PARTS & SERVICE NEWS

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(C)

SUBJECT: CHECKING FOR BACKLASH OF DIFFERENTIAL GEAR

PURPOSE: To introduce inspection procedures to check if excessive backlash is not ocurring in the differential gear assembly (by wear of the adjust-nut).

APPLICATION:
HD785-3 Dump Trucks, S/N 2001 thru 4140, 4143 and 4144
HD785-5 Dump Trucks, S/N 2001 thru 4140, 4143 and 4144
HD785-5LC Dump Truck S/N A10144, A10224 and A10228 thru A10258
HD985-3 Dump Trucks, S/N 1001 thru 1048
HD985-5 Dump Trucks, S/N 1001 thru 1048
330M Dump Trucks, S/N BFP41-A thru BFP41-DA and A10190 thru A10227

FAILURE CODE: 2B4040

DESCRIPTION:

With already shipped dump truck with Serial numbers above, if the fitting clearance between the outer race of the side bearing and the differential carrier is too large, when instantaneous load-direct change occurs such as when the vehicle's ABS or differential lock is activated or when the vehicle is traveling on bumpy surfaces, the outer race makes dragging turns to render abnormal wear to the adjust nut in its end face, resulting in excessive backlash of the bevel gear, thus causing secondary failures and damaging the tooth surface of the gears or air leakage though the sealing section of the differential lock.

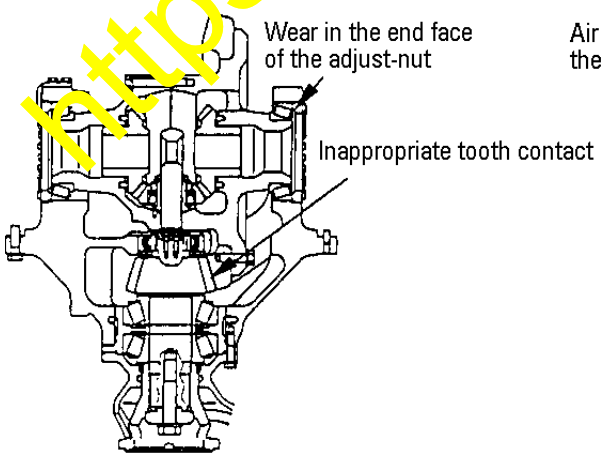
Conduct the inspections outlined on succeeding pages and, when deemed necessary, implement the modification following the procedures designated in this **PARTS & SERVICE NEWS.**

2. List of parts

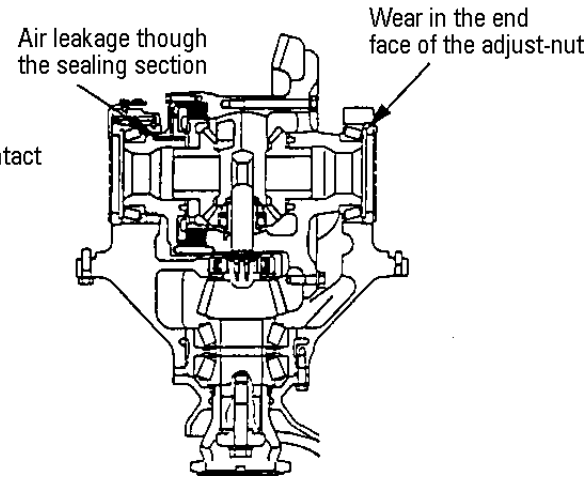
Part No.	Part Name	Purpose of part	Q'ty	Remarks
561-22-61005 (561-22-61003)	Diff A. (Diff A.)	Reworked	1 (1)	For standard spec. vehicles
561-22-61005 (561-22-61004)	Diff A. (Diff A.)		1 (1)	For standard spec. vehicles
561-88-68003 (561-88-68001)	Diff A. (Diff A.)		1 (1)	For differential-lock spec. vehicles
561-88-68003 (561-88-68002)	Diff A. (Diff A.)		1 (1)	For differential-lock spec. vehicles
561-22-00061 (561-22-00060)	Case ass'y (Case ass'y)		1 (1)	For standard spec. vehicles
561-88-00011 (561-88-00010)	Case ass'y (Case ass'y)		1 (1)	For differential-lock spec. vehicles
561-22-61960 (568-22-11960)	Bearing (Bearing)	Replacement	2 (2)	For replacement when found to be damaged
585-22-21140 (561-22-61140)	Nut (Nut)		2 (2)	
561-22-05060 (561-22-05060)	Service K Service K		1 (1)	Consumable part
566-09-21110 (566-09-21110)	O-ring (O-ring)		2 (2)	Consumable part
—	Locktite 620	Additional	1	

