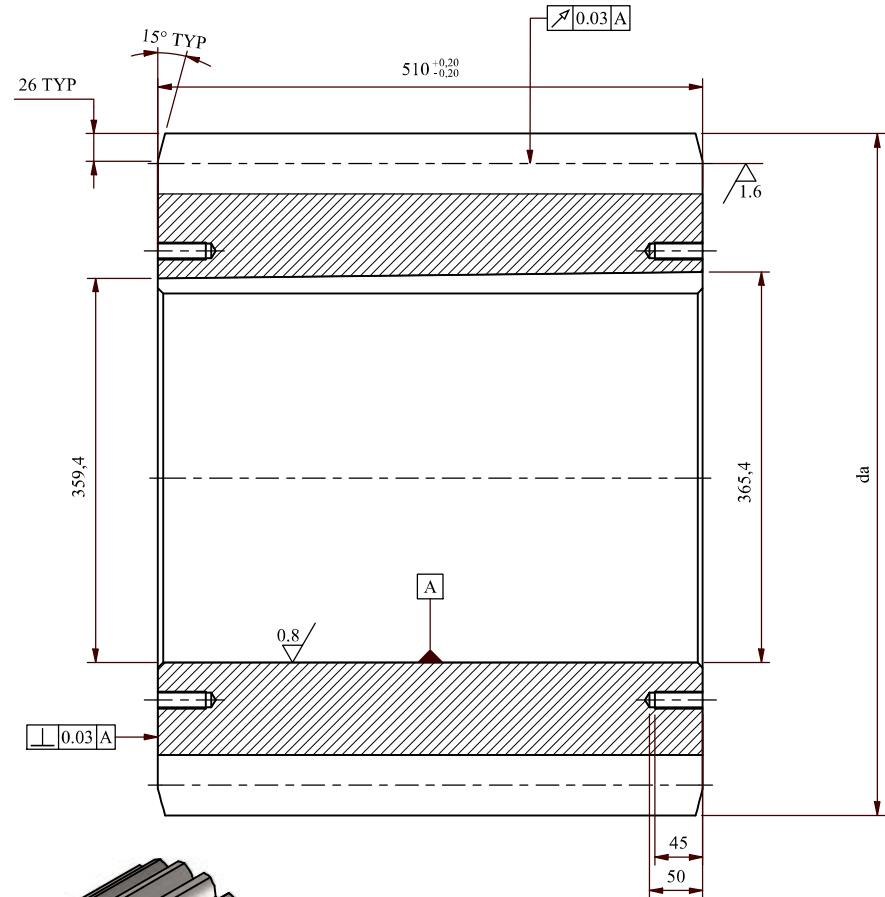
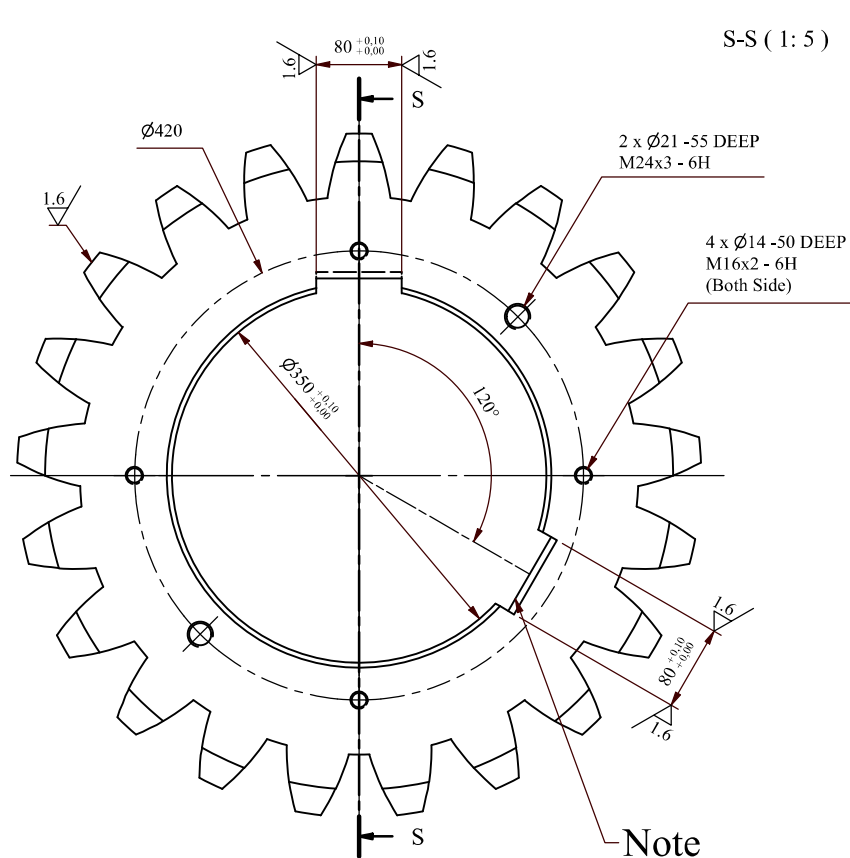
توجه :

- 1- تمامی ابعاد بر حسب میلی متر می باشد .
- 2- تلرانس سایر اندازه ها طبق نرم (DIN 7168 T2(7.86) میباشد.
- 3- کیفیت سطوح : $\sqrt{3.2/0.8}$

Rev: 1	Date: 22.10.92	Checked By: A.H.Ahmadi	YASUJ CEMENT COMPANY	
Drawn By: J.Behrourzpoor	Design By:	Approved By: Kh.Nikbakht		
Code:	Material: (1.6579)		Acc.to: 08.13/14	
Scale: N.T.S	PART No: چرخ دنده اصلی آسیاب سیمان		Weight kg	
	Girth Gear Of cement Mills Ø2.6*13		Drawing No:	
			Page: 4/5	







Helical Gear			
Thooth Data	Symbol (Unit)	Value	Tolerance
Center Distance	a (mm)	2613	JS7
Normal Module	mn (mm)	26	----
Number Of Teeth	Z	21	----
Hand Of Gear	dir	Spur	----
Pressure Angle	an(deg)	20°	----
Helix Angle	β (deg)	----	----
Profile Shift Coefficient	X*	0.8	----
Tip Diamerer	da (mm)	Ø598	-0.00 -0.10
Root Diameter	df (mm)	Ø522.08	----
Operating Pitch Diameter	dw (mm)	Ø546	----
Number Of Teeth Spanned	K	4	----
Actuel Base Tangent Lenght	Wk (mm)	290.52	-0.16 -0.29

