

**PARTS & SERVICE
NEWS**

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SUBJECT: RECONDITIONING OF WORN AXLE PARTS ON DUMP TRUCKS

PURPOSE: To introduce the reconditioning method of worn axle parts.

APPLICATION: HD205 thru HD1600M Dump Trucks, All Serial Nos.

DESCRIPTION:

1. Introduction

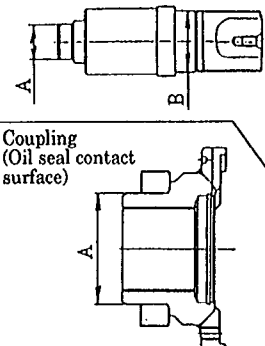
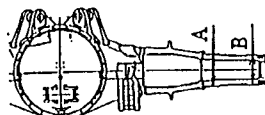
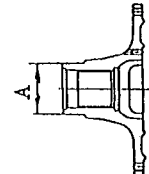
This PARTS & SERVICE NEWS introduces the method of reconditioning the axle wheel bearing inner races and other related portions which have been worn out due to their material creep.

(Note) The axle material will be deteriorated in the strength due to the residual stress, if the material remains as the build-up welded without the heat treatment.

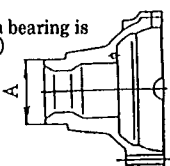
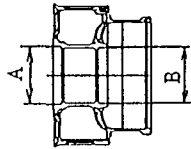
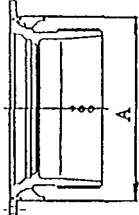
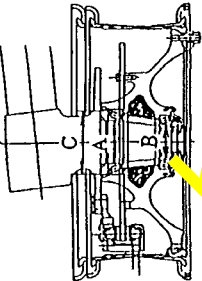
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2. Applicable main parts and portions

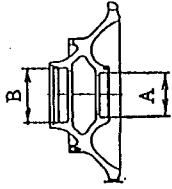
(★1) The wheel bearing inner races are transition-fitted onto the wheel shafts for facilitating their adjustment as well as for their removal and installation. Consequently, the inner race drag turning may sometimes cause streaks to remain on the shaft surfaces. Where such streaks are within the repair limits, the surface roughness should be eliminated with the sand-paper, enabling the shafts to be used continuously.

Part Name	Truck Model	HD205-3	HD325		HD465		HD785		HD1200M	HD1600M	Example of applicable repair spraying		
			-5	-6	-3	-5	-2						
Output shaft 	Shaft (where a bearing is fitted on)	P/N	—	566-01-12214	566-01-72210	569-01-12212	569-01-62600	561-01-12213	561-01-62600 561-01-62601	561-01-12213	582-01-12210 582-01-12212	B	
	Dimension A	—	$\phi 40_{-0.034}^{0.009}$	$\phi 40_{-0.025}^{0.009}$	$\phi 55_{-0.040}^{0.010}$	←	←	←	←	←	←		
	Surface roughness	—	▽▽	←	←	←	←	←	←	←	←		
	Repair limit	—	$\phi 39.8$	←	$\phi 54.8$	←	←	←	←	←	←		
	Dimension B	—	$\phi 65_{-0.007}^{0.012}$	←	$\phi 85_{-0.009}^{0.013}$	←	$\phi 95_{-0.009}^{0.011}$	←	←	←	$\phi 120_{-0.009}^{0.013}$		←
	Surface roughness	—	▽▽	←	←	←	←	←	←	←	←		
	Repair limit	—	$\phi 64.975$	←	$\phi 84.975$	←	$\phi 94.975$	←	←	←	$\phi 119.975$		←
	P/N	—	566-01-12712	566-01-72720	568-01-12711	569-01-62720	562-01-12712	561-01-62720	562-01-12712	582-01-12710	582-01-12710		B
Dimension A	—	$\phi 95h9_{-0.087}^0$	←	$\phi 110h9_{-0.087}^0$	←	$\phi 125h9_{-0.100}^0$	←	←	$\phi 150h9_{-0.100}^0$	←			
Surface roughness	—	▽▽	←	←	←	←	←	←	←	←			
Repair limit	—	Depth of abrasion 0.1	←	←	←	←	←	←	←	←	←		
Housing 	Housing tube (where a bearing is fitted in) (★1)	P/N	567-22-43101	566-22-43103	←	569-01-63101	569-01-63101	561-22-43103	561-22-63101	562-22-23112	582-22-19333	A	
	Dimension A	$\phi 170_{-0.054}^{0.014}$	$\phi 220_{-0.061}^{0.015}$	←	$\phi 260_{-0.069}^{0.017}$	←	$\phi 320_{-0.078}^{0.018}$	←	←	$\phi 400_{-0.098}^{0.062}$	←		
	Surface roughness	▽▽	←	←	←	←	←	←	←	←	←		
	Repair limit	$\phi 169.830$	$\phi 219.801$	←	$\phi 279.778$	←	$\phi 319.754$	←	$\phi 399.754$	←	←		
	Dimension B	$\phi 160_{-0.054}^{0.014}$	$\phi 220_{-0.061}^{0.015}$	←	$\phi 260_{-0.069}^{0.017}$	←	$\phi 300_{-0.069}^{0.017}$	←	←	$\phi 400_{-0.098}^{0.062}$	←		
Surface roughness	▽▽	←	←	←	←	←	←	←	←	←			
Repair limit	$\phi 159.830$	$\phi 199.801$	←	$\phi 259.778$	←	$\phi 229.778$	←	$\phi 399.754$	←	←			
Differential 	Coupling (oil seal contact surface)	P/N	567-22-12140	566-22-11460	566-81-22821	566-22-11460	569-22-61230	561-22-41421	561-22-61231	562-22-21230	582-22-11231	B	
	Dimension A	$\phi 75h9_{-0.011}^0$	$\phi 100_{-0.087}^0$	←	←	$\phi 130h9_{-0.100}^0$	$\phi 125h9_{-0.100}^0$	$\phi 150h9_{-0.100}^0$	$\phi 145h9_{-0.100}^0$	$\phi 160h9_{-0.100}^0$	$\phi 160h9_{-0.100}^0$		
	Surface roughness	▽▽	←	←	←	←	←	←	←	←	←		
	Repair limit	Depth of abrasion 0.1	←	←	←	←	←	←	←	←	←		
	P/N	567-22-1142	—	—	—	—	—	—	—	—	582-22-11232		
	Dimension A	$\phi 100h9_{-0.074}^0$	—	—	—	—	—	—	—	—	$\phi 165h9_{-0.100}^0$		
Surface roughness	▽▽	—	—	—	—	—	—	—	—	←			
Repair limit	Depth of abrasion 0.1	—	—	—	—	—	—	—	—	Depth of abrasion 0.1			