3. Possible failure phenomena

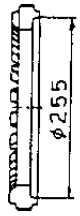
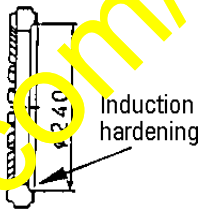
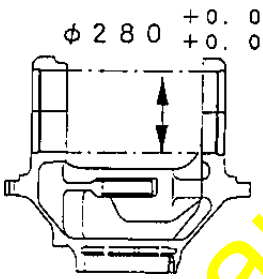
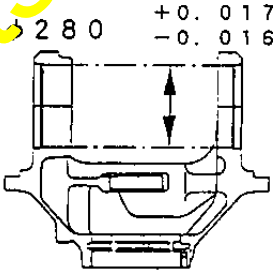
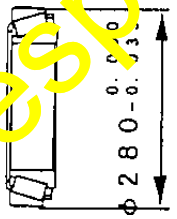
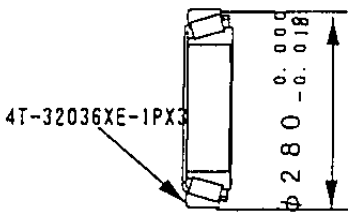
Inappropriate tooth contact between gears leading to breakage



Air leakage though the sealing section of the differential lock



4. Contents of the improvements being implemented to the new vehicles being produced in the factory
   (1) The contact area on the end face of the adjust-nut has been enlarged and, at the same time, induction hardening process has been supplemented to harden the surface of the part to suppress wears.
   (2) Tolerance for the differential carrier bore diameter has been changed to employ "intermediate fit". ("Complete clearance fit" employed thus far.)
   (3) Tolerance on the outer diameter of the side bearing has been narrowed to lessen the fitting clearance in order not to let the outer race make free-running.

Part names	Current state	Improved state
Adjust-nut		
Differential carrier		
Side bearing		

5. Inspection procedures
   Since backlash of the differential bevel gear will increase when the end face of the adjust-nut wears, check if the aforesaid backlash has increased by measuring the turning distance of the parking brake disc. Remember the above when making this inspection.

5-1. Necessary tools
   · Dial gauge block equipped with magnet
   · Crowbar (of a diameter of 15 to 20 mm and a length of about 1 m)
   · Scale

1 place, Ⓐ

5-2. Procedures

(1) Park the vehicle on a level surface and pull the retarder lever to park the vehicle.

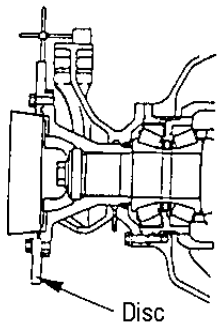
(2) Set the gauge block equipped with magnet to the parking brake cage so that the point of the gauge can reach the outer periphery of the parking brake disc.

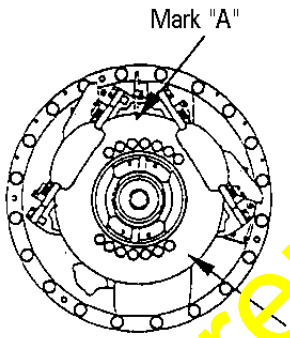
(3) Insert the crowbar into the transmission-side propeller shaft spider to turn the propeller shaft by a force of about 30 kg and mark "A" to the position, on the outer periphery of the parking brake disc, of the tip end of the gauge.