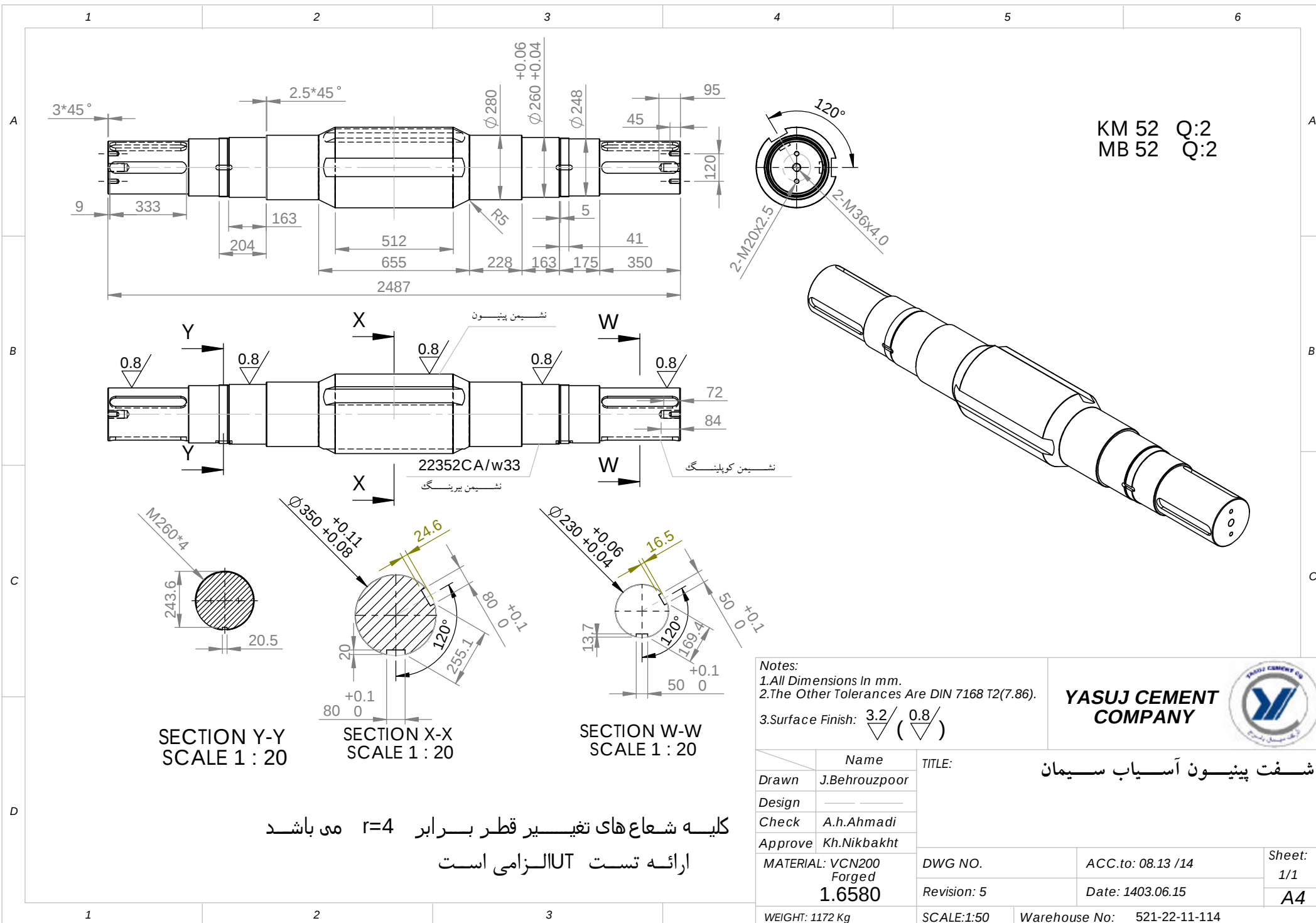
Table Hardening			
○	Quench and Tempered	-	HB
Type Hardness			HRC
● Case-Hardened Surface Hardness			Depth
○	Cementation Hardness	of Teeth	○
○	Nitriting Hardness	of Teeth	○
○	Induction Hardness	of Teeth	○
Certificates On Material Tests According To ISO 10474			
Batch Analysis		●	
Penetrating Fluid Test (PT)		●	After Grinding
Magnetic Test (MT)		●	After Grinding
Ultrasonick Test (UT)		●	Befor Roughing

