Model a four-cylinder engine crankshaft, piston and connecting rod assembly

Software: CATIA V5

Task statement

Model the reciprocating crank train of an inline four-cylinder engine as a set of solid parts in millimetres, then assemble them into a product. Work from the supplied dimensioned diagrams: diagram_01.png, diagram_01_sheet2.png to diagram_01_sheet6.png and their detail images.

Create six parts, each named after the component:

1. PISTON: outside diameter Ø85, overall height 90, domed crown of R120.

- Three ring grooves, 4.3 wide, with a groove-root diameter of Ø79.
  - Inner cavity Ø76, 85 deep from the open end.
  - Ø33.8 transverse piston-pin bore, with skirt cut-outs 27 high at the pin bosses.
  - Section A-A detail: R40 underside relief, R10 transitions, and widths of 38 and 50 across the pin bosses.

2. CONNECTING_ROD: small end of Ø45 outside with a Ø33.8 pin bore. Big-end half-bore of R27 / R36, rod width 38 at the big end, 201.2 between the pin and crankpin centres, and two Ø9 bolt holes at 76 centres.

3. CONNECTING_ROD_CAP: the mating half-bearing cap.

- 94 wide, 60 high and 38 thick.
  - Half-bore R27 inside, R36 outside.
  - R10 corner blends and 27.5 / 22.53 chamfer geometry.
  - Two Ø9 bolt holes in R9 bosses at 76 centres.

4. CRANKSHAFT: a single shaft.

- Ø32 nose, 80 long.
  - Ø72 main journals, 38 long.
  - Ø54 crankpins, 46 long, offset 44 from the shaft axis.
  - Webs 15 thick with an R80 / R36 profile and a 33° taper.
  - Rear flange Ø144, 10 thick, carrying 8 holes of Ø10 on a Ø100 bolt circle.

5. PISTON_PIN: a Ø33.8 pin, 82 long.

6. PISTON_RING: a flat ring, Ø85 outside and Ø79 inside, 4.3 thick.

Build a sub-product named MINI_ASSEMBLY for one cylinder. It holds one piston, three piston rings seated in the grooves, one piston pin through the piston and the rod small end, one connecting rod, and one connecting rod cap closed on the rod big end.

Build the top-level product 4_CYLINDER_ENGINE_ASSEMBLY. It contains the crankshaft and four MINI_ASSEMBLY instances, one per crankpin, so that the big ends sit concentric on the crankpins. The pistons stand at the staggered heights set by the crank throws, as shown in the front, top and isometric views at 1:5.

The bill of materials must resolve to:

- PISTON ×4
- CONNECTING ROD ×4
- CRANKSHAFT ×1

- CONNECTING ROD CAP ×4
- PISTON RING ×12
- PISTON PIN ×4

Save each part as its own CATPart and each product as a CATProduct.

Rubrics

- **R1:** The model shall include a PISTON part with outside diameter 85 and overall height 90.
- **R2:** The PISTON shall have three ring grooves 4.3 wide with a root diameter of 79.
- **R3:** The PISTON shall have a transverse pin bore of diameter 33.8 and an internal cavity of diameter 76.
- **R4:** The PISTON crown shall be domed with radius 120.
- **R5:** The model shall include a CRANKSHAFT part with a rear flange of diameter 144 and thickness 10.
- **R6:** The CRANKSHAFT flange shall carry 8 holes of diameter 10 on a 100 diameter bolt circle.
- **R7:** The CRANKSHAFT shall have main journals of diameter 72 and a front nose of diameter 32 and length 80.
- **R8:** The CRANKSHAFT shall have four crankpins of diameter 54 offset 44 from the main axis, separated by webs 15 thick.
- **R9:** The model shall include a CONNECTING_ROD_CAP part 94 wide, 60 high and 38 thick, with a half-bore of radius 27.
- **R10:** The CONNECTING_ROD_CAP shall have two bolt holes of diameter 9 at 76 centres.
- **R11:** The model shall include a CONNECTING_ROD part whose small-end bore is diameter 33.8.
- **R12:** The model shall include a PISTON_PIN part of diameter 33.8 and length 82.
- **R13:** The model shall include a PISTON_RING part with outside diameter 85, inside diameter 79 and thickness 4.3.
- **R14:** The model shall position each connecting rod big end concentric with a crankpin, with the cap closed around it.
- **R15:** The model shall seat each piston pin through its piston and the connecting rod small end.
- **R16:** The model shall contain a MINI_ASSEMBLY product grouping one piston, three piston rings, one piston pin, one connecting rod and one connecting rod cap.
- **R17:** The model shall contain a top-level 4_CYLINDER_ENGINE_ASSEMBLY product holding one CRANKSHAFT and four MINI_ASSEMBLY instances.
- **R18:** The model's product structure shall total 4 pistons, 4 connecting rods, 1 crankshaft, 4 connecting rod caps, 12 piston rings and 4 piston pins.

Input files

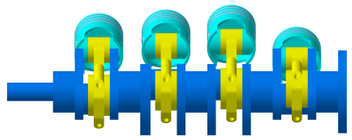
- task_files/diagrams/diagram_01.pdf
- task_files/diagrams/diagram_01.png
- task_files/diagrams/diagram_01_detail01.png
- task_files/diagrams/diagram_01_detail02.png
- task_files/diagrams/diagram_01_detail03.png
- task_files/diagrams/diagram_01_detail04.png
- task_files/diagrams/diagram_01_sheet2.png
- task_files/diagrams/diagram_01_detail05.png
- task_files/diagrams/diagram_01_detail06.png
- task_files/diagrams/diagram_01_sheet3.png

- task_files/diagrams/diagram_01_detail07.png
- task_files/diagrams/diagram_01_detail08.png
- task_files/diagrams/diagram_01_sheet4.png
- task_files/diagrams/diagram_01_detail09.png
- task_files/diagrams/diagram_01_detail10.png
- task_files/diagrams/diagram_01_sheet5.png
- task_files/diagrams/diagram_01_detail11.png
- task_files/diagrams/diagram_01_detail12.png
- task_files/diagrams/diagram_01_sheet6.png
- task_files/diagrams/diagram_01_detail13.png
- task_files/diagrams/diagram_01_detail14.png

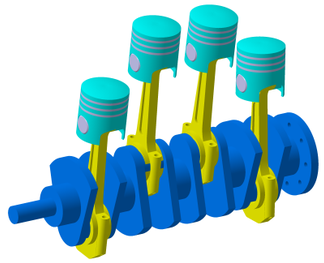
Deliverables

- **.catpart:** output_files/project_files/CONNECTING_ROD_CAP.CATPart: The deliverable is six CATPart files (PISTON, PISTON_RING, PISTON_PIN, CONNECTING_ROD, CONNECTING_ROD_CAP, CRANKSHAFT), a MINI_ASSEMBLY CATProduct for one cylinder, and a 4_CYLINDER_ENGINE_ASSEMBLY CATProduct that assembles the crankshaft with four cylinder sub-assemblies.
- **.catpart:** output_files/project_files/CONNECTING_ROD.CATPart: The deliverable is six CATPart files (PISTON, PISTON_RING, PISTON_PIN, CONNECTING_ROD, CONNECTING_ROD_CAP, CRANKSHAFT), a MINI_ASSEMBLY CATProduct for one cylinder, and a 4_CYLINDER_ENGINE_ASSEMBLY CATProduct that assembles the crankshaft with four cylinder sub-assemblies.
- **.catpart:** output_files/project_files/CRANKSHAFT.CATPart: The deliverable is six CATPart files (PISTON, PISTON_RING, PISTON_PIN, CONNECTING_ROD, CONNECTING_ROD_CAP, CRANKSHAFT), a MINI_ASSEMBLY CATProduct for one cylinder, and a 4_CYLINDER_ENGINE_ASSEMBLY CATProduct that assembles the crankshaft with four cylinder sub-assemblies.
- **.catproduct:** output_files/project_files/MINI_ASSEMBLY.CATProduct: The deliverable is six CATPart files (PISTON, PISTON_RING, PISTON_PIN, CONNECTING_ROD, CONNECTING_ROD_CAP, CRANKSHAFT), a MINI_ASSEMBLY CATProduct for one cylinder, and a 4_CYLINDER_ENGINE_ASSEMBLY CATProduct that assembles the crankshaft with four cylinder sub-assemblies.
- **.catpart:** output_files/project_files/PISTON_PIN.CATPart: The deliverable is six CATPart files (PISTON, PISTON_RING, PISTON_PIN, CONNECTING_ROD, CONNECTING_ROD_CAP, CRANKSHAFT), a MINI_ASSEMBLY CATProduct for one cylinder, and a 4_CYLINDER_ENGINE_ASSEMBLY CATProduct that assembles the crankshaft with four cylinder sub-assemblies.
- **.catpart:** output_files/project_files/PISTON.CATPart: The deliverable is six CATPart files (PISTON, PISTON_RING, PISTON_PIN, CONNECTING_ROD, CONNECTING_ROD_CAP, CRANKSHAFT), a MINI_ASSEMBLY CATProduct for one cylinder, and a 4_CYLINDER_ENGINE_ASSEMBLY CATProduct that assembles the crankshaft with four cylinder sub-assemblies.
- **.catpart:** output_files/project_files/PISTON_RING.CATPart: The deliverable is six CATPart files (PISTON, PISTON_RING, PISTON_PIN, CONNECTING_ROD, CONNECTING_ROD_CAP, CRANKSHAFT), a MINI_ASSEMBLY CATProduct for one cylinder, and a 4_CYLINDER_ENGINE_ASSEMBLY CATProduct that assembles the crankshaft with four cylinder sub-assemblies.
- **.catproduct:** output_files/project_files/4_CYLINDER_ENGINE_ASSEMBLY.CATProduct: The deliverable is six CATPart files (PISTON, PISTON_RING, PISTON_PIN, CONNECTING_ROD, CONNECTING_ROD_CAP, CRANKSHAFT), a MINI_ASSEMBLY CATProduct for one cylinder, and a 4_CYLINDER_ENGINE_ASSEMBLY CATProduct that assembles the crankshaft with four cylinder sub-