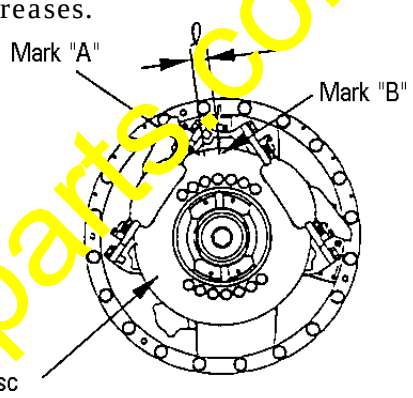
(4) Turn the propeller shaft to the direction opposite to that according to the above Paragraph (3) in the same manner and mark "B" to the position, on the outer periphery of the parking brake disc, of the tip end of the gauge.

(5) Measure the moved distance (the distance "ℓ" between the marks "A" and "B") of the outer periphery of the brake disc using the scale.

★ When doing the above, make sure the retarder lever is being pulled all the way; otherwise, the vehicle may move to cause possible hazards and, furthermore, the moving distance of the outer periphery of the brake disc increases.







5-3 Determination criterion

The moved distance of the outer periphery of the brake disc (the measured distance "ℓ") should be 50 mm or less.

In case the above moved distance exceeds 50 mm, disassemble the differential assembly to check the wear statuses of the adjust-nut and of the bearing hole in the differential carrier to make the repairs outlined below.

Ⓐ 6. Repair procedures

(1) Measure the dimension of the bore diameter of the worn bearing hole of the differential carrier.

(2) In case the thermal spraying repair for the bearing hole of the differential carrier is possible. → [Contents of the repair works]

① Pad the bore surface of the bearing hole of the differential carrier by thermal spraying to make the dimension of the hole diameter within the new tolerance.
② Apply adhesive on the external periphery of the outer race of the bearing before installing into the bearing hole.
③ Install the new adjust nut with the hardened end face. (According to Sections 7, 8 and 9.)

(3) In case the thermal spraying repair for the bearing hole of the differential carrier is not possible.

↓

Was the bore diameter of the bearing hole of the measured differential carrier ϕ280.100 or less?

YES →

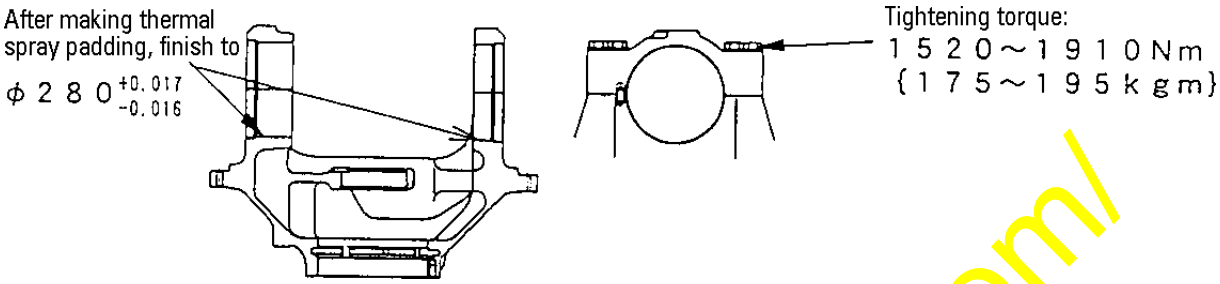
① Apply adhesive on the external periphery of the outer race of the bearing before installing into the bearing hole.
② Install the new adjust nut with the hardened end face. (According to Sections 8 and 9.)

NO →

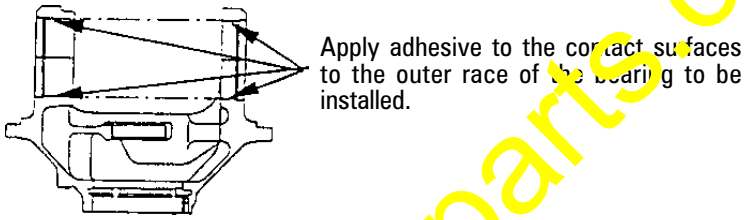
① Replace the differential carrier with the new differential carrier of the modified tolerance.
② Apply adhesive on the external periphery of the outer race of the bearing before installing into the bearing hole.
③ Install the new adjust nut with the hardened end face. (According to Sections 8 and 9.)