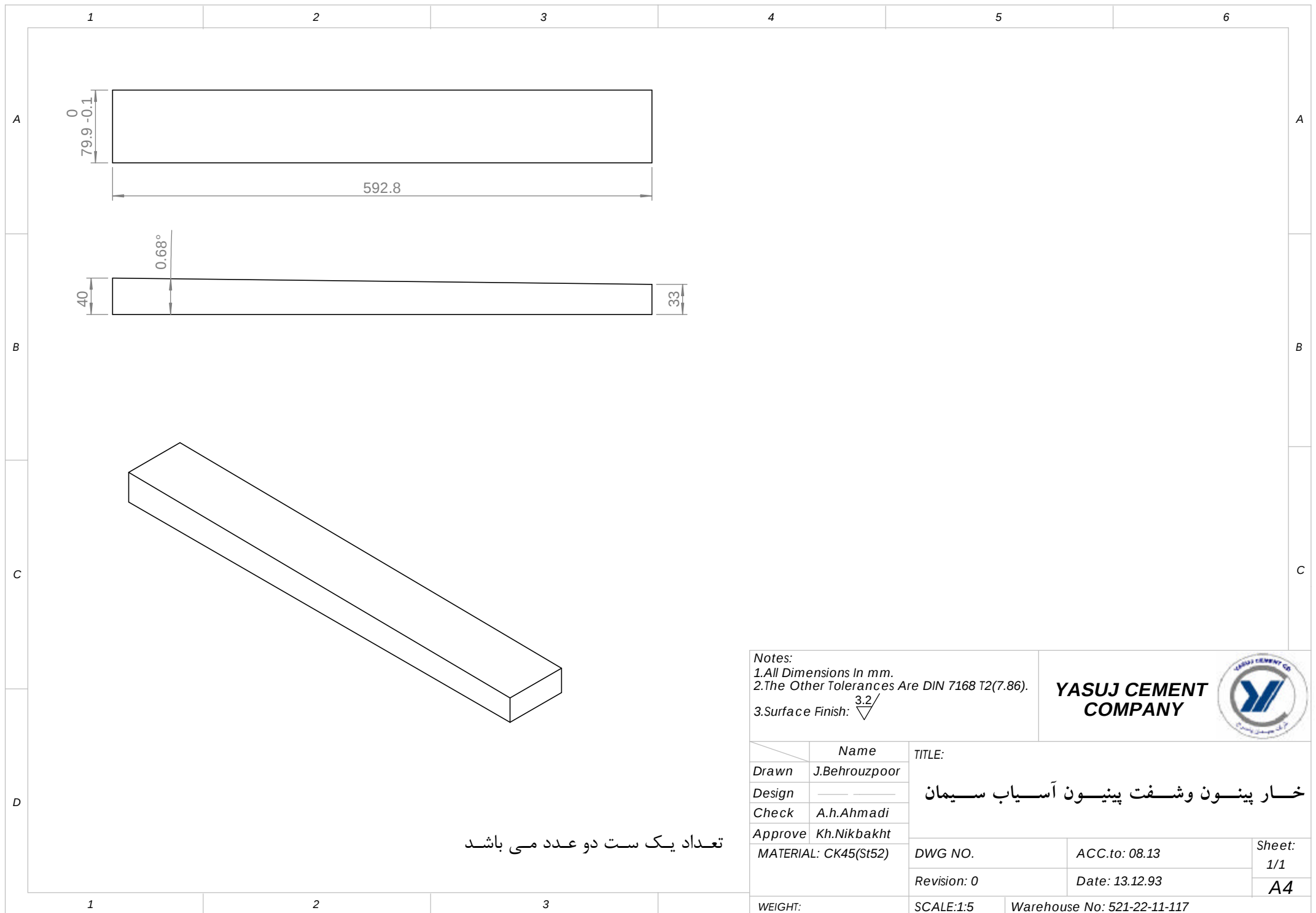
خط اثر دایره گام در دو طرف سطح پینیون ایجاد شود

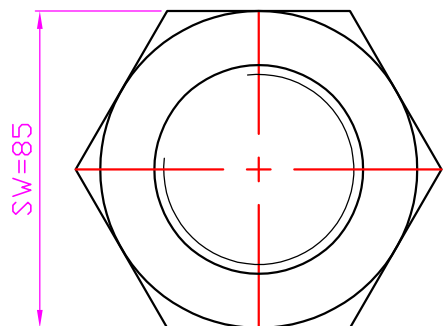
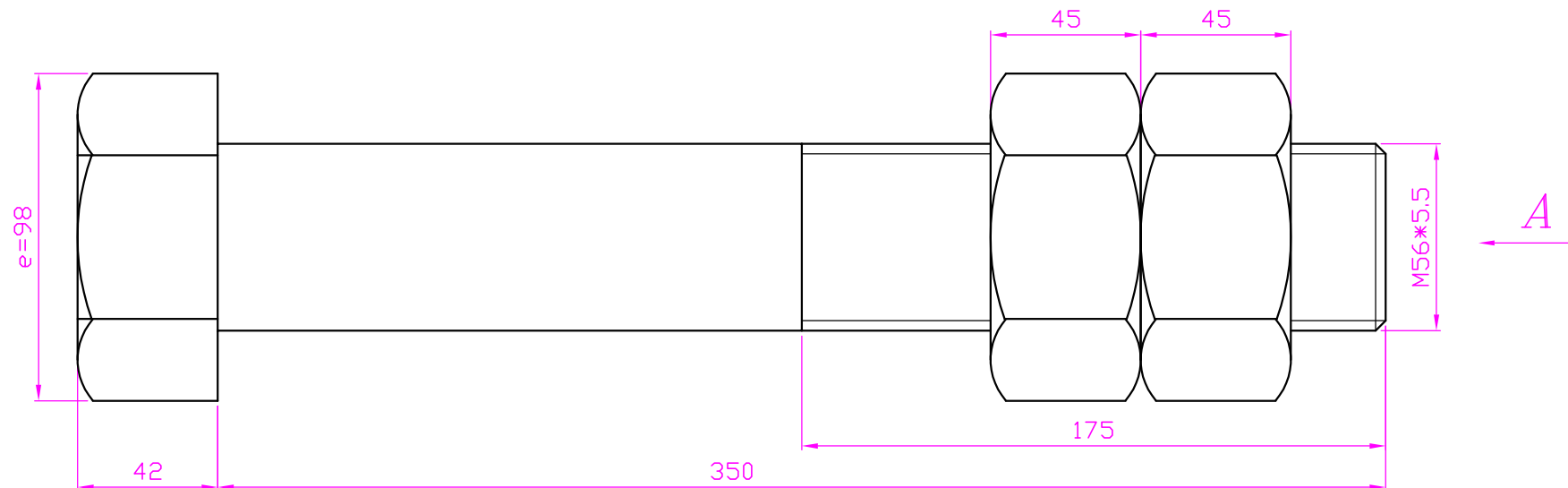
Note: جهت کونیک جای خار نسبت بهم عکس می باشد.

Forged

SHEET: 1/1	Project NO: w - 031120 - 1403	Project Title: 1403	TOLERANCE: DIN 7168 f
SCALE: 1:14	Processes: Machining ●	DWG Title: Pinion	SURFACES 1.6 GENERAL ✓
MATERIAL: 1.6580	Design: N.Sadeghian	Drawn: N.Sadeghian	Controlled: A.Kiani
	Checked: A.Torkzadeh	Approved: F.Fazel	







View.A

- توجه :
1. تمامی ابعاد بر حسب میلی متر می باشد.
 2. حتماً و صرفاً از تکنولوژی فورج استفاده شود
 3. از جوش مهره روی شافت برای ساخت پیچ پرهیز شود.
 4. پس از ساخت عملیات حرارتی الزامی است.