(★2) The wheel bearing inner races are transition-fitted onto the wheel shafts for facilitating their adjustment as well as for their removal and installation. Consequently, the inner race drag turning may sometimes cause streaks to remain on the shaft surfaces. Where such streaks are within the repair limits, the surface roughness should be eliminated with the sand-paper, enabling the shafts to be used continuously.

Part Name	Truck Model	HD205-3	HD325		HD465		HD785		HD1200M	HD1600M	Example of applicable repair spraying
			-5	-6	-3	-5	-2				
Differential 	P/N	565-22-13315 567-22-41521	569-22-21510 569-22-21520	←	←	569-22-61510 569-22-61520	561-88-48310 561-88-48320	561-22-11511 561-22-61521	562-22-11510 562-22-11530	582-22-11510 582-22-11530	C
	Dimension A Surface roughness	$\phi 100^{+0.095}_{-0.073}$ ▽▽▽	$\phi 150^{+0.090}_{-0.065}$ ←	←	←	$\phi 160^{+0.095}_{-0.070}$ ←	$\phi 180^{+0.090}_{-0.075}$ ←	←	$\phi 200^{+0.111}_{-0.082}$ ←	$\phi 220^{+0.124}_{-0.095}$ ←	
	Repair limit	$\phi 100$	$\phi 150$	←	←	$\phi 160$	$\phi 180$	←	$\phi 200$	$\phi 220$	
Final drive 	P/N	567-22-42711	566-22-42710	566-22-72710	569-22-12711	569-22-65710 569-22-6710	561-22-32710	561-22-62713	562-22-22710	582-22-12711	C
	Dimension A Surface roughness	$\phi 260^{+0.036}_{-0.088}$ ▽▽	$\phi 340^{+0.041}_{-0.098}$ ←	←	$\phi 420^{+0.045}_{-0.108}$ ←	←	$\phi 480^{+0.045}_{-0.108}$ ←	←	$\phi 620^{+0.078}_{-0.160}$ ←	←	
	Repair limit	$\phi 259.965$	$\phi 339.960$	←	$\phi 419.955$	←	$\phi 479.955$	←	$\phi 619.950$	←	
	Dimension B Surface roughness	$\phi 240^{+0.033}_{-0.079}$ ▽▽	$\phi 310^{+0.036}_{-0.088}$ ←	←	$\phi 400^{+0.045}_{-0.108}$ ←	←	$\phi 460^{+0.045}_{-0.108}$ ←	←	$\phi 620^{+0.078}_{-0.160}$ ←	←	
Repair limit	$\phi 239.970$	$\phi 309.965$	←	$\phi 399.960$	←	$\phi 459.955$	←	$\phi 619.950$	←		
Rear brake 	Inner gear (oil seal contact surface)	P/N	—	—	—	—	—	561-99-78210	—	—	B
	Dimension A Surface roughness	—	—	—	—	—	—	$\phi 580h9^{+0}_{-0.175}$ ▽▽▽	—	—	
Retainer (oil seal contact surface)	P/N	566-33-11322	←	←	568-33-11933	←	←	←	562-33-21320	←	B
	Dimension A Surface roughness	$\phi 430h9^{+0}_{-0.155}$ ▽▽▽	←	←	$\phi 580h9^{+0}_{-0.175}$ ▽▽▽	←	←	←	$\phi 850h9^{+0}_{-0.230}$ ←	←	
Repair limit	Depth of abrasion 0.3	←	←	←	←	←	←	←	←	←	
Front axle 	P/N	567-50-1112	566-50-41242	566-50-71110	569-50-31210 569-50-31211	569-50-61113	561-50-31110	561-50-61113	562-50-12202 562-50-11202	582-50-11201	C
	Dimension A Surface roughness	$\phi 105^{+0.012}_{-0.047}$ ▽▽▽	$\phi 130^{+0.014}_{-0.054}$ ←	←	$\phi 160^{+0.014}_{-0.054}$ ←	$\phi 180^{+0.014}_{-0.054}$ ←	$\phi 190^{+0.015}_{-0.061}$ ←	$\phi 220^{+0.015}_{-0.061}$ ←	$\phi 300^{+0.056}_{-0.088}$ ←	$\phi 320^{+0.062}_{-0.095}$ ←	
	Repair limit	$\phi 104.858$	$\phi 129.830$	←	$\phi 159.830$	$\phi 179.830$	$\phi 189.801$	$\phi 219.801$	$\phi 299.780$	$\phi 319.754$	
	Dimension B Surface roughness	$\phi 80^{+0.010}_{-0.040}$ ▽▽▽	$\phi 120^{+0.012}_{-0.047}$ ←	←	$\phi 140^{+0.014}_{-0.054}$ ←	$\phi 160^{+0.014}_{-0.054}$ ←	$\phi 160^{+0.014}_{-0.054}$ ←	$\phi 180^{+0.014}_{-0.054}$ ←	$\phi 300^{+0.056}_{-0.088}$ ←	←	
Repair limit	$\phi 79.881$	$\phi 119.858$	←	$\phi 139.830$	$\phi 159.830$	$\phi 159.830$	$\phi 179.830$	$\phi 299.780$	←		