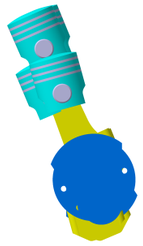
assemblies.



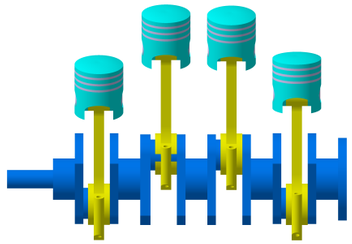
Bottom view
Scale: 1:5



Isometric view
Scale: 1:5



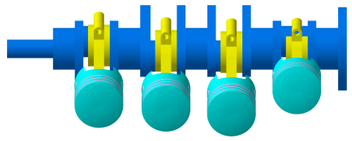
Right view
Scale: 1:5



Front view
Scale: 1:5



Left view
Scale: 1:5



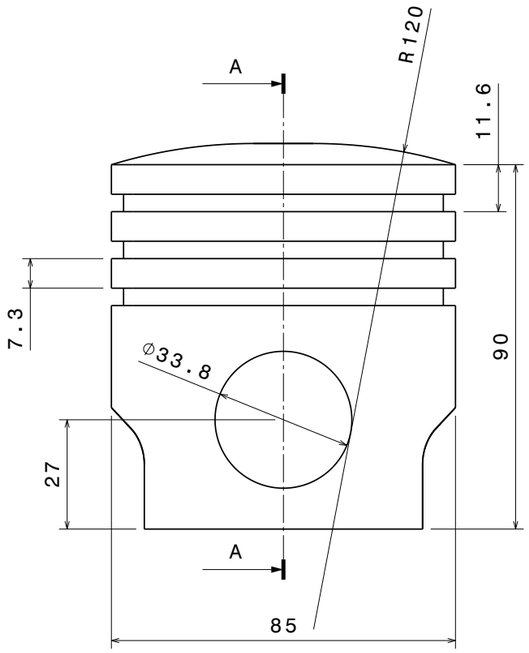
Top view
Scale: 1:5

ITEM NO.	PART NAME	QTY
1	PISTON	4
2	CONNECTING ROD	4
3	CRANKSHAFT	1
4	CONNECTING ROD CAP	4
5	PISTON RING	12
6	PISTON PIN	4

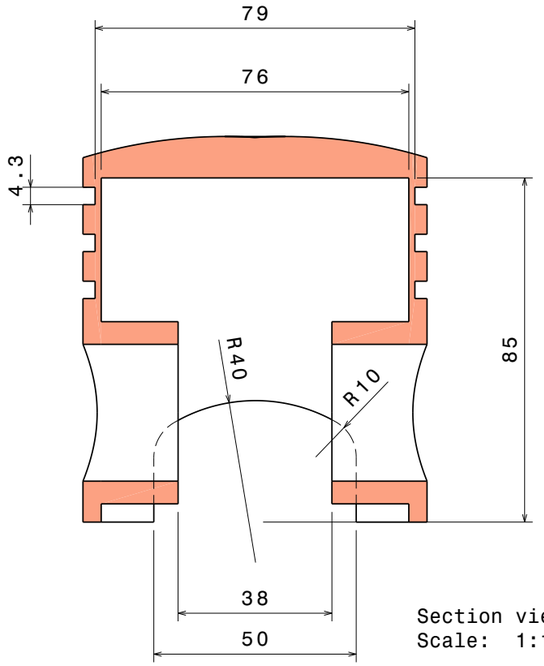
DESIGNED BY: charan	4 CYLINDER ENGINE ASSEMBLY		I _
DATE: 05-09-2026			H _
CHECKED BY: XXX			G _
DATE: XXX			F _
SIZE A2	DASSAULT SYSTEMES		E _
			D _
SCALE 1:5	WEIGHT (kg) 39.00	DRAWING NUMBER ASSEMBLY	SHEET 1
			C _
			B _
This drawing is our property; it can't be reproduced or communicated without our written agreement.			A _

NOTES
1. DO NOT SCALE THE DRAWING; USE THE FIGURED DIMENSIONS.

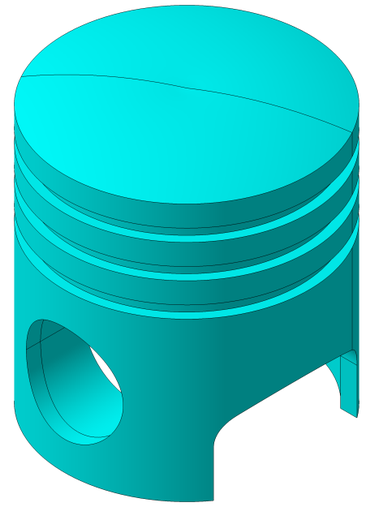
UNITS: AS SHOWN	SCALE: **AS SHOWN**	PROJECTION:
TITLE: **FOUR-CYLINDER ENGINE CRANKSHAFT, PISTON AND CONNECTING ROD ASSEMBLY**		SIZE: **A3**
DRAWING NO.: **MKV-28E7F5FF-01**	REV: **0**	SHEET: **1 OF 6**



Front view
Scale: 1:1



Section view A-A
Scale: 1:1



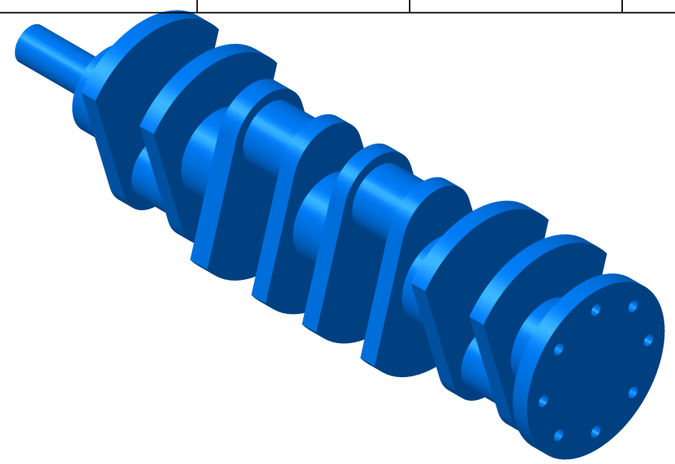
Isometric view
Scale: 1:1

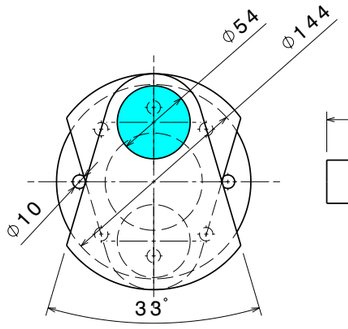
DESIGNED BY: charan	4 CYLINDER ENGINE ASSEMBLY		I _
DATE: 05-09-2026			H _
CHECKED BY: XXX			G _
DATE: XXX			F _
SIZE A3	DASSAULT SYSTEMES		E _
			D _
			C _
SCALE 1:1	WEIGHT (kg) XXX	DRAWING NUMBER 1.PISTON	SHEET 1/1 B _
			A _

This drawing is our property; it can't be reproduced or communicated without our written agreement.