2	Nut M56*5.5		2	CK45 Grade8.8		
1	Bolt M56*5.5*350		1	M040 Grade10.9		
No.	Name		QTY	Material	DWG NO	Weight(kg)
Rev: 0	Date: 19.12.86	Checked By: Kh.Nikbakht		YASUJ CEMENT COMPANY		
Drawn By: J.Behrrouzpoor	Design By: _____	Approved By: Kh.Nikbakht				
Code:	921-48-31-168		Material:		Acc.to: 08.13/14	
Scale: N.T.S	PART No: پیچ و مهره فک آسیاب سیمان Bolt&Nut				Weight kg	
					Drawing No:	
					Page: 5/5	

Technical Specification and Quality Requirements

For

Manufacturing of Girth Gear and Pinion

CEMENT YASUJ

Sep 2025

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<u>18- Surface Protection</u>	<u>18</u>
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1- Materiel

- | | | | |
|-----------------|----------------|---------------------|---------------|
| 1.1) Girth gear | 35 CrNiMo6-6 | Material No. 1.6579 | EN 10293-2005 |
| 1.2) Pinion | 30 Cr I Have 8 | Material No. 1.6580 | EN 10269 |

2- Casting:

2.1) Gear and Pinion Material as specified above.

2.2) Product identification shall be carried out on each cast segment which must Include:

a- Manufacturer's Job Number.

b-Manufacturer's logo. - Drawing Number.

d- "e" to identify the cope side of casting.

e-Foundry heat/melt number formed into the mould.

f-Foundry logo.

g- Identification shall be placed where it will not be removed at machining.

3-Chemical analysis

3.1) The foundry during the melting process shall control the chemical analysis of the gear material: This is to ensure the desired mechanical and hardness properties are achieved.

3.2) A material sample must be taken from the laddel/s just prior to pouring and from the test bars on the casting after knockout.

3.3) A chemical analysis certificate shall be provided by the manufacturer (Foundry). This analysis shall be performed by a suitably calibrated spectrograph.

4- Microstructure

4.1) A microstructure preparation and examination must be undertaken on a sliced section of each test bar.

Care shall be taken to ensure burning does not take place when cutting, which can impair the microstructure. It is then fine polished and etched for viewing under suitable magnification.

4.2) The assessment of microstructure shall be in accordance with the relevant DIN or ISO standard for the material of Girth gear and Pinion (materials 1.6579 and 1.6580).

4.3) A certificate of microstructure shall be provided by the Foundry (manufacturer). The content of the report shall include:

4.3.1- The product heat/melt number.

4.3.2- The manufacturer job number.

4.3.3- The structure of the matrix.

4.3.4- The magnification by which the microstructure was viewed at.

4.3.5- Name of the person analysing the microstructure.

4.3.6- A photo of the actual microstructure of each sample specimen.

5- Foundry Fettling

5.1) All sharp edges, projections and surplus appendages (flash, ingates, risers, scabs etc.) are to be removed and ground smooth. Any risers or large areas of metal that need to be removed must be adequately cut prior to knocking off to prevent damage of the castings.

5.2) Filleted areas between the inside rim and body and webs are to be ground smooth if they have any scabbing, laps or uneven surfaces.

5.3) All surfaces shall be sand or grit blasted on all surfaces prior to any ultrasonic testing. The blasting process is also to be completed after any heat treatment to remove any subsequent scale.

6- Mechanical Testing

6.1) Following tests shall be carried out on test specimens:

6.1.1- Tensile test to identify the ultimate tensile strength.

6.1.2- Yield point.

6.1.3- Elongation.

6.1.4- Reduction of area.

6.1.5- Impact energy (charpy "V" test).

7- Material Test Standard

7.1) All tests and chemical analysis of test specimens shall be carried out as per

EN 1024 3.1 B

or DIN 50049 3.1 B Standards.

8- Hardness Testing

8.1) Hardness testing shall be performed in accordance with the ISO 6506-1 for the metallic Materials- Brinell hardness test.

8.2) Hardness equipment to be used is direct Brinell measuring method.

8.3) Hardness test locations in the as cast condition shall be conducted on the inside rim located 25 mm to 100mm from top face of both cope and drag sides.

8.4) Other hardness test locations are:

8.4.1- The outside rim between chill locations and not on the chills (Because this will result in a distorted reading for the overall hardness of the casting).

8.4.2- The bolt up flanges of each girth gear half.

8.5) Hardness tests report shall include (as a minimum) the following information:

8.5.1- Casting heat/melt number.

8.5.2- manufacturer job number.

8.5.3- Test date.

8.5.4- Actual hardness results.

8.5.5- Hardness range.

8.5.6- Compliance/noncompliance to specification.

8.5.7- Personnel completing the last. The final hardness test report on the proof machined (rough machined) onsting is the controlling and nocepted hardness for the gears.

8.6) Areas for hardness testing in the as cast condition are to be ground down to a minimum of 3 mm deep prior to testing in order to remove the surface skin which can give a faiso rending.

8.7) Test intervals for hardness mensurement of gears aro:

8.7.1- At the as cast stage, Prior to heat treatment or machining.

8.7.2- After any heat treatment (where applicable).

8.7.3- After machining (either proof machined or finished machined).

9- Tensile Testing

9.1) Tensile testing to be carried out in accordance with DIN ISO 6892 standard. Gears shall have a tensile test carried out from integral test blocks as cast and heat treated with the product.

9.2) Size of test blocks is defined by the relevant DIN ISO standard

9.3) Location and test block type shall be determined by the manufacturer.

9.4) Tensile tests shall be carried out by accredited laboratories. A certificate of results shall be submitted to client (Main manufacturer and end user of gears). The Certificate shall include the following:

9.4.1- The testing authority

. 9.4.2- Casting heat/melt number.

9.4.3- manufacturer's job number.

9.4.4- Test date.

9.4.5- Ultimate tonsile strength.

9.4.6- Proof stress.

9.4.7- Elongation.

Y 9.5) Acceptance criteria for tensile strength, Proof strength and elongation are in accordance with DIN 150 6892 or ASTM equivalent standard.

9.6) Failure of a test bar to the specification will require a re-test to be undertaken in accordance with the above DIN ISO standard.

9.7) where subsequent test bars still fail to meet specification, then an engineering evaluation shall be undertaken.

10- Ultrasonic Testing.

10.1) Ultrasonic testing shall be performed on all as cast gears to ensure integrity of the casting prior to further heat treatment, machining or gear cutting operations

10.2) Ultrasonic inspection shall be carried out as described in "Stahl-Eisen-Prüfblatt 1922",

10.3) Test class 1 shall apply for severity levels 1 to 4. and test class 2 for severity level 5.

10.4) The testing personnel shall be experienced in Ultrasonic testing of heavy section steel castings.