Part Name	Truck Model	HD205-3	HD325		HD465		HD785		HD1200M	HD1600M	Example of applicable repair spraying
			-5	-6	-3	-5	-2	-3			
Retainer (oil seal contact surface)	P/N	567-27-41130	566-27-41130	←	569-30-11161	569-27-61130	561-27-11160	561-27-11160	←	←	B
	Dimension C Surface roughness	$\phi 180h9_{-0.100}^0$	$\phi 220h9_{-0.115}^0$	←	$\phi 280h9_{-0.130}^0$	←	$\phi 330h9_{-0.140}^0$	←	←	←	
	Repair limit	Depth of abrasion 0.1	←	←	←	←	←	←	←	←	
Hub (where a bearing is fitted in)	P/N	567-27-41210	566-27-41211	566-27-71210	569-30-11124 569-30-11125	569-27-61211	561-27-31211	561-27-61213	562-27-21212	568-27-19212	C
	Dimension A Surface roughness	$\phi 140_{-0.072}^{-0.032}$	$\phi 215_{-0.095}^{-0.050}$	←	$\phi 250_{-0.095}^{-0.050}$	$\phi 240_{-0.095}^{-0.050}$	$\phi 270_{-0.088}^{-0.038}$	$\phi 280_{-0.112}^{-0.060}$	$\phi 460_{-0.148}^{-0.085}$	$\phi 460_{-0.148}^{-0.085}$	
	Repair limit	$\phi 139.980$	$\phi 214.970$	←	$\phi 249.970$	$\phi 239.970$	$\phi 289.965$	$\phi 279.965$	$\phi 459.955$	$\phi 459.955$	
	Dimension B Surface roughness	$\phi 190_{-0.095}^{-0.050}$	$\phi 230_{-0.095}^{-0.050}$	←	$\phi 290_{-0.112}^{-0.060}$	$\phi 270_{-0.095}^{-0.050}$	$\phi 340_{-0.127}^{-0.079}$	$\phi 340_{-0.127}^{-0.079}$	$\phi 460_{-0.148}^{-0.085}$	$\phi 480_{-0.172}^{-0.109}$	
	Repair limit	$\phi 189.970$	$\phi 229.970$	←	$\phi 289.965$	$\phi 279.965$	$\phi 339.960$	←	$\phi 459.955$	$\phi 479.955$	



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3. Introduction of the spray reconditioning method of the worn portions of shafts, cases, etc.
If the worn portions of bearing fitted portions and the oil seal contact surfaces are reconditioned by means of the build-up welding, there will be a possibility of their cracking due to the thermal stress. Consequently, the metallic powder spray reconditioning method featuring the minimal thermal strain (The temperature is so low as "100° to 150°C") is introduced herein, using the device mfd. by METCO as the example.

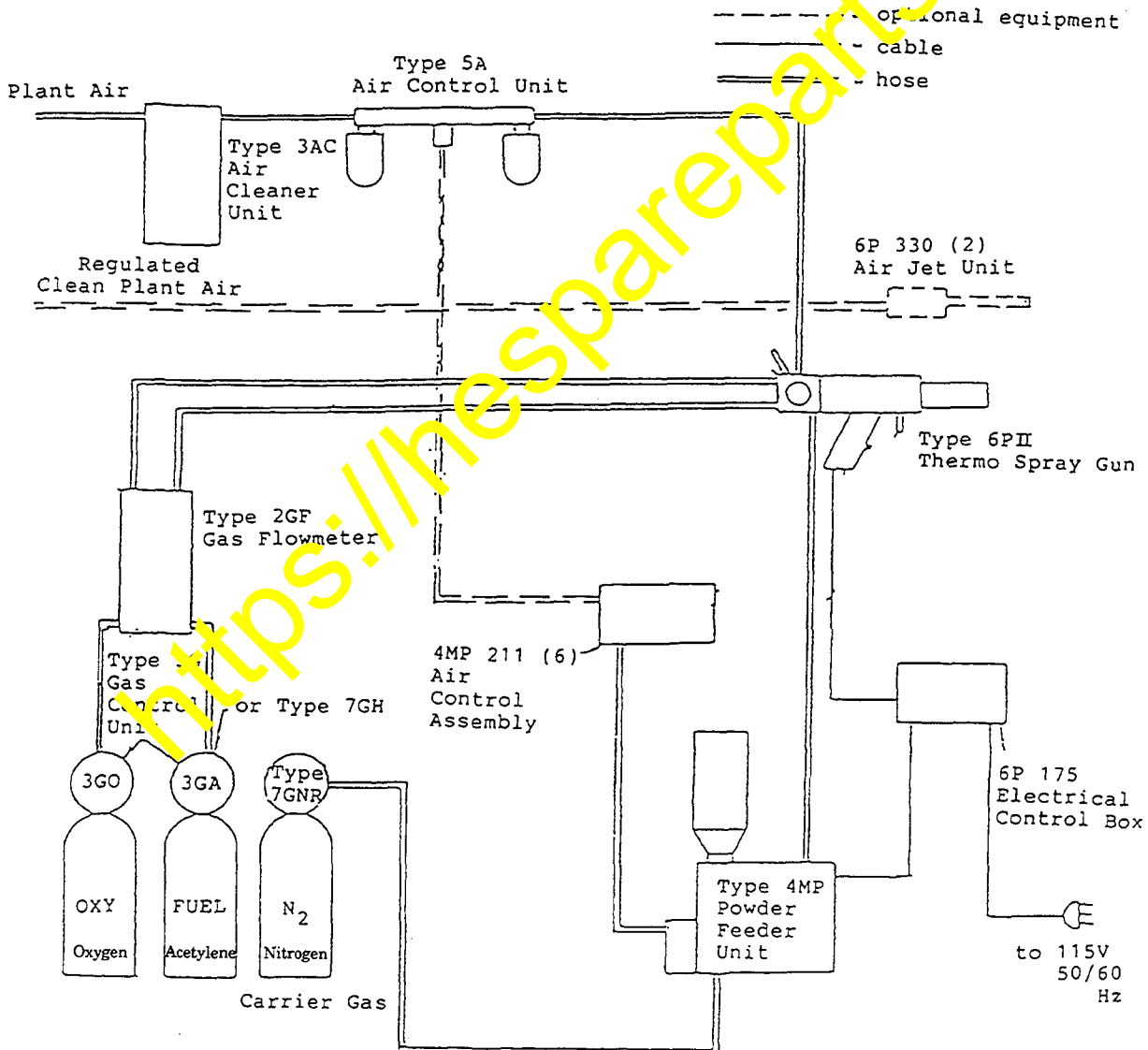
3-1 Procedure of a general spray reconditioning method