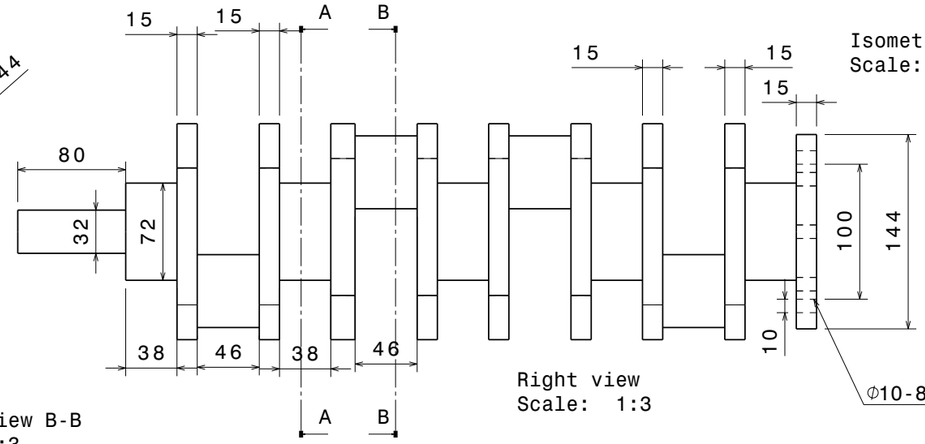
NOTES
1. DO NOT SCALE THE DRAWING; USE THE FIGURED DIMENSIONS.

UNITS AS SHOWN	SCALE **AS SHOWN**	PROJECTION
TITLE **FOUR-CYLINDER ENGINE CRANKSHAFT, PISTON AND CONNECTING ROD ASSEMBLY**		SIZE **A3**
DRAWING NO. **MKV-28E7F5FF-02**	REV **0**	SHEET **2 OF 6**



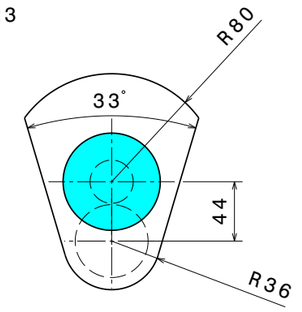


Section view B-B
Scale: 1:3



Right view
Scale: 1:3

Isometric view
Scale: 1:3



Section view A-A
Scale: 1:3

DESIGNED BY: chara	4 CYLINDER ENGINE ASSEMBLY
DATE: 05-09-2026	
CHECKED BY: XXX	
DATE: XXX	
SIZE A3	DASSAULT SYSTEMES
SCALE 1:3 / WEIGHT (kg) 25.59 / DRAWING NUMBER 3.CRANKSHAFT / SHEET 1/3	

This drawing is our property; it can't be reproduced or communicated without our written agreement.

I	_
H	_
G	_
F	_
E	_
D	_
C	_
B	_
A	_

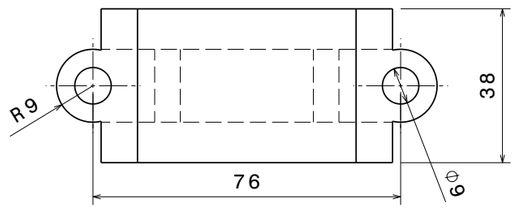
NOTES
1. DO NOT SCALE THE DRAWING; USE THE FIGURED DIMENSIONS.

UNITS	SCALE	PROJECTION
AS SHOWN	**AS SHOWN**	

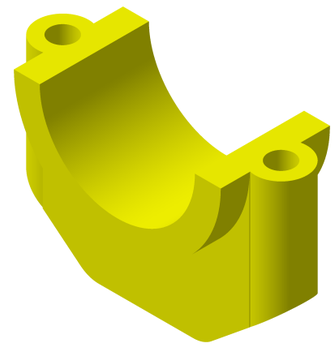
TITLE: **FOUR-CYLINDER ENGINE CRANKSHAFT, PISTON AND CONNECTING ROD ASSEMBLY**

SIZE: **A3**

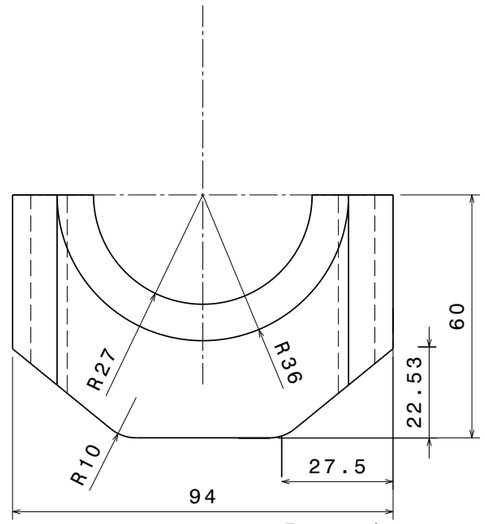
DRAWING NO.	REV	SHEET
MKV-28E7F5FF-03	**0**	**3 OF 6**



Top view
Scale: 1:1



Isometric view
Scale: 1:1



Front view
Scale: 1:1

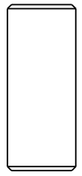
DESIGNED BY: charan	4 CYLINDER ENGINE ASSEMBLY		
DATE: 05-09-2026			
CHECKED BY: XXX			
DATE: XXX			
SIZE A3	DASSAULT SYSTEMES		
SCALE 1:1	WEIGHT (kg) 0.62	DRAWING NUMBER 4.CONNECTING ROD CAP	SHEET 1/4

This drawing is our property; it can't be reproduced or communicated without our written agreement.

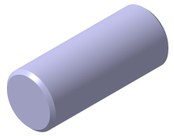
I	_
H	_
G	_
F	_
E	_
D	_
C	_
B	_
A	_

NOTES
1. DO NOT SCALE THE DRAWING; USE THE FIGURED DIMENSIONS.

UNITS AS SHOWN	SCALE **AS SHOWN**	PROJECTION
TITLE **FOUR-CYLINDER ENGINE CRANKSHAFT, PISTON AND CONNECTING ROD ASSEMBLY**		SIZE **A3**
DRAWING NO. **MKV-28E7F5FF-04**	REV **0**	SHEET **4 OF 6**



Bottom view
Scale: 1:2



Isometric view
Scale: 1:2

5.PISTON PIN

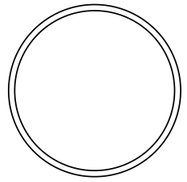


Front view
Scale: 1:2



6.PISTON RING

Isometric view
Scale: 1:2



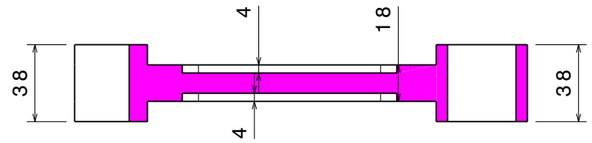
Front view
Scale: 1:2

Left view
Scale: 1:2

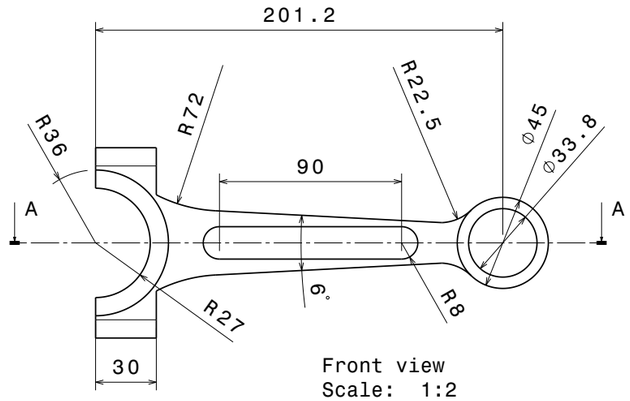
DESIGNED BY: charan		4 CYLINDER ENGINE ASSEMBLY	I _
DATE: 05-09-2026			H _
CHECKED BY: XXX			G _
DATE: XXX			F _
SIZE A3		DASSAULT SYSTEMES	E _
			D _
			C _
SCALE 1:2	WEIGHT (kg) 0.58	DRAWING NUMBER 5.PISTON RING , 6.PISTON PIN	SHEET 1/5
This drawing is our property; it can't be reproduced or communicated without our written agreement.			B _
			A _

NOTES
1. DO NOT SCALE THE DRAWING; USE THE FIGURED DIMENSIONS.