* Replace the bearing only if it is found to be damaged. In such case, use the new bearing with the modified tolerance.

7. Thermal spraying repair for the bearing hole in the differential carrier
   Fastening the differential carrier and the cap altogether using the bolts, pad the bore surface by metallic thermal spraying to repair accordingly referring to the example of making similar repair with the material FCD450 as was introduced in the previously issued Service News No. A930163 "Repair of Axle on Dump Truck". (Refer to Note 1.)



8. Adhering the outer periphery of the outer race of the bearing



Using adhesive : "LOCTITE 620" made by "Loctite" (Anaerobic adhesive suitable for gluing of cylindrically shaped parts)
(Where to purchase from: Refer to Note 2.)

Features : · Applicable to fastening of running-fit parts.
· Since the setting speed is quick, total setting can be expected in 25 to 35 minutes under a room temperature on surfaces of majority of metal kinds.

Handling precaution:
When persons carrying sensitive skins handle this anaerobic adhesive "LOCTITE 620" by bare hands repetitively for a long time, eruptions may occur on the skin. Therefore, when a direct contact of this adhesive to your bare skin occurs, be sure to wash it off using running water and a soap.

Application procedures:
1) Clean the contact surfaces to the baring of the differential carrier and the differential cap using alcoholic solvent or the sort. (The adhesion deteriorates if oil or soiling remains on the contact surfaces.)
2) Similarly clean the surfaces of the outer race of the bearing.
3) Apply "LOCTITE 620" onto the contact surface to the bearing of the differential carrier and the differential cap.
4) Install the outer race of the bearing and fasten the cap to adjust the tooth contact and pre-load.
   ★ Be careful not to spend longer time for pre-load adjustment and tooth contact adjustment since the adhesive sets quickly.

Precautions when removing and reinstalling the adhered outer race:
(1) Since the outer race is being adhered to the differential cap and differential carrier and as the adhesive had set, hammer the cap to separate them. The hammering impacts will work to separate the adhered surfaces.
(2) When reinstalling them back, remove residue adhesive having set on the contact surface to the bearing of the differential carrier and differential cap in advance. Such residue adhesive can be removed using a wire brush.

9. Disassembly and reinstallation procedures.
   Refer to the relevant section in the Chapter "Disassembly and Assembly" of the Shop Manual for HD785 or HD985.