10.5) Ultrasonic equipment to be used should be a calibrated Sonatest 330 (Master scan) or Krautkrilmer USN 60 SW or equivalent.

10.6) Testing probes must be calibrated longitudinal 1 MHZ or 2 MHZ with the option of angle probes being utilized to ensure all relevant areas of castings are scanned.

10.7) Ultrasonic test intervals are:

10.7.1- In the as cast stage.

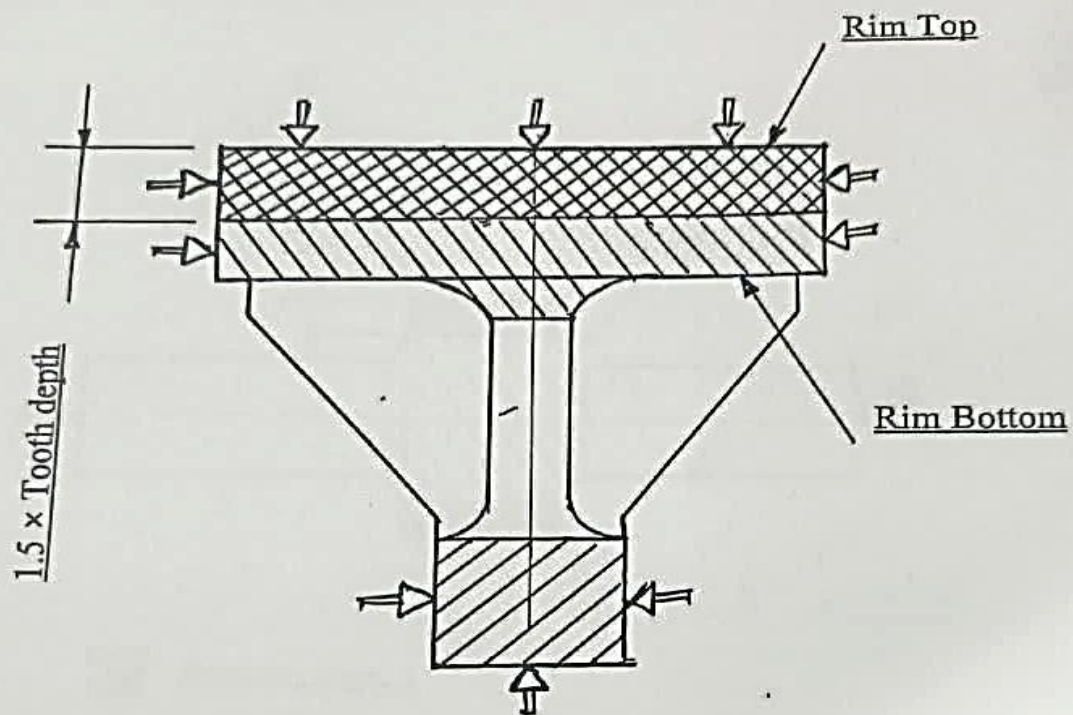
10.7.2-After proof machining.

10.8) The areas to be examined by ultrasonic are 100% of the areas indicated in figure 1 plus 100% of the mating flange of each gear half.

10.9) Surface finish for ultrasonic testing on a machined surface must not exceed 6.3 μm Ra roughness.

10.10) Ultrasonic testing rules are in accordance with DIN 1690 Part2 with the standard designations for different severity levels.

10.11) The different severity levels of testing areas are shown in figure below (figure 1).



Severity level 1



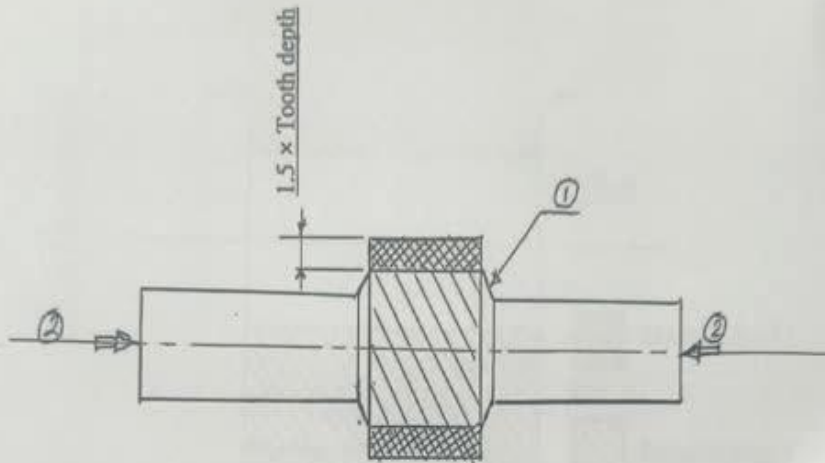
Severity level 2



Severity Level 3



"FIGURE 1" "Gear Section View"