No.	Process, step	Main point						
1	Processes before the spraying 1) Cleaning, degreasing 2) Undercutting 3) Masking 4) Shotblasting	to be carried out according to the conditions of the workpiece Undercutting a portion to be reconditioned into such dimensions that the thickness of the sprayed metal coating over 0.3 mm on the side can be ensured in the finished dimensions. Protection of such boundaries where neither shotblasting nor spraying must be allowed with the masking tape, plate cover, etc. An important process determining the sprayed quality for ensuring the adhesive strength.						
2	Spraying 1) Preheating 2) Spraying	(by the METCO 6P-II thermospraying system) Preheating a zone to be sprayed in the range from 85° to 100°C Spraying is performed with the spraying powder and a spray gun by setting the pressure, the flow rate, the spraying distance, the spraying speed, etc. of air, gas, etc. to their respective specified values. The 2-layer sprayed overlay may be sometimes applied to ensure the surface hardness and the adhesive strength as required. (Normally, the amount of the spraying powder is 2 times as much as the finished coating thickness.)						
(Reference) On the main component elements of the spraying powder								
Kind of the METCO powder	Main component elements (%)					Coating hardness	Bonding rate (kg/cm ²)	Machining after the spraying
	Cr	Al	Mo	Ni	Others			
#442	8.5	7.0	5.0	70.5	9.0	HRc 30	280	Grinding * (Turning)
#447	0	5.5	5.0	89.5	0	HRb 75	420	Grinding or turning
*: A zone sprayed with the powder #442 is liable to peel off on a turning machine. To avoid such peeling, the grinding should be preferred.								
3	Finish-machining 1) Turning	The turning should be carried out of necessity, when the grinding cannot be carried out due to the finish-machining of the zone sprayed with the powder #447 or to the dimensions of contour of the workpiece, and to the availability of the spraying devices. Finish-machining of the zone sprayed with the powder #442.						

No.	Process, step	Main point
2)	Finishing with the sandpaper	Where the grinding is not performed, the turned surfaces should be finished with the sandpaper (#240). Further, where the specified surface roughness cannot be obtained with the oil-sealed surface or by means of grinding, the ground surface should be finished.
3)	Grinding	The diamond stone is desirable for the grinding wheel. In general, the silicon carbide type, GC46J or K is recommended for the satisfactory grindability. If such a general grinding stone used for the steel material as the white arrandam Series WA60K is used in the METCO powder #442, the sprayed surface will be cracked due to the heat generated by the clogged abrasive grains of the grinding stone, causing a possibility of damaging the sprayed coating.

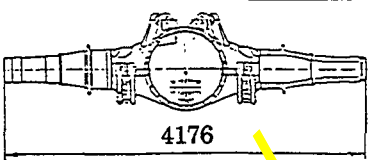
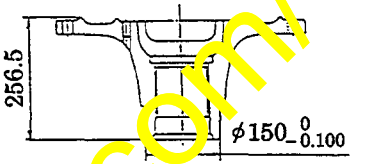
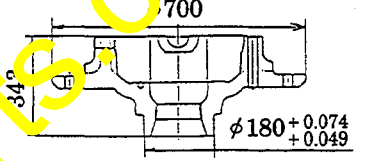
3-2 Configuration of applicable spray system (Example: METCO 6P II)

TYPICAL 6P II THERMOSPRAY INSTALLATION

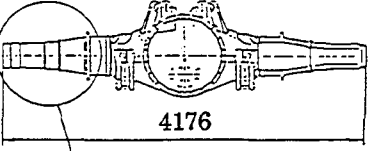


3-3 Examples of the spray reconditioning (on HD785-3)

3-3-1 Parts to be reconditioned

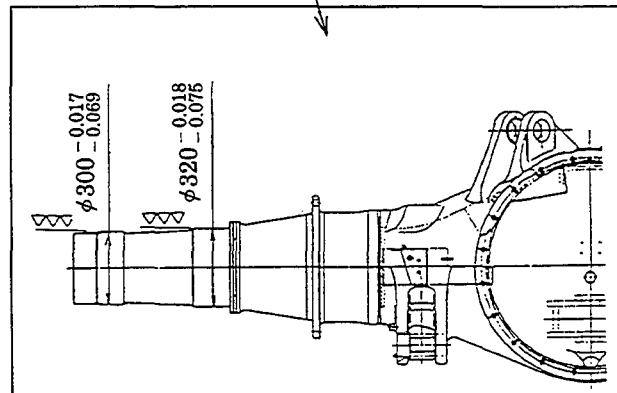
No.	Part No.	Part Name	Material hardness	Where to recondition	Schematic drawing
A	561-22-63211	Tube	HRC \geq 30	Where a bearing is fitted in	
B	561-22-61231	Coupling	HRC \geq 55	Oil seal contact surface $\phi 150_{-0.100}^0$	
C	561-22-61511	Case		Where a bearing is fitted in	