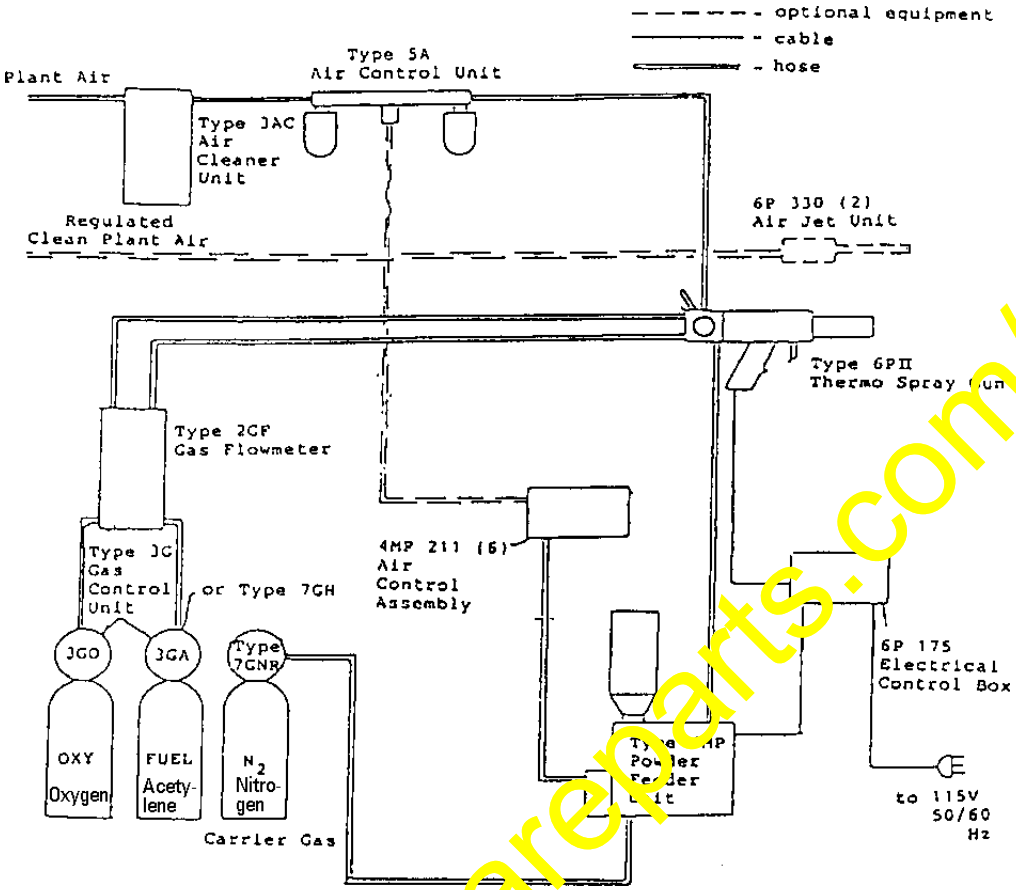
(Note 1) Introduction of the thermal spraying repair method
(An extract from Service News No. A930163)

Introduced below are the metallic powder thermal spraying repair method using the equipment manufactured by METCO.

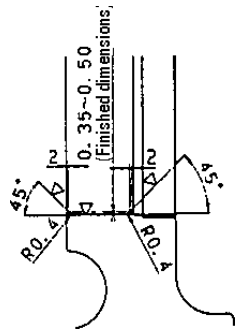
• Procedures of generally known thermal spraying repair method

No.	Processes and procedures	Key points
1	Pre-treatment and pre-processing before starting the thermal spraying repair work	
	1) Washing and degreasing treatments	Wash and degrease the repairing surfaces when deemed necessary checking the subject structures.
	2) Undercutting	Undercut the repairing surfaces to a dimension whereby a thickness on a side of the thermal spray film of 0.3 mm or more can be secured in totally finished dimensions.
	3) Masking	Mask to protect the border sections on which shot blasting and thermal spraying need to be avoided using masking tape or plate covers.
	4) Shot blasting treatment	This is an important treatment to secure the necessary adhesion strength which can influence the thermal spraying quality.
2	Thermal spraying processes	(By use of METCO's 6P-II Thermo-Spray thermal spraying system)
	1) Pre-heating	Pre-heat the thermal spraying surfaces to 85 to 100°C.
	2) Thermal spraying processes	Perform thermal spraying processes using the metallic powder for thermal spraying and the spray gun after setting the pressure, flow rate, thermal spraying distance, thermal spraying rate, etc. of air and other gasses to the prescribed values. There may be cases where dual-layer padding is required to secure the surface hardness and adhesion strength. (In such cases, double the thermal spraying quantity of the finished film thickness will usually be required.)
3	Finishing processes	
	1) Lathing	Lathing can only be allowed when grinding to finish the thermal spray padded surfaces using Powder #447 is not feasible for some reason, because of the dimensions and shape of the workpiece or by availability of necessary facilities. Finishing of the thermal spray padded surfaces using Powder #442
	2) Emery paper finishing	When grinding finish is not feasible as above, finish the lathed surfaces using emery paper (#240). Also, when necessary surface coarseness cannot be acquired by grinding, such as on oil seal surfaces, finish the ground surfaces using emery paper.
	3) Grinding finish	Although diamond grinding stones are more desirable as the using grinding stone, for general use, silicon carbide type grinding stones and GC46J or GC46K grinding stones carry satisfactory grinding capacities. Meanwhile, if white alundum type WA60K for general steel applications is used for the thermal spray padded surfaces using Powder #442, cracking may occur in the thermal spray padded surfaces due to heat generating from blinding by the grinding stone to deteriorate the thermal spray padded surface quality.