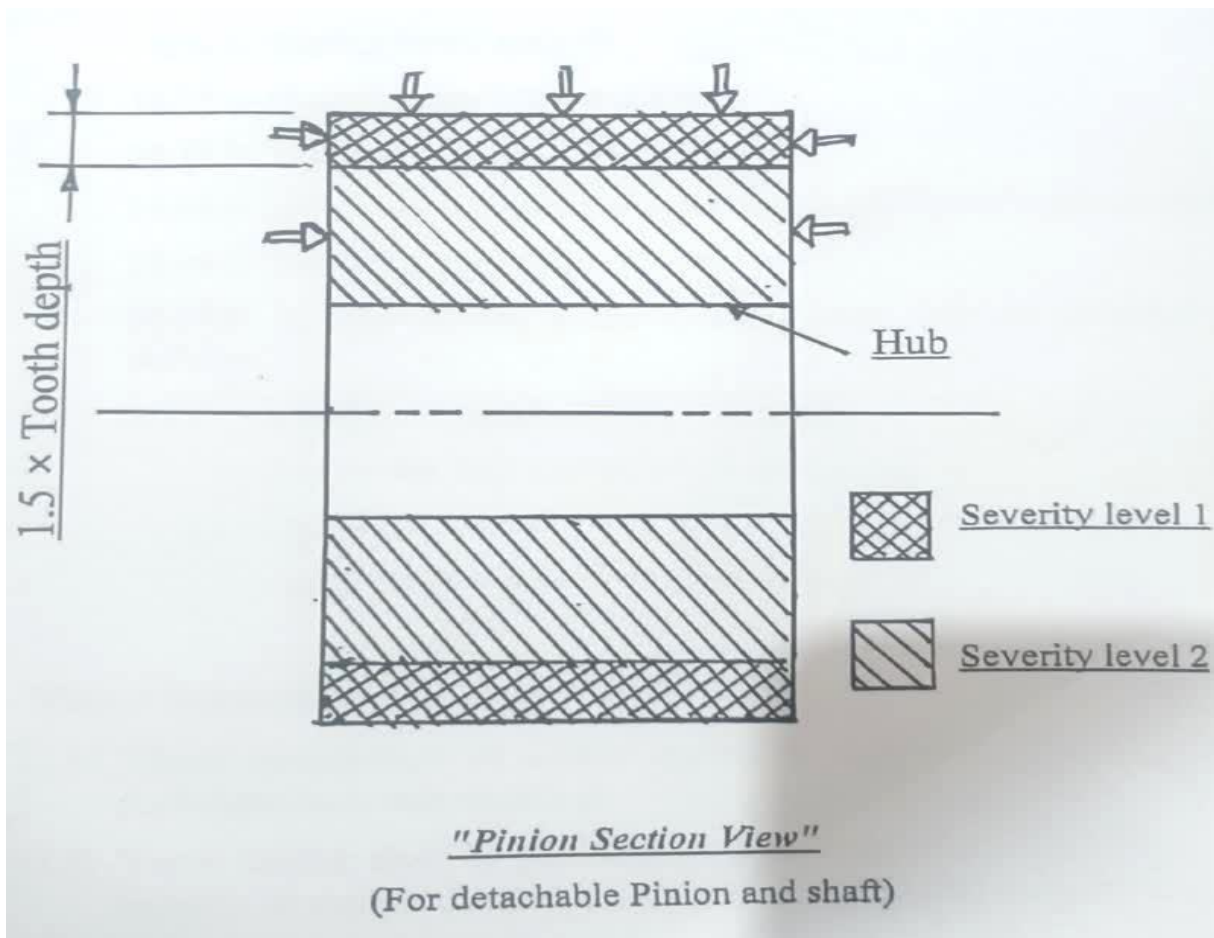
 Severity level 1

 Severity level 2

(1) (2)- Shaft and fillets severity level 1

"Shaft Pinion View" (Forged, heat treated and Proof machined)

Severity level designation



10.12) For requirements regarding the maximum permissible values for features of indications in the case of Ultrasonic inspection as in "Stahl-Eisen-Prüfblatt 1922", refer to table 3 of DIN 1690-Part2 for different Severity levels shown in "figure 1"

10.13) Acceptance Criteria for ultrasonic results shall be in accordance with figure 1. Any indications which are equal to or greater than the "DAC" (distance amplification curve) in the quality level is to be recorded as not complying with this specification. A reflection equal to or greater than 6 mm flat bottom hole or a reduction in back wall echo of 20db or greater shall be the criteria used in mapping discontinuities.

10.14) Ultrasonic test certificate shall include (as a minimum) the following information:

10.14.1- Casting heat/melt No.

10.14.2- Manufacturer's job number

10.14.3-Test date

10.14.4- Results of ultrasonic test including compliance or non compliance.

10.14.5-Personnel completing the test

10.14.6- A map of any nonconforming areas shall be provided which includes: - a traced or scaled outline of all areas. - its position and size relative to the casting. - length by width dimensions. - depth below the surface and thickness.

11- Visual inspection.

11.1) Visual examination of surface quality of Gear halves and Pinion shall performed in as cast condition.

11.2) Visual testing shall be performed on all areas of the castings to ensure freedom of surface discontinuities such as dross or inclusions on them.

11.3) Surfaces are to be clean prior to inspection e.g. free of loose sand or scabbing and appendages removed.

11.4) The testing personnel must be experienced in visual inspection of castings

11.5) The visual inspection method is based on ASTM A 802/802 M-89 or ISO 11971: 2008 E.

11.6) The casting areas where the surface is to be examined is indicated in figure 2.

11.7) Different surface examination zones are identified in Gear tooth figure 2.

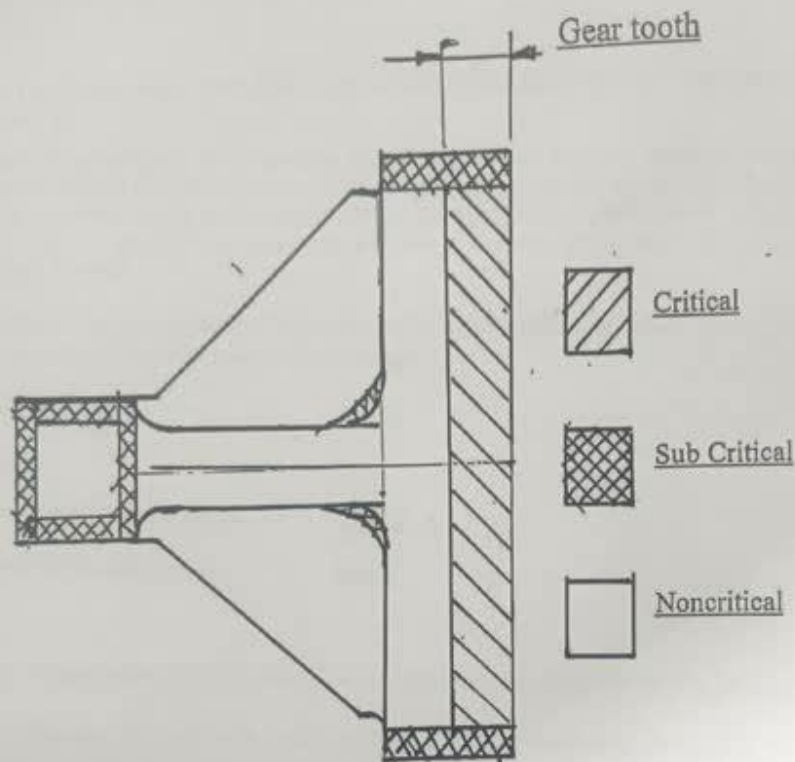


Figure 2. "Gear Section View"

11.8) Acceptance criteria for defect sizes are as below:

Visual defect type	Acceptance criteria		
	Critical Zone	Sub Critical Zone	Non Critical Zone
Scabs & Burn in	None Permitted	None Permitted	None Permitted
Gas holes, Porosity inclusions, Laps	None Permitted	6 mm Max. Length 3 mm Max. Depth	12 mm Max. Length 6 mm Max. Depth
DROSS	None Permitted	16 mm Max. Length 5 mm Max. Depth	20 mm Max. Length 10 mm Max. Depth

" table 1 "

**Note: Depths may need to be determined in conjunction with other test methods ie:
Ultrasonic.**

Defects of greater size than specified are acceptable on "as cast" surfaces where it is determined the defect will be completely removed upon completion of proof machining. Defect clusters [defined as four or more defects of size smaller than the acceptance criteria (table 1) but within an area of 50×50 mm) are deemed non acceptable and are to be reported to "Shahrood cement company" and the main supplier.