3-3-2 Example (A) of the reconditioning

Part No.	Part Name	Material hardness	Where to recondition	Schematic drawing
561-22-63211	Tube	HRC $>$ 30	Where a bearing is fitted in	

Notes

- ① Pin holes of $\phi 8$ and $\phi 9$ in dia. are high in the surface pressure. Therefore, the thermospray is not suitable for these holes. The method of pressing a pinning into place after the boring operation is appropriate.
- ② For the detail of a zone to be reconditioned, see the separate drawing.



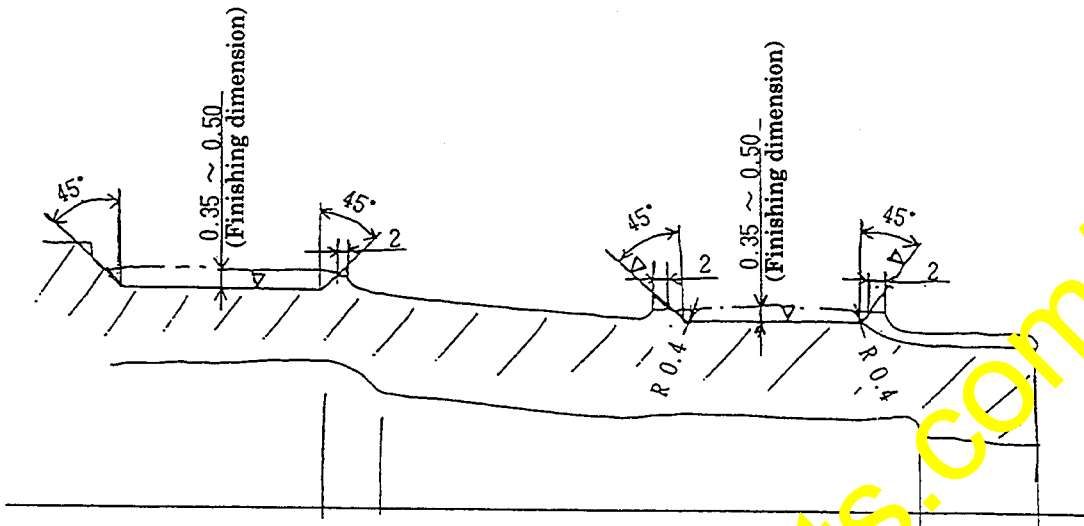
1. Cleaning and degreasing of a part
Clean the part and degrease the tube all over.

Notes

- ① When the organic flux is used as the degreasing agent, conform to "the how to use the organic flux".
- ② Confirm that the part is free from cracks and any other defects.

2. Undercutting

Turn the zone to be reconditioned as shown below.



Notes

- ① The overall peripheral runout should be within 0.100 mm.
- ② No cutting oil should be used in the turning operation.

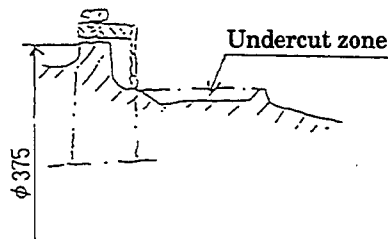
3. Masking

Expose the undercut area and stick the masking tape along the boundary in the width range of from 30 to 40 mm. Then, protect the surface from the shotblasting and the thermal spraying.

★ Masking tape: METCO BPM-19

Notes

- ① It is difficult to mask the flanged portion of 375 in dia. with the tape. Such a collar as shown at the right is recommended.
- ② The tape should be applied in two layers.



4. Shotblasting

(For the detail of the shotblasting, conform to the manufacturer's instructions.)
The undercut zone should be shotblasted evenly all over.

- ★ 1) Grits: METCO LIGHT C
- 2) Discharge pressure: 6 kg/cm²

Notes

- ① In the shotblasting operation, a protector or the like should be used from the operational safety and health viewpoints.
- ② The shotblasted surface must not be touched by hand to prevent the surface from being fouled with oil, grease, etc.
- ③ The spraying should be applied onto the whole surface within one hour after the shotblasting operation.

5. Preheating

Ignite a spray gun without furnishing it with the powder and heat the portion to be sprayed while rotating it.

- ★ 1) Preheating temperature: 85 to 100°C
- 2) Temperature gauge: Digital temp. gauge

Notes

- ① Perform the preheating operation with protectors like spectacles put on.
- ② Heat the workpiece thoroughly in consideration of its mass.
- ③ Perform the preheating on each zone to be subjected to the spraying.
- ④ The heating temp. must not exceed 200°C (to avoid the distortion under heat).

6. Spraying

(For the detail of the spraying operation, conform to the sprayer manufacturer's instructions.)

- 1) Previously connect the hoses, etc. for oxygen, acetylene, air, spraying powder, etc. and electric supply cables to a spray gun. Fill the powder container with #447.
- 2) Set the specified values based on the spraying conditions.