Configuration of using equipment and devices (In case of using METCO's 6P-Ⅱ)



- Thermal spraying procedures
  (1) Washing and degreasing the object part
  Wash the object part and degrease the thermal spraying surfaces and neighboring sections.
  ★ When using an organic solvent as the degreaser, do so in conformity with the "Organic Solvent Handling Rules".
  ★ Check and make sure cracking or any other defects are not found on the thermal spraying surfaces.
  (2) Undercutting processes
  Machine the repairing section by lathe turning to the shape shown in the drawing given at right.
  ★ Overall deviation of the bore diameter of the repairing surfaces should be within 0.100 mm.
  ★ Do not use cutting oil for the lathe turning work.



  (3) Masking processes
  Making the undercut section exposed, apply masking tape around the border of the undercut section for a width of about 30 mm in double layers to protect the masked surfaces from shot blasting and thermal spraying.
  ☆ Recommended masking tape: METCO BPM-19
  (4) Shot blasting processes (Perform shot blasting following the instructions of the manufacturer of the equipment.)
  Shot-blast the all around the undercut section evenly.
  ☆ 1) Grit: METCO Light C
  2) Discharge pressure: 600 kPa
  ★ 1) Since the shot blasting is a dangerous work, wear appropriate personal protective devices from the safety and hygienic viewpoints.
  2) Do not touch the shot blasted surfaces to keep them from adhesion of oily substance.
  3) Apply thermal spraying on the whole necessary surfaces within an hour after finishing the shot blasting work.

(5) Pre-heating
Light the thermal spray gun without powder supply to heat the thermal spraying surfaces turning the direction.

☆ 1) Pre-heating temperature: 85 to 100 °C
2) Temperature gauge: Digital temperature gauge

★ 1) Wear appropriate personal protective devices such as safety goggles before starting the work.
2) Apply sufficient heating in consideration of the mass of the workpiece.
3) Pre-heating temperature should not exceed 200 °C.
(This is to prevent occurrence of thermal strain.)

(6) Thermal spraying processes (Conduct thermal spraying processes following the instructions of the manufacturer of the thermal spraying equipment and devices.)

① Connect hoses for hydrogen, acetylene, air and thermal spraying powder and power cable to the thermal spray gun and fill the powder unit with #447 powder in advance.

② Make necessary settings in conformity with the thermal spraying conditions.
Thermal spraying conditions:

Part No. of the Thermo-Spray Gun	Distance between the gun and the workpiece mm (inches)	Thermal spraying angle of the gun (•)	Air pressure kg/cm² (psi)	Hydrogen pressure kg/cm² (psi)	Oxygen flow rate scale setting	Acetylene gas pressure kg/cm² (psi)	Acetylene gas flow rate scale setting	Powder carrier nitrogen gas pressure kg/cm² (psi)
6PII	100 – 180 (4 – 7)	90°	2.1 (30)	2.8 (40)	45	1.1 (15)	55	3.9 (55)

Part No. of the Thermo-Spray Gun	Nitrogen gas flow rate scale setting	Thermal spraying rate kg/H (lb/H) mm/bus (inch/bus)
6PII	37	2.0 (4 1/2) 0.05 (0.002)

③ Setting the workpiece to a turning machine such as a lathe and turn the workpiece.
☆ Turning circumferential speed 10 m/min.

④ Lighting the gun, evenly apply thermal spraying maintaining the prescribed thermal spraying distance avoiding unevenness.
☆ Thermal spraying capacity of the powder : 1 kg = 0.1 mm × 1 m²
Thermal spraying rate
(According to the thermal spraying condition table) : 2.0 kg/H
Padding thickness (film thickness) : 0.7 – 1.0 mm

⑤ Control the thermal spray padding thickness assuming it from the thermal spraying time.