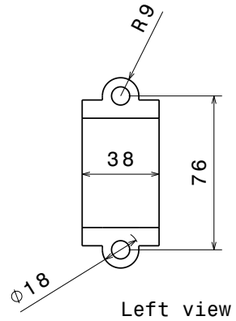
UNITS AS SHOWN	SCALE **AS SHOWN**	PROJECTION
TITLE **FOUR-CYLINDER ENGINE CRANKSHAFT, PISTON AND CONNECTING ROD ASSEMBLY**		SIZE **A3**
DRAWING NO. **MKV-28E7F5FF-05**	REV **0**	SHEET **5 OF 6**



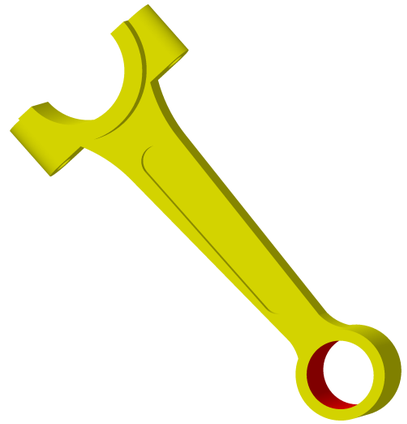
Section view A-A
Scale: 1:2



Front view
Scale: 1:2



Left view
Scale: 1:2



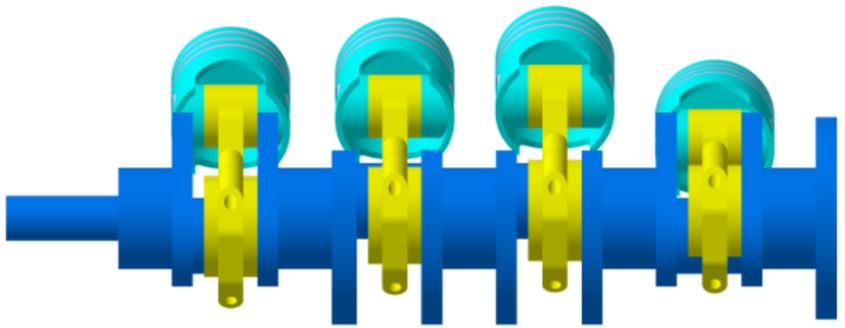
Isometric view
Scale: 1:2

DESIGNED BY: charan		4 CYLINDER ENGINE ASSEMBLY	I _
DATE: 05-09-2026			H _
CHECKED BY: XXX			G _
DATE: XXX			F _
SIZE A3		DASSAULT SYSTEMES	E _
			D _
			C _
			B _
			A _
SCALE 1:2	WEIGHT (kg) 1.03	DRAWING NUMBER 2.CONNECTING ROD	SHEET 1/2

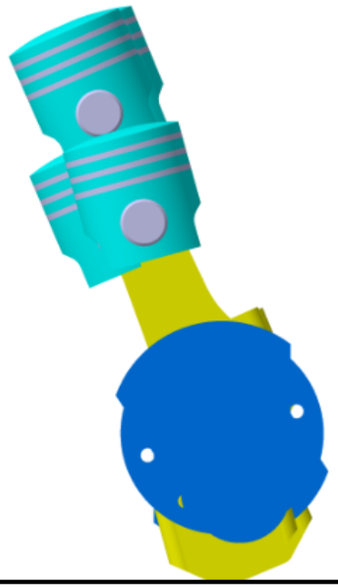
This drawing is our property; it can't be reproduced or communicated without our written agreement.

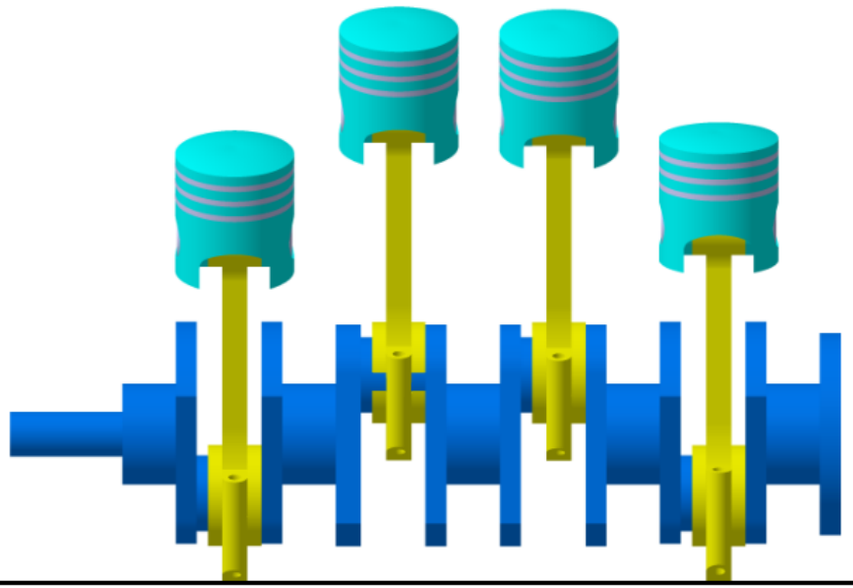
NOTES
1. DO NOT SCALE THE DRAWING; USE THE FIGURED DIMENSIONS.

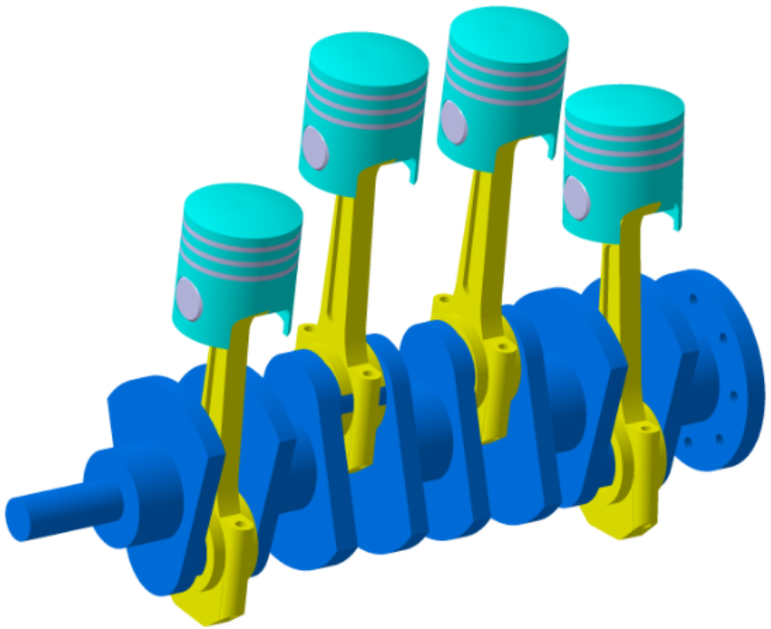
UNITS AS SHOWN	SCALE **AS SHOWN**	PROJECTION
TITLE **FOUR-CYLINDER ENGINE CRANKSHAFT, PISTON AND CONNECTING ROD ASSEMBLY**		SIZE **A3**
DRAWING NO. **MKV-28E7F5FF-06**	REV **0**	SHEET **6 OF 6**



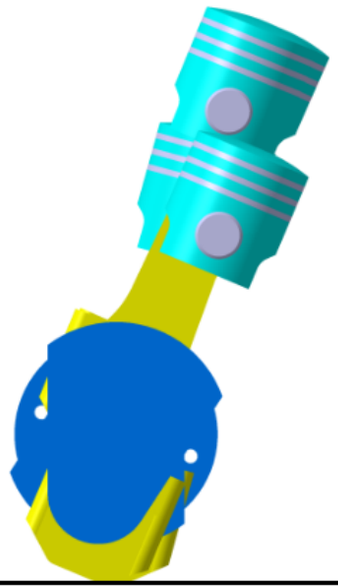
Bottom view
Scale: 1:5







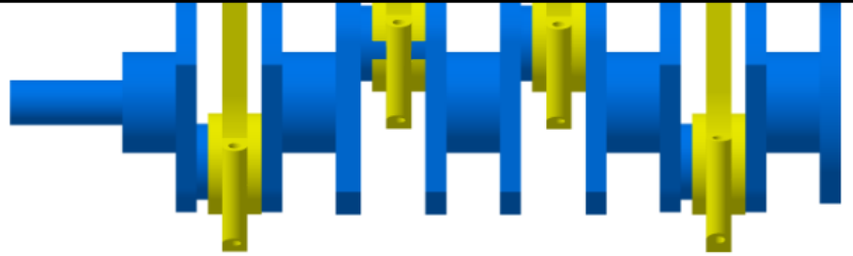
Isometric view
Scale: 1:5



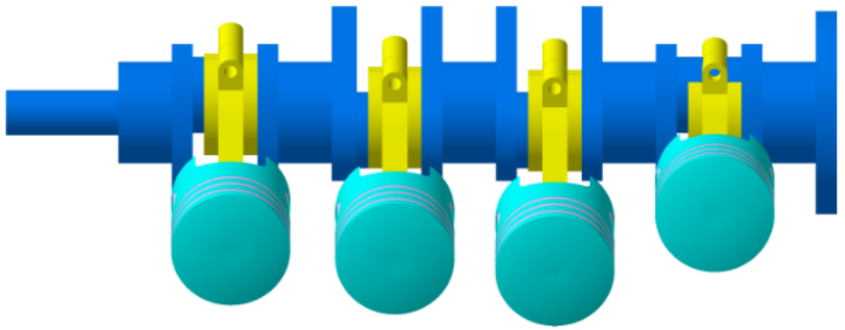
ITEM NO.	PART NAME	QTY
1	PISTON	4
2	CONNECTING ROD	4