Table of the spraying conditions

Thermo-spray gun No.	Distance between the gun and the workpiece mm (inch)	The spraying angle of the gun (°)	Air pressure kg/cm ² (psi)	Oxygen pressure kg/cm ² (psi)	Oxygen flow scale	Acetylene gas pressure kg/cm ² (psi)
6P-II	100-180 (4-7)	90°	2.1 (30)	2.8 (40)	45	1.1 (15)

Thermo-spray gun No.	Acetylene gas flow scale	Powder feed nitrogen gas pressure kg/cm ² (psi)	Nitrogen gas flow scale	Amount of spray kg/H (1b/H) mm/pass (in/pass)
6P-II	55	3.9 (55)	37	2.0 (4 1/2) 0.05 (0.002)

- 3) Under the spraying conditions described above, set a part to be reconditioned on a rotary machine like a lathe and run the machine.

★ Peripheral speed of rotation: 10 m/min

- 4) Ignite the spray gun and perform the spraying evenly, keeping the specified spraying distance.

★ ① Powder spraying capacity: 1 kg = 0.10 mm × 1 m²
 ② Amount of spraying (from the Table of spraying conditions): 2.0 kg/H

- 5) The thickness of the sprayed overlay should be estimated and controlled in reference to the spraying time.

- 6) Stop the rotary machine (lathe) at proper intervals, measure the thickness of the sprayed overlay with a micrometer, and check the surface for the uniform overlay with a scale, etc. set thereon. At the same time, check the sprayed surface for abnormalities like cracks. etc.

Notes

- ① No contact with cloth, hands, etc. must be allowed on the sprayed surface.
 - ② When the spraying is to be continued, it should be carried on before the surface cools down.
 - ③ Where the surface has cooled down, perform the preheating again before the spraying.
- 7) After the spraying has been performed to the specified dimensions, the sprayed overlaying should be performed on the remaining area.

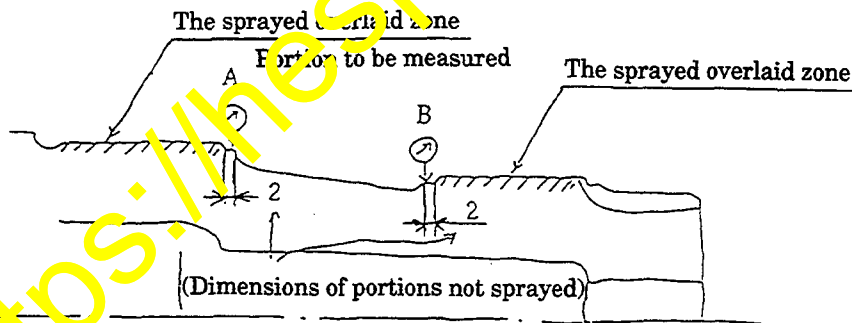
★ Dimension of the sprayed overlay (coating thickness): 0.7 to 1.0 mm

- 8) Remove the masking tape, etc. and check the sprayed surface.

Note: The sprayed overlay must be free from cracks and abnormal porous layer.

7. Finish-machining

- 1) Set a reconditioned part on the lathe.
- 2) Perform the centering



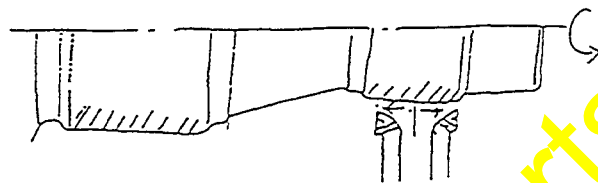
★ The overall peripheral runouts of the L.H and R.H portions to be measured:
within 0.080 mm

- 3) Finish the reconditioned zone to the dimensions on the drawing under the following machining conditions.

Machining conditions

Type of applicable cutting tool	Nose R (mm) at the tool tip	Peripheral speed (m/min)	Amount of feed (mm/rev)	Depth of cut (mm/cycle)	The cutting tool feed direction
For machining the cast iron (K10)	0.4	20	0.1 – 0.2	0.2	See below

Note: The cutting tool feeding direction



The cutting tool is fed from the midpoint onto the left and the right sides, alternately

- 4) Finish the tool-machined surface with the sandpaper.

★ Sandpaper: CC#240

Notes

- ① In case of the finishing with the sandpaper, be careful not to allow the hand or fingers to be drawn into the rotation of the workpiece.
- ② The finished surface roughness checking must be made by means of a comparison with the "surface roughness standard sample".

★ Cylinder external surface roughness standard sample: 799-101-8150

3-3-3 Example (B) of the reconditioning

Part No.	Part Name	Material hardness	Where to recondition	Schematic drawing
56122-61231	Coupling	HRC \geq 55	Oil seal contact surface $\phi 150_{-0.100}^0$	

Notes

- ① A part to be reconditioned is so high in the hardness that the shotblasting is difficult to be applied effectively. Consequently, the powder #447 high in the bonding rate is sprayed in the first layer as the "bond coat" and the powder #442 high in the hardness should be applied in the surface 2nd layer.
- ② For the detail of the part to be reconditioned, see the separate drawing.

1. Cleaning and degreasing of a part to be reconditioned

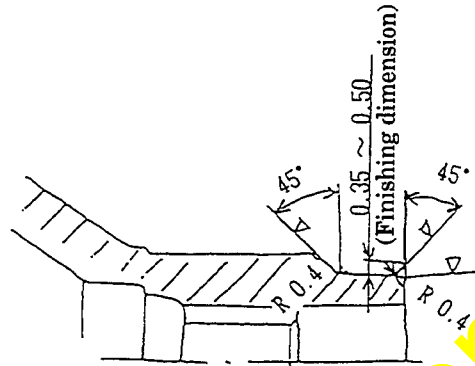
Clean the part and degrease the surrounding area of the portion to be reconditioned by means of the spraying.

Notes

- ① Where the organic flux is used as the degreasing agent, conform to the "How to use the organic flux".
- ② Confirm that the part is free from cracks and other defects.