11.9) Other surface features of castings shall have the following quality levels identified in ASTM A802 and the (SCRATA) comparator samples.

1- Surface texture	<u>level 3</u>
2-Inserts	<u>level 3</u>
3- Expansion Discontinuities	<u>level 2</u>
4- Metal Removal Marks	<u>level 2</u>

11.10) Comparators for definition of am features are also shown in ASTM A802/A802 M Standard.

11.11) Grinding of surfaces to blend out defects may be undertaken providing they do not exceed the depths stated in table 1.

The defects shall be ground out and smoothly blended, in order to prevent the possible propagation of cracks.

11.12) Welding is not allowed on surfaces identified as "critical" and "subcritical" Zones in "figure 2".

11.13) For non critical zones with defect size mentioned in table 1, welding is allowed only if after fine finishing of defect and (M.T) and (U.T) of defect area, no presence of under surface defects is proved. Note that the grinding depth shall not exceed the depth of the defect shown in table 1.

11.14) All rules and surface quality requirements for Pinion (in as cast condition) is the same as Girth gear, considering the outer surface and hub as critical and side (lateral) surfaces as Sub critical zone.

11.14-1) Girth Gear Surface quality must be Visually checked (by Customer representative) Prior to painting.

11.15) A visual inspection report shall be provided where areas are found that does not comply with the acceptance criteria in section (11.8) and (11.9) the report content shall include (as a minimum) the following information.

11.15.1-Casting heat / melt number.

11.15.2-Manufacturer's job number.

11.15.3-Test date. 11.15.4- Personnel completing the test.

11.15.5- Results of the test including compliance or non compliance.

11.15.6- A sketch or map of all nonconforming areas including the sizes and locations.

12- Magnetic Particle Testing (MT)

12.1) Magnetic particle testing shall be done in accordance with Din 1690-Part 2 or its equivalent by ASTM A903/A903 M 12.2) All testing must be employed along with a 100% visual examination of the casting to detect surface discontinuities in following areas

12.2.1- All filleted areas of the gear (Cope and drag side)

12.2.2- Mating flange of gear halves and the gear rim.

12.2.3- Bolt connection of gear to the tangent plates.

12.2.4- The finished gear teeth after final gear cutting in the machine shop.

12.3) The magnetic particle testing (MT) shall be performed by

12.3.1- As cast areas mentioned in section 12.2 wet color contrast visible method.

12.3.2- finished gear teeth- wet fluorescent method.

12.4) Equipment used for examination shall be calibrated as per ISO 9001-2000.

12.5) The testing personnel must be experienced in magnetic particle examination of gears.

12.6) Magnetic particle test areas are on:

12.6.1- Any surface defects found. (after 100% visual inspection).

12.6.2- The filleted areas at cope and drag side of gear halves and mating flange as well as bolt connection areas of gear to tangent plates and the gear rim.

12.6.3-on machined gear teeth.

12.7) Magnetic Particle test in as cast condition to be completed after fettling of the casting. Surplus material such as ingates, fins, risers and loose sand must be removed prior to testing.

12.8) Acceptance criteria and defect size evaluation for magnetic particle testing considering the severity level 1 for mating flange and level 2 for other areas mentioned in section 12.6 shall be in accordance with DIN 1690 Part2. or its equivalent ASTM E125 Maximum permissible indications in the case of magnetic particle testing as in Stahl-Eisen-Prüfblatt 1935 (reference area 105 mm×148 mm, corresponding to size of A6 as in DIN476) is shown in table 1 of DIN 1690 Part2 for different severity levels.

12.9) Failure to meet the specified Magnetic particle criteria shall be reported to main supplier and the customer (Shahrood Cement Co.) by the subcontractor.

12.10) Grinding surfaces to blend out defects such as dross or laps may be undertaken providing it does not exceed 6mm in depth on as cast surfaces. Deep grinding (over 6mm) which may affect the structural integrity of casting is not allowed.

12.11) Defects which will be removed at machining do not need to be reported providing it is clearly ascertained that the defect's will be completely removed during this operation. The extent of the defect's may need to be established in conjunction with ultrasonic inspection, in order to establish that the defect will be removed.

12.12) Grinding on machined surfaces to remove discontinuities is not allowed.

12.13) The magnetic particle test certificate shall include (as a minimum) the following information:

12.13.1- Casting heat/melt number.

12.13.2-Manufacturer's job number.

12.13.3- Results of test including compliance of or non compliance.

12.13.4-Personnel completing the test.

12.13.5- A sketch of any nonconforming areas showing its position and size if they were unable to be satisfactorily ground.

13- Dimensional Inspection on Castings (Foundry). 13.1) Dimensional Inspection shall be completed on castings at the following stages:

13.1.1- After knock out (to determine adequate machining allowances and establish the contraction amount that has taken place particularly with respect to half gears where contraction amounts can vary depending on the shape and size of the gear).

13.1.2- After Heat Treatment (to determine if any dimensional changes have occurred due to the heat treatment performed).

13.1.3- After final machining and gear cutting to establish that specified requirements have been achieved (This stage shall be completed by the machine shop).

13.2) Dimensional inspection on unmachined castings shall be performed on all major dimensions eg, outside diameter, inside diameter, inside rim diameter, etc.

13.3) The personnel completing the dimensional inspection (before and after heat treatment, and after machining) shall be trained and experienced in the measurement of gears and familiar with the interpretation of engineering drawings.

13.4) A dimensional report after heat treatment shall be provided from the sub contractor and shall include the following:

13.4.1- Casting heat/melt number.

13.4.2- Manufacturer job number.

13.4.3- Inspection date.

13.4.4- Personnel Completing the inspection.