Right view
Scale: 1:5



Front view
Scale: 1:5



Top view
Scale: 1:5

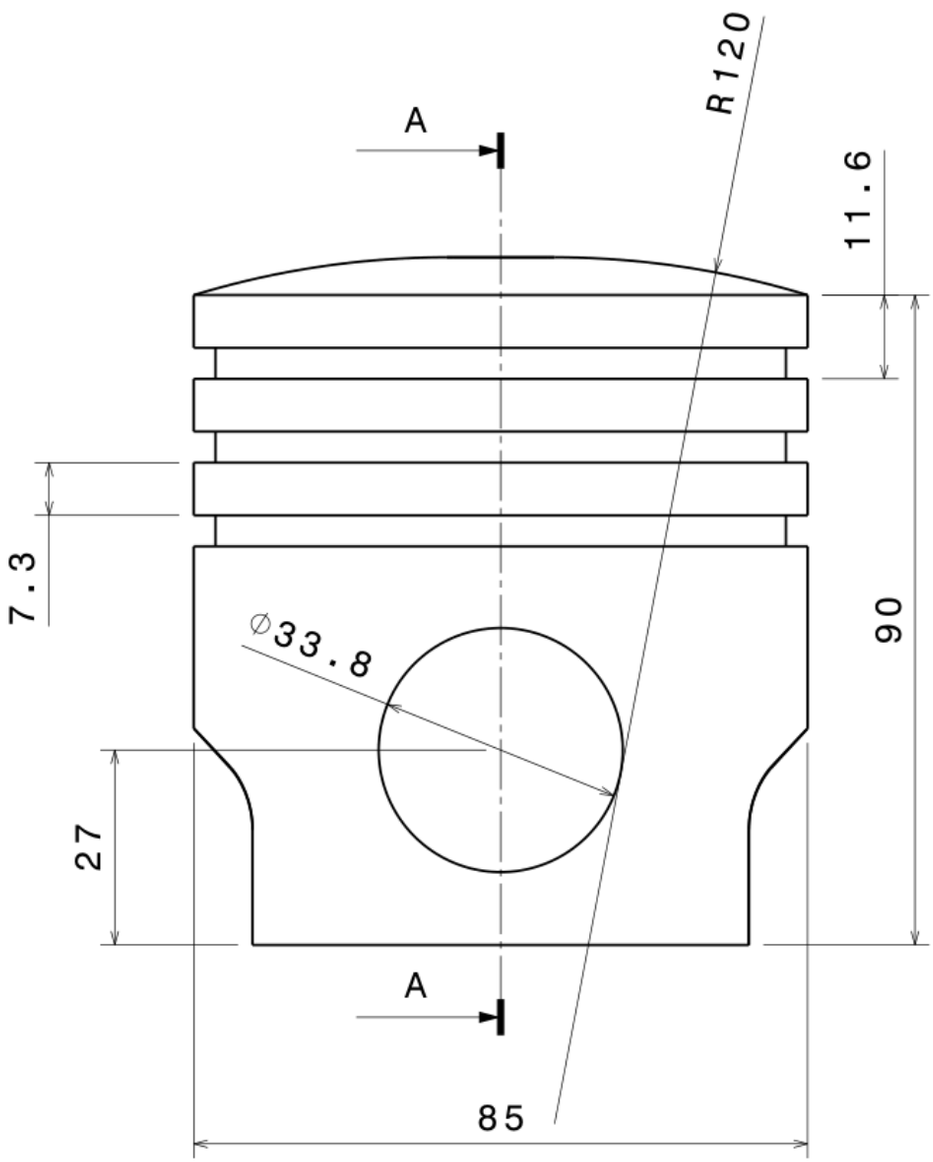


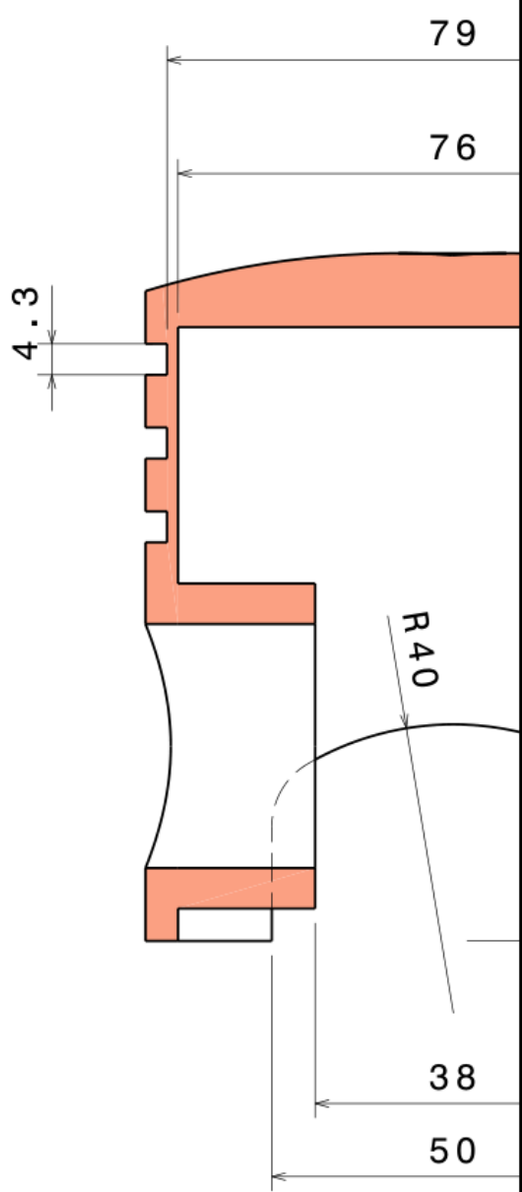
Left view
Scale: 1:5

NO.		
1	PISTON	4
2	CONNECTING ROD	4
3	CRANKSHAFT	1
4	CONNECTING ROD CAP	4
5	PISTON RING	12
6	PISTON PIN	4

DESIGNED BY: charan DATE: 05-09-2026	4 CYLINDER ENGINE ASSEMBLY		I _ H _ G _ F _ E _ D _ C _ B _ A _
CHECKED BY: XXX DATE: XXX			
SIZE A2	DASSAULT SYSTEMES		
SCALE 1:5	WEIGHT (kg) 39.00	DRAWING NUMBER ASSEMBLY	SHEET 1

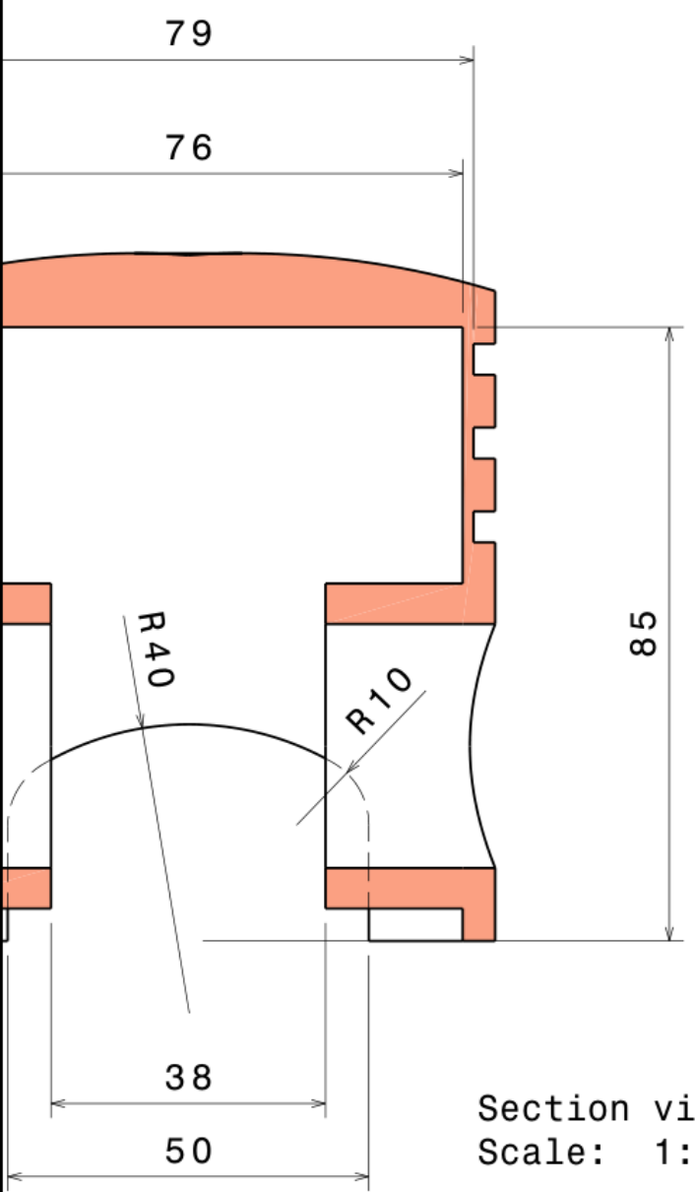
This drawing is our property; it can't be reproduced or communicated without our written agreement.