2. Undercutting

Turn the portion to be reconditioned as shown below.



Notes

- ① The overall peripheral runout of the portion to be reconditioned should be within 0.100 mm.
- ② No cutting oil must be used in the turning operation.

3. Masking

Expose the undercut area and stick the masking tape doubly along the boundary in the width ranging from 30 to 40 mm, thereby protecting the undercut portion from the shotblasting and the spraying.

★ Masking tape: METCO BPM-19

4. Shotblasting

(For the detail of the shotblasting, conform to the manufacturer's instructions.)

The undercut zone should be shotblasted evenly all over.

- ★ 1) Grits: METCO LIGHT C
- 2) Discharge pressure: 6 kg/cm²

Notes

- ① In the shotblasting operation, a protector or the like should be used from the operational safety and health viewpoints.
- ② The shotblasted surface must not be touched by hand to prevent the surface from being fouled with oil, grease, etc.
- ③ The spraying should be applied onto the whole surface within one hour after the shotblasting operation.

5. Preheating

Ignite a spray gun without furnishing with the powder and heat the portion to be sprayed while rotating it.

- ★ 1) Preheating temperature: 85 to 100°C
- 2) Temperature gauge: Digital temp. gauge

Notes

- ① Perform the preheating operation with protectors like spectacles put on.
- ② Heat the workpiece thoroughly in consideration of its mass.
- ④ The heating temp. must not exceed 200°C (to avoid the distortion under heat).

6. Spraying

(For the detail of the spraying operation, conform to the sprayer manufacturer's instructions.)

- 1) Previously connect the hoses, etc. for oxygen, acetylene, air, spraying powder, etc. and the electric supply cables to a spray gun. Fill the powder unit with #447.
- 2) Set the specified values based on the spraying conditions.

Table of the spraying conditions

Spraying powder	Distance between the gun and the workpiece mm (inch)	Spraying angle of the gun (°)	Air pressure kg/cm ² (psi)	Oxygen pressure kg/cm ² (psi)	Oxygen flow scale	Acetylene gas pressure kg/cm ² (psi)
#447 (1st layer)	100-180 (4-7)	90°	2.1 (30)	2.8 (40)	45	1.1 (15)
#442 (2nd layer)	250 (10)	90°	2.1 (30)	2.8 (40)	45	1.1 (15)

Spraying powder	Acetylene gas flow scale	Powder feed nitrogen gas pressure kg/cm ² (psi)	Nitrogen gas flow scale	Amount of spray kg/H (1b/H) mm/pass (in/pass)
#447 (1st layer)	55	3.9 (55)	37	2.0 (4 1/2) 0.05 (0.002)
#442 (2nd layer)	55	3.9 (55)	37	2.3 (5) 0.05 (0.002)

- 3) Under the spraying conditions described above, set a part to be reconditioned on a rotary machine like a lathe and run the machine.

★ Peripheral speed of rotation: 10 m/min

- 4) Ignite the spray gun and perform the spraying evenly, keeping the specified spraying distance.

- ★ ① Powder spraying capacity: 1 kg = 0.10 mm × 1 m²
- ② Amount of spraying (from the Table of spraying conditions): 2.0 kg/H

- 5) Spraying of #447 for the 1st layer serves to increase the bonding strength of #442 in the 2nd layer.
Spraying for the 1st layer should be stopped in the sprayed overlay of 0.10 mm in the thickness.
- 6) In the spraying for the 2nd layer, exclude the powder #447 remaining in the powder unit and fill the unit with the powder #442.
- 7) Set the specified value of the powder #442 according to the Table of the spraying conditions.
- 8) Spray #442 in the same manner as in #447.
- 9) The thickness of the sprayed overlay should be estimated and controlled in reference to the spraying time.
- 10) Stop the rotary machine (lathe) at proper intervals, measure the thickness of the sprayed overlay with a micrometer, and check the surface for the uniform overlay with a scale, etc. set thereon. At the same time, check the sprayed surface for abnormalities like cracks, etc.

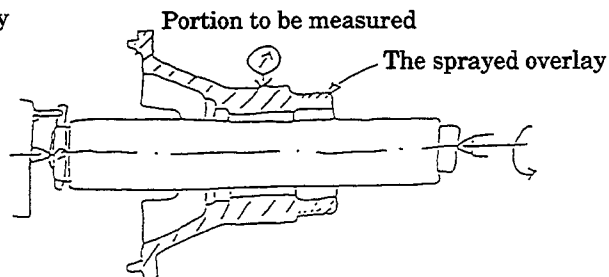
Notes

- ① No contact with cloth, hands, etc. must be allowed on the sprayed surface.
 - ② When the spraying is to be continued, it should be carried on before the surface cools down.
 - ③ Where the surface has cooled down, perform the preheating again before the spraying.
- 11) The spraying is completed by performing it to the specified dimensions.
★ Dimension of the sprayed overlay (coating thickness): 0.7 to 1.0 mm
 - 12) Remove the masking tape, etc. and check the sprayed surface.

Note: The sprayed overlay must be free from cracks and abnormal porous layer.

7. Finish-machining

- 1) Set the reconditioned part on a grinder with a taper mandrel inserted in the involute spline core.
- 2) Check the centering accuracy



★ The overall peripheral runout: within 0.030 mm

- 3) Grind the O.D. of a reconditioned part to the dimension on the drawing under the grinding conditions indicated below.