13.4.5- The specified dimension as taken from the drawing.

13.4.6- The actual dimension measured.

13.4.7- Actual machining allowance on each surface/ dimension.

13.4.8- The drawing reference number.

13.4.9- A statement of compliance (or separate certificate of compliance)

13.5) Acceptance criteria shall be as per the drawing.

13.6) Failure to meet the specified drawing will require further engineering evaluation to be completed.

14- Heat Treatment

14.1) The heat treatment for the casting shall be performed to obtain the necessary hardness and physical properties.

14.2) The layout of 1/2 gears in the furnace shall be prepared by the responsible party/subcontractor including thermocouple and packing placement and approved and by the main manufacturer / Foundry.

14.3) The heat treatment cycle required to be determined by the subcontractor, established in writing and submitted to main manufactures/Foundry.

14.4) In heat treatment cycle the heating up rate shall not exceed to 60° C/hr.

14.5) In heat treatment cycle the cooling down rate shall not exceed 50° C/hr.

14.6) Heat treatment graphs (curves) of gear and pinion shall be submitted to the main supplier/manufacturer by the responsible party/subcontractor.

14.7) The hardness of gear shall be within (280-300) HB.

14.8) The hardness of Pinion must be (40) HB more than the gear hardness. ie. (320-340) HB.

5- Machining and Gear Cutting

15.1) The requirements for machining and gear cutting shall be outlined in a separate inspection and test plan by the machining responsible/subcontractor. The ITP shall contain all relevant operations including hold and witness points.

15.2) The machine shop/subcontractor is responsible for recording all machined dimensions and notifying the relevant test authority for any nondestructive testing which needs to be completed.

15.3) Machining set up and method shall be to suit the requirements of the relative AGMA or DIN levels.

15.4) Cope side of casting (gear) shall remain on the same common side during machining process.

15.5) Match marking of each joint flange of the gear is required.

15.6) Match marking of each fitted bolt (used for tightening of joint flanges) is required.

15.7) Spring check of the gear must be completed after rough machining and final machining. Final spring check requires measurement taken axially, radially and at joint gap. Gear joint bolts are to be tightened again to check joint gap measurement.

15.8) Final gear dimensions shall be measured and recorded. This includes but is not limited to:

15.8.1-Outside diameter.

15.8.2- Under rim diameter.

15.8.3- Rim thickness.

15.8.4- Jacking flange diameter.

15.8.5-Face width.

15.8.6-Joint thickness.

15.8.7- Size of joint fitted and clearance holes.

15.8.8- Mounting flange hole size (The holes that will be connected to the tangent plates when mounling the gear on kiln shell).

15.8.9- Chordal dimension. of a.m holes.

15.9) Gear joint flange tightness to be measured and recorded. A 0.04 mm feeler guage to be used for the measurement. Report is required.

15.10) Axial and radial run out shall be limited to 0.04 mm/m of gear diameter. Each measurement station must be hard stamped with appropriate number. Report is required.

16.1) Characteristics of the teeth is shown in table below:

		pinion	Girth Gear
Module	m_n	26	26
Number of teeth	Z	21	180
Normal pressure angle	α_n	20	20
Helix angle	β	0	0
Pitch diameter	D^*_{O2}	546mm	4680mm
Addendum, modification coefficient	X	0.2	-0.2
Height of tooth	$12.25 \times m_n$	58/5mm	60mm
Quality and tolerance acc. To		Din 3962 grade 8	Din 3962 grade 9
Basic tooth Profile		Din 867	Din 867
Basic tool profile		Din 3972 Profile II	Din 3972 Profile II
Backlash		—	—

a) Profile form deviation "fr"

b) Profile angle deviation f HA

c) Total profile deviation Fr

d) Individual pitch deviation fp

e) Normal base pitch deviation f pc

f) Pitch error fu

g) Total pitch deviation Fp

h) Pitch-span deviation over 1/8 of periphery $F_p^{Z/B}$

i) Concentricity deviation Fr

j) Tooth thickness fluctuation Rs Shall comply with the relevant tolerances in tables of Din 3962- Part 1. Page 15 (for Normal module 25)

16.2) All deviation charts and graphs such as profile deviation, tooth lead deviation, involute profile etc. shall be provided by the responsible party and submitted to main supplier/manufacturer.

16.3) Lead, pitch and profile are to be measured and recorded using suitably calibrated equipment. Certified and traceable masters shall be employed. Pitch measurements are to be taken of every tooth. Dimensions must meet the relevant DIN quality standard as specified in the drawing and this specification. Computer generated reports are required.

16.4) Tooth surface finish shall be verified using appropriate measurement. Report required.

16.5) Joint hardware shall be supplied. Certificates for material type and quality. are required. Unless otherwise indicated on the relevant drawing, 1x torque nut and 1x flexnut plus hardened washers shall be supplied per stud. Fitted stud diameters to be measured and recorded. Certification required.

17- External inspectors.

17.1) Inspectors representing the clients must be allowed access to any premises for the inspection of the gear and pinion in different stage of operations. It shall also be included on the relevant ITP to ensure it is clear what operations the inspector will be associated with.

17.2) Witness and hold points as per the ITP require a minimum of 3 weeks notice prior to the event.

18-Surface Protection.

18.1) Machined surfaces shall be coated with a "Shell Ensis", "Tectyl 506" or similar material to protect from corrosion. All teeth must be suitably covered with "Denso Tape" or similar material to prevent air and moisture from corroding the surface.

19- Painting.

19.1) The paint system shall be specified in the contract and approved by the client (Shahrood Cement Co.)

19.2) Abrasive blast prior to painting as per ISO 8501-1 class 2.5

19.3) Prime painting of the casting is required prior to dispatch from foundry to machine shop and is to be applied within 4 hours of abrasive blasting.

20-Packaging.

20.1) Packaging shall be arranged to protect the casting after final gear cutting.

20.2) Timber packing shall be mounted to the gear to prevent damage to any machined surface. 20.3) Sisalkraft 310 bitumen paper or an approved equivalent shall be used between timber and metal surfaces to prevent corrosion.

20.4) Export packaging as per ISPM 15 compliant timber must be used. The timber must be stamped appropriately and have a certificate of fumigation.

21-Final Book

A final book including all certificates, test reports, charts, graphs and reports of any engineering action taken for test results in all manufacturing stages must be submitted to client (Shahrood Cement Co.).