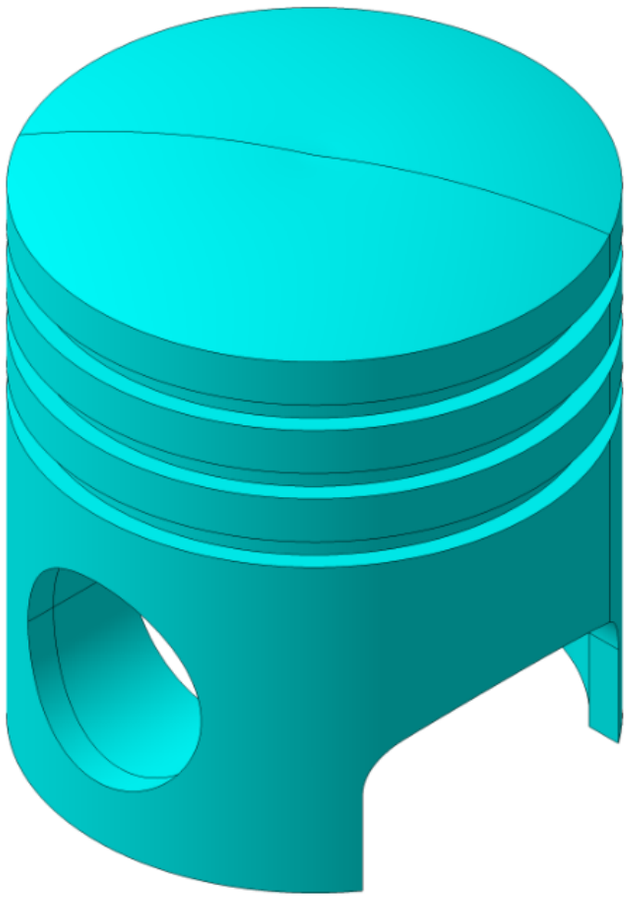


Front view
Scale: 1:1

DESIG	
DATE:	
CHECK	
DATE:	
SIZE	A
SCALE	1
This	



Section view A-A
Scale: 1:1

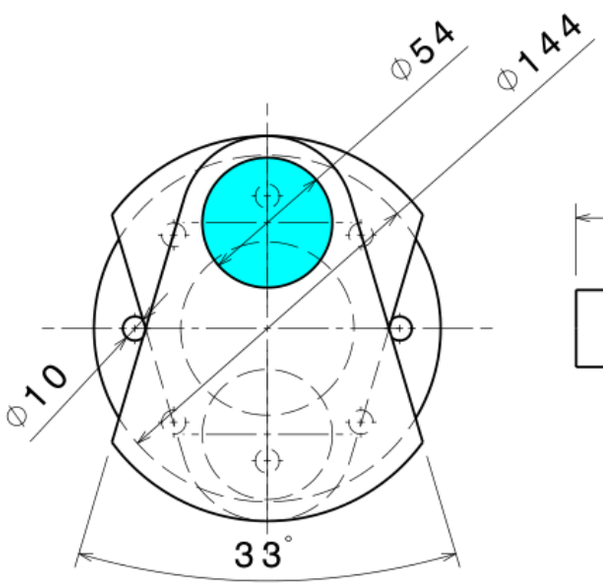


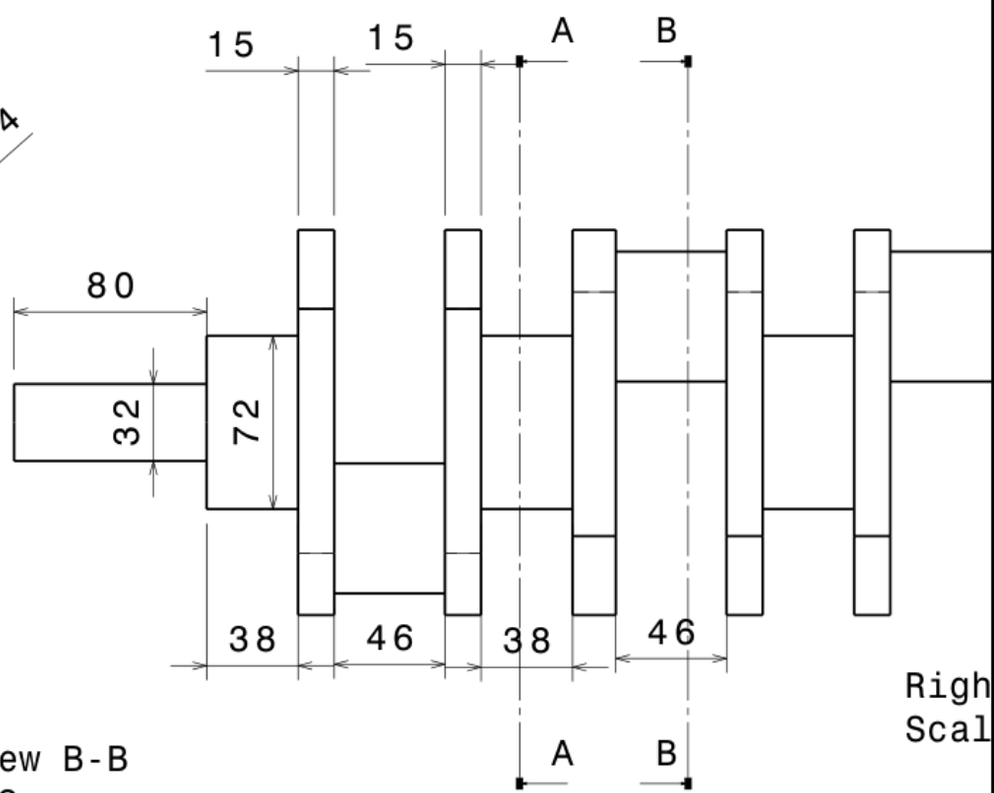
Isometric view
Scale: 1:1

DESIGNED BY: charan	4 CYLINDER ENGINE ASSEMBLY
DATE: 05-09-2026	
CHECKED BY: XXX	
DATE: XXX	
SIZE A3	DASSAULT SYSTEMES
SCALE 1:1 / WEIGHT (kg) XXX	DRAWING NUMBER 1.PISTON / SHEET 1/1

This drawing is our property; it can't be reproduced or communicated without our written agreement.