Grinding conditions

Applicable grinding stone	Grinding speed (m/min)	Spherical speed of the workpiece (m/min)	Cutting speed	Grinding method	Grinding liquid
GC46J or K	1800—2200	15—20	Manual feed	Flange cut	Soluble or solution

Notes

- ① The grinding stone should be subjected properly to the dressing to prevent the grit clogging.
 - ② The rough grinding should be performed with the grinding stone subjected to the rough dressing.
 - ③ When the grinding operation has proceeded to its finishing dimension, the traverse cutting must not be performed at all.
(The plunger cutting is better in the grinding efficiency.)
- 4) The parts to be reconditioned should be mounted on a lathe together with the mandrel. Then, the end face and the chamfered portions, etc. should be machined with the cutting tool as indicated on the drawing.
- 5) The portion chamfered to 30° with the cutting tool and the ground O.D. surface should be finished with the sandpaper.

★ Sandpaper: CC#240, CC#400

Notes

- ① In case of the finishing with the sandpaper, be careful not to allow a hand or fingers to be drawn into the rotation of the workpiece.
- ② The sandpaper must not be moved longitudinally in reference to the rotary shaft.
- ③ The finished surface roughness $1.6\mu\text{s}$ of the O.D. area is difficult to obtain. Its last finishing must be performed with the used sandpaper CC#400.
- ④ The finished surface roughness checking must be made by means of a comparison with the "Surface roughness standard sample".

★ Cylinder external surface roughness standard sample: 799-101-8150

3-4 Example (C) of the reconditioning

Part No.	Part Name	Material hardness	Where to recondition	Schematic drawing
561-22-61511	Case		Where a bearing is fitted in	

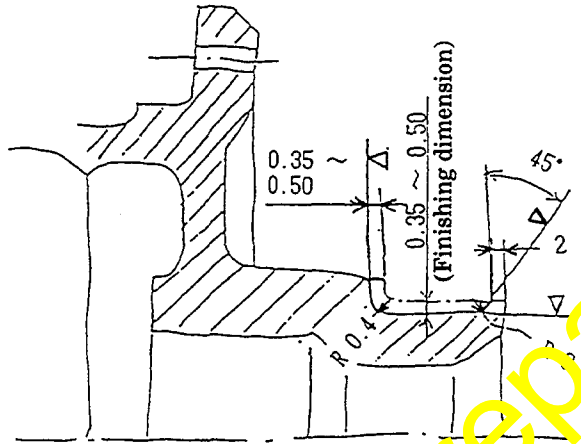
Note) For the detail of a portion to be reconditioned, see the separate drawing.

1. **Cleaning and degreasing of a part**
Clean the part and degrease the tube all over.

Notes

- ① Where the organic flux is used as the degreasing agent, conform to the "How to use the organic flux".
- ② Confirm that the part is free from cracks and any other defect.

2. **Undercutting**
Turn the portion to be reconditioned as shown below.



Notes

- ① The overall peripheral runout of the portion to be reconditioned must be within 0.100 mm.
- ② No cutting oil must be used in the turning operation.

3. **Masking**
Expose the undercut area and stick the masking tape doubly along the boundary in the width ranging from 30 to 40 mm, thereby protecting the undercut area from the shotblasting and the spraying.

★ Masking tape: METCO BPM-19

4. **Shotblasting**
(For the detail of the shotblasting, conform to the manufacturer's instructions.)
The undercut zone should be shotblasted evenly all over.

- ★
- 1) Grits: METCO LIGHT C
 - 2) Discharge pressure: 6 kg/cm²

Notes

- ① In the shotblasting operation, a protector or the like should be used from the operational safety and health viewpoints.
- ② The shotblasted surface must not be touched by hand to prevent the surface from being fouled with oil, grease, etc.
- ③ The spraying should be applied onto the whole surface within one hour after the blasting operation.

5. Preheating

Ignite the spray gun without furnishing it with the powder and heat the portion to be sprayed while rotating it.

- ★ 1) Preheating temperature: 85 to 100°C
- 2) Tem. gauge: Digital temp. gauge

Notes

- ① Perform the preheating with protectors like spectacles put on.
- ② Heat the workpiece thoroughly in consideration of its mass.
- ④ The heating temp. must not exceed 200°C (to avoid the distortion under heat).

6. Spraying

(For the detail of the spraying operation, conform to the sprayer manufacturer's instructions.)

- 1) Previously connect the hoses, etc. for oxygen, acetylene, air, spraying powder, etc. and the electric supply cable to the spray gun. Fill the powder unit with #447.
- 2) Set the specified values on the basis of the spraying conditions.

Table of the spraying conditions

Thermo-spray gun No.	Distance between the gun and the workpiece mm (inch)	Spraying angle of the gun (°)	Air pressure kg/cm ² (psi)	Oxygen pressure kg/cm ² (psi)	Oxygen flow scale	Acetylene gas pressure kg/cm ² (psi)
6P-II	100-180 (4-7)	20°	2.1 (30)	2.8 (40)	45	1.1 (15)

Thermo-spray gun No.	Acetylene gas flow scale	Powder feed nitrogen gas pressure kg/cm ² (psi)	Nitrogen gas flow scale	Amount of spray kg/H (1b/H) mm/pass (in/pass)
6P-II	55	3.9 (55)	37	2.0 (4 1/2) 0.05 (0.002)

- 3) Under the spraying conditions indicated above, set a part to be reconditioned on a rotary machine like a lathe and run the machine.

★ Peripheral speed of rotation: 10 m/min

- 4) Ignite the spray gun and perform the spraying evenly, keeping the specified spraying conditions.

- ★ ① Powder spraying capacity: 1 kg = 0.10 mm × 1 m²
- ② Amount of spraying (from the Table of spraying conditions): 2.0 kg/H
- ③ Dimension of the sprayed overlay (Coating thickness): 0.7 to 1.0 mm

- 5) The thickness of the sprayed overlay should be estimated and controlled in reference to the spraying time.

- 6) Stop the rotary machine (lathe) at proper intervals, measure the thickness of the sprayed overlay with a micrometer