⑥ Interrupt the turns once in a while to measure the thermal spray padding thickness using a micrometer and, also, check if padding is made evenly applying a scale or the like on the end surfaces.
Meanwhile, do not fail to check existence of cracking and other defects in the thermal spray padded surfaces.

★ 1) Do not touch the thermal spray padded surfaces by bare hands nor by waste cloth.
2) When continuing thermal spraying after an interruption, do so before the surface cools down.
3) If the surface temperature has cooled down, repeat pre-heating before resuming thermal spraying.

⑦ Remove masking tape or any other masking means used on the workpiece and inspect the thermal spray padded surfaces.

★ Cracking or abnormally porous section should not be found in the thermal spray padded surfaces.

(7) Finishing

① Install the workpiece to a lathe or similar equipment.

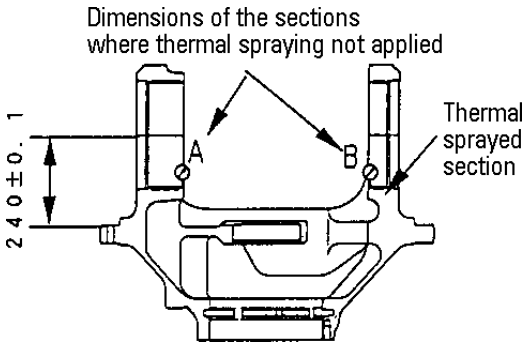
② Align the center.

★ Deviation in dimensions "A" and "B" measured throughout the whole periphery of the bore: within 0.07 mm

③ Finish the workpiece under the following processing conditions.

Finished dimensions : $\phi 280^{+0.017}_{-0.016}$

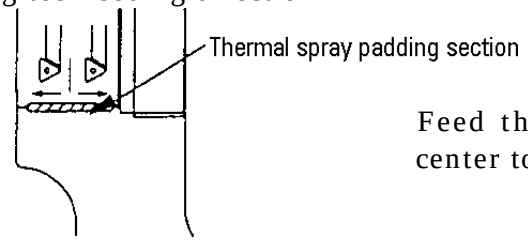
Finished surface coarseness : 12.5 S ▽▽



Processing conditions

Using cutting-tool type	Tool-end nose radius (mm)	Circumferential speed (m/min.)	Feeding distance (mm/rev.)	Depth of cut (mm/time)	Cutting-tool feeding direction
For machining of cast iron (K10)	0.4	20	0.1 – 0.2	0.2	As follows

Cutting-tool feeding direction



Feed the cutting-tool from the center toward left and right.

④ Finish the machined surfaces using emery paper.

☆ Using emery paper: CC#240

★ 1) When finishing the surfaces using emery paper, be careful not to be caught by the turning workpiece by hand or by fingers.

2) When checking the surface coarseness of the finished surface, make comparisons with the "standard surface coarseness chips".

(Note 2) Where to purchase "LOCTITE 620"

Countries	Handling company names	Addressees	Phone numbers
Australia	Locktite Australia Pty. Ltd.	3 Endeavour Road Caringbah, N.S.W 2229 Australia P.O.Box2622 Taren Point, N.S.W, 2229, Australia	61-2-9525-8366
UK	Locktite (UK) Limited	Watchmead Welwyn Garden City Hertfordshire AL7 1JB England	44-1707-821000
South Africa	Locktite (South Africa) (Pty) Ltd.	9 Yaron Avenue Lea Glen, Florida Tvl. 1709 Republic of South Africa	27-11-674-1930
Spain	Locktite Espana. S.A	Poligono Industrial Lea Alparrache Parcella 56 E-28600 Navalcarnero (Madrid), Spain	34-1-860◦ 90. 00
Singapore	Locktite (Singapore) Pte. Ltd.	401 Commonwealth Drive #04-01/02 Haw Par Technocentre Singapore 149598	65-473-1822
U.S.A.	World Headquarters	10 Columbs Boulevard Hartford Square North Hartford, CT 06106	860-520-5000

As for other countries and areas, access to the following Internet web site address:
"http://www.loctite.com"