I	_
H	_
G	_
F	_
E	_
D	_
C	_
B	_
A	_

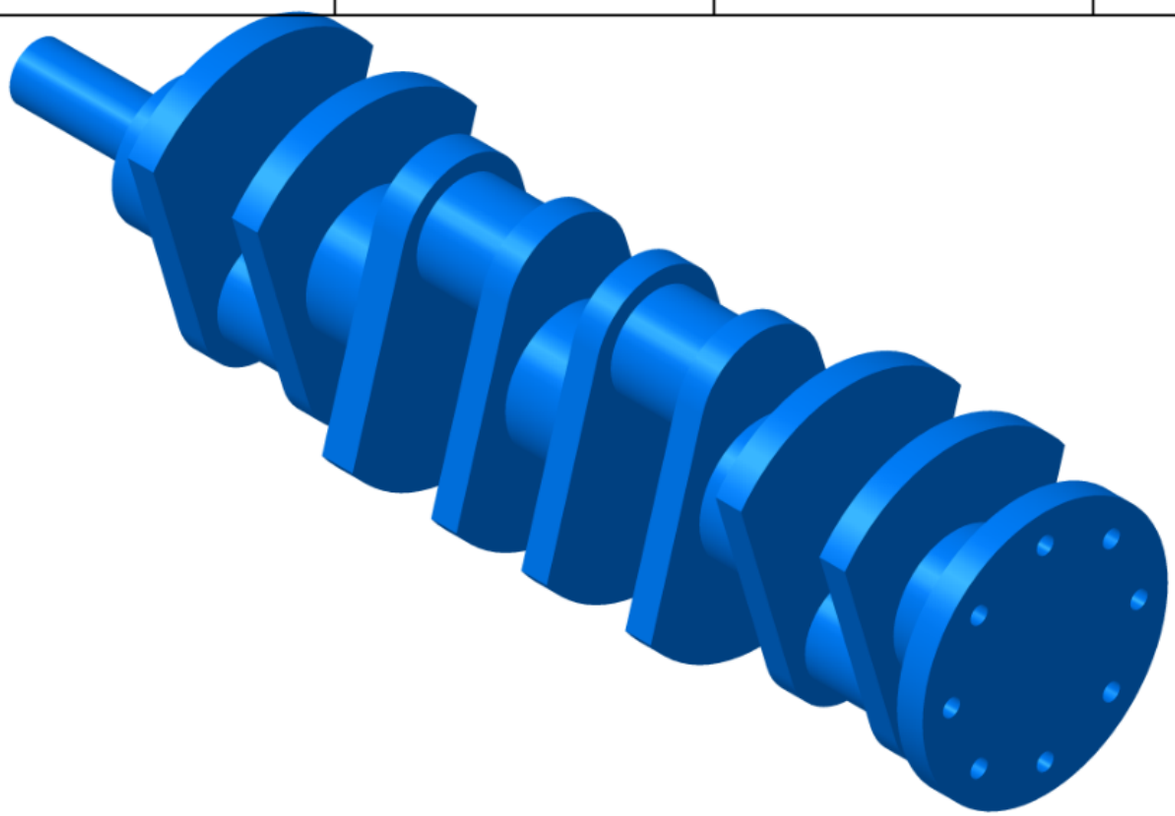




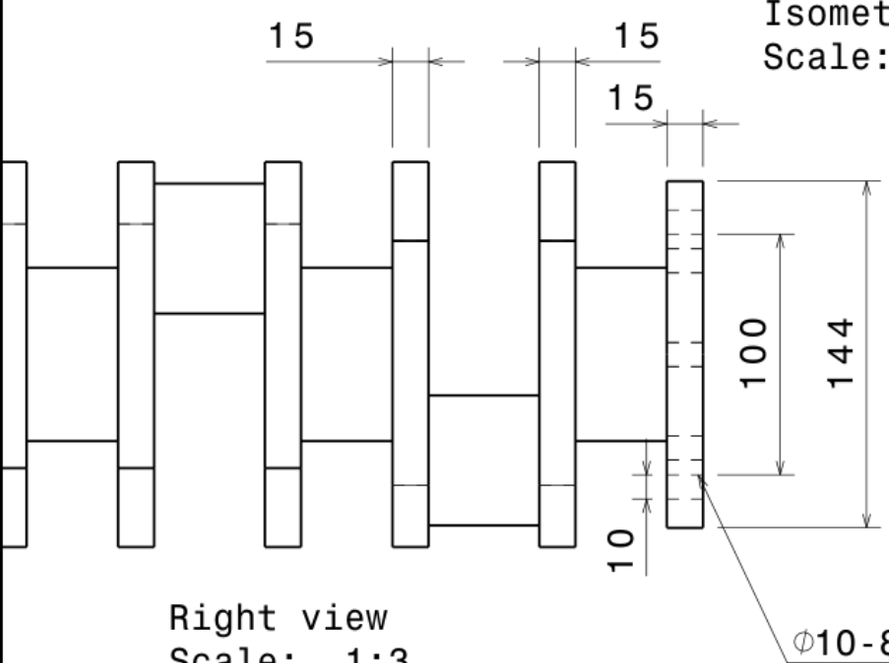
Section view B-B
Scale: 1:3

Righ
Scal

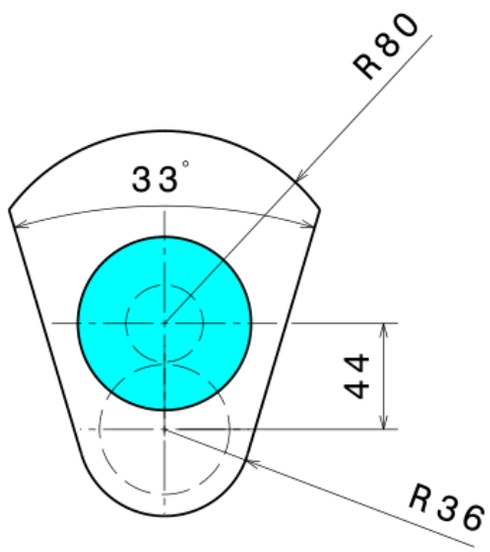
DESIG	
DATE:	
CHECK	
DATE:	
SIZE	A
SCALE	1:
This	



Isometric view
Scale: 1:3



Right view
Scale: 1:3

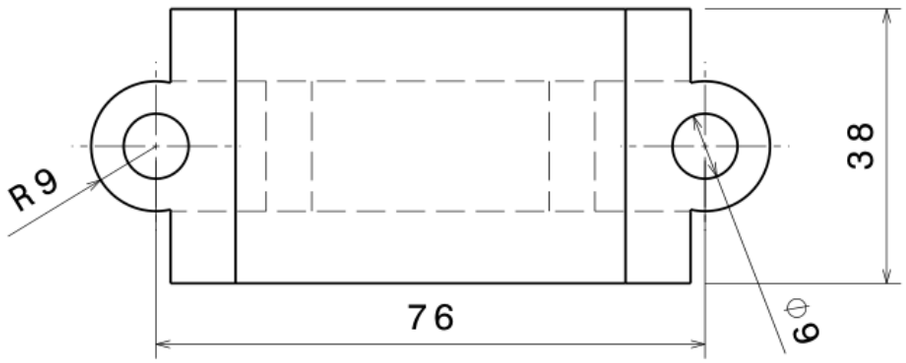


Section view A-A
Scale: 1:3

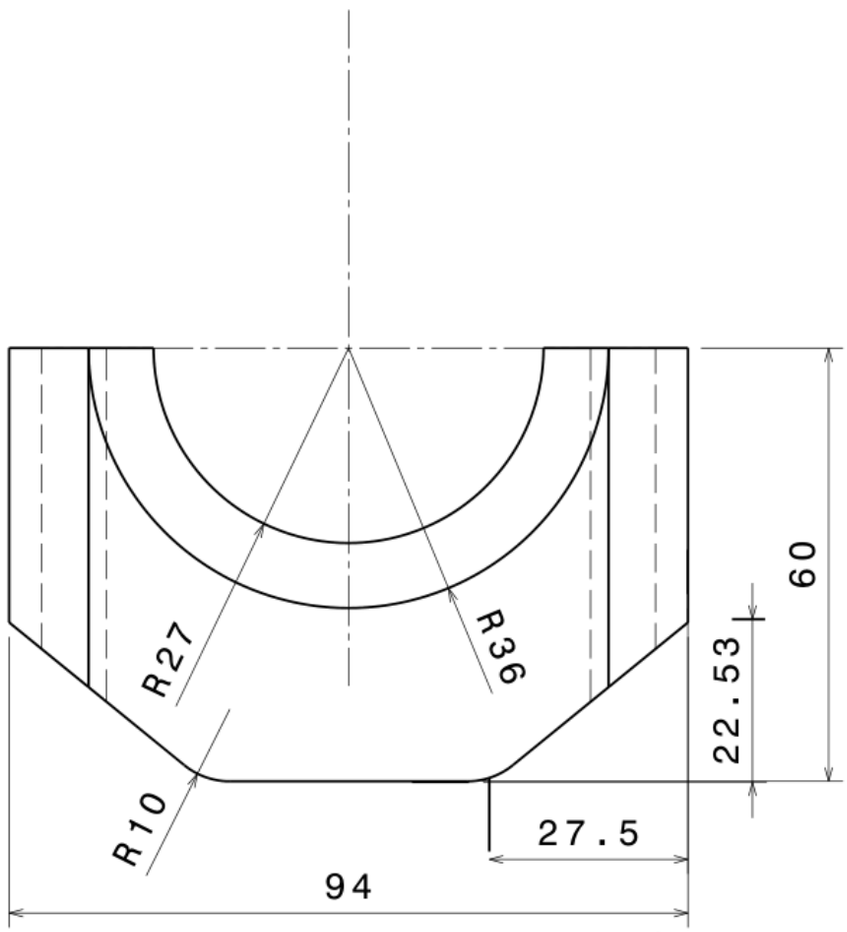
DESIGNED BY: chara DATE: 05-09-2026	4 CYLINDER ENGINE ASSEMBLY		
CHECKED BY: XXX DATE: XXX			
SIZE A3	DASSAULT SYSTEMES		
SCALE 1:3	WEIGHT (kg) 25.59	DRAWING NUMBER 3.CRANKSHAFT	SHEET 1/3

This drawing is our property; it can't be reproduced or communicated without our written agreement.

I	_
H	_
G	_
F	_
E	_
D	_
C	_
B	_
A	_

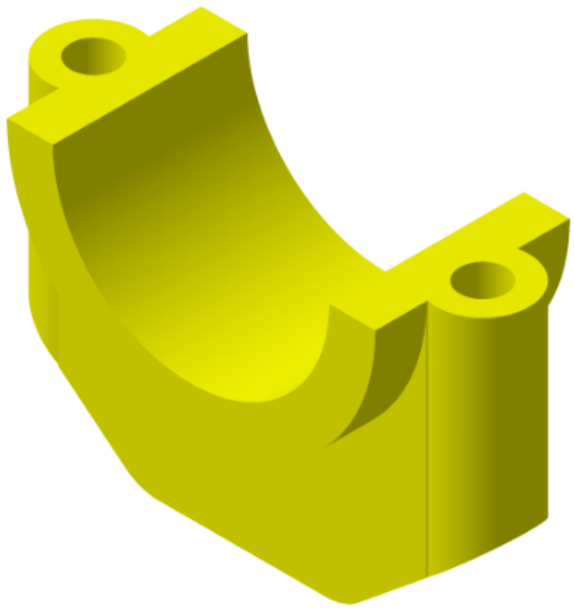


Top view
Scale: 1:1



Front view
Scale: 1:1

DESIG
DATE:
CHECK
DATE:
SIZE
A
SCALE
1
This



Isometric view
Scale: 1:1

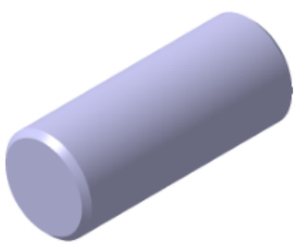
DESIGNED BY: charan DATE: 05-09-2026		4 CYLINDER ENGINE ASSEMBLY		
CHECKED BY: XXX DATE: XXX				
SIZE A3		DASSAULT SYSTEMES		
SCALE 1:1	WEIGHT (kg) 0.62	DRAWING NUMBER 4.CONNECTING ROD CAP	SHEET 1/4	

This drawing is our property; it can't be reproduced or communicated without our written agreement.

I	_
H	_
G	_
F	_
E	_
D	_
C	_
B	_
A	_

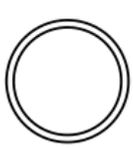


Bottom view
Scale: 1:2



Isometric view
Scale: 1:2

5.PISTON PIN



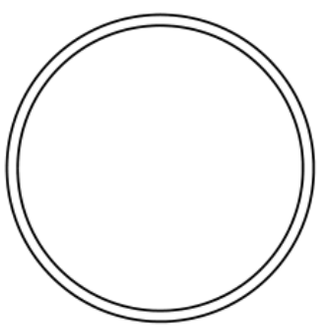
Front view
Scale: 1:2

DESIG
DATE:
CHECK
DATE:
SIZE
A
SCALE
1:
This



6.PISTON RING

Isometric view
Scale: 1:2



Front view
Scale: 1:2

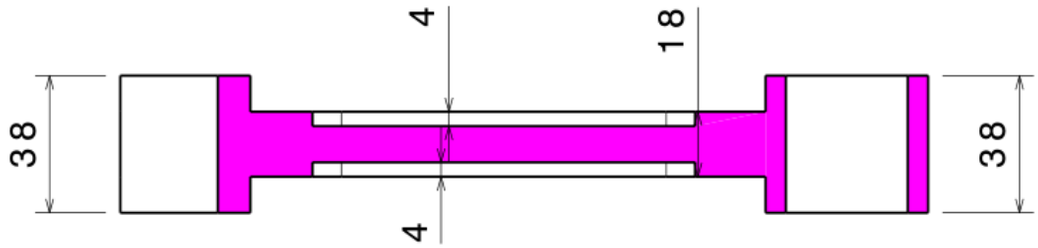


Left view
Scale: 1:2

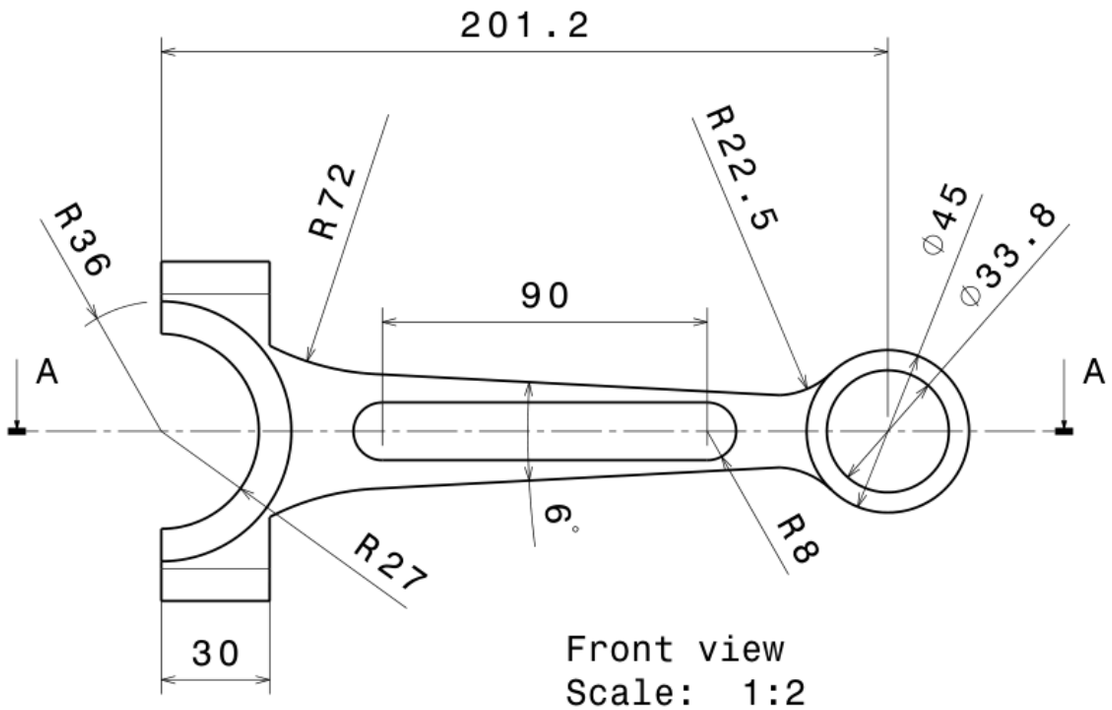
DESIGNED BY: charan DATE: 05-09-2026	4 CYLINDER ENGINE ASSEMBLY		
CHECKED BY: XXX DATE: XXX			
SIZE: A3	DASSAULT SYSTEMES		
SCALE: 1:2	WEIGHT (kg): 0.58	DRAWING NUMBER: 5.PISTON RING , 6.PISTON PIN	SHEET: 1/5

This drawing is our property; it can't be reproduced or communicated without our written agreement.

I	_
H	_
G	_
F	_
E	_
D	_
C	_
B	_
A	_



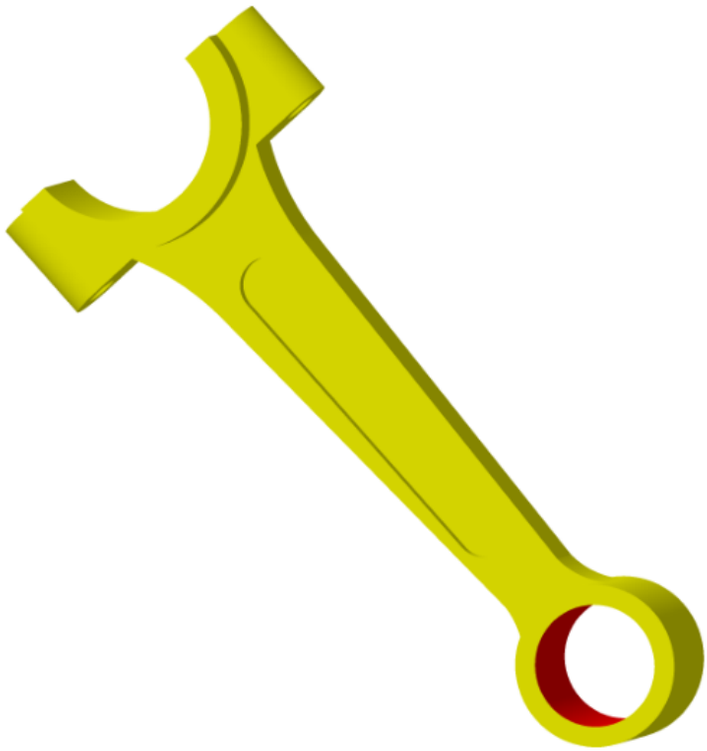
Section view A-A
Scale: 1:2



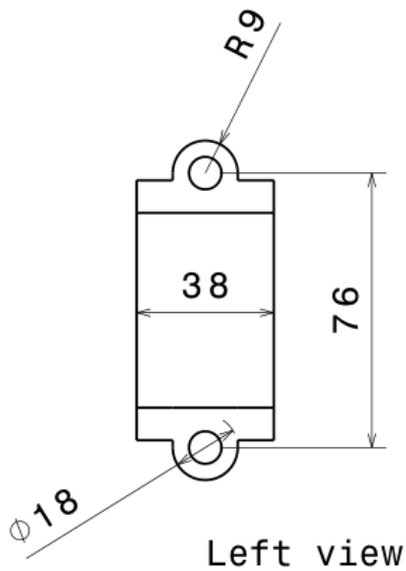
Front view
Scale: 1:2

⌀18

DESIG
DATE:
CHECK
DATE:
SIZE
A
SCALE
1:
This



Isometric view
Scale: 1:2



Left view
Scale: 1:2

DESIGNED BY: charan DATE: 05-09-2026	4 CYLINDER ENGINE ASSEMBLY		
CHECKED BY: XXX DATE: XXX			
SIZE A3	DASSAULT SYSTEMES		
SCALE 1:2	WEIGHT (kg) 1.03	DRAWING NUMBER 2.CONNECTING ROD	SHEET 1/2

This drawing is our property; it can't be reproduced or communicated without our written agreement.

I	_
H	_
G	_
F	_
E	_
D	_
C	_
B	_
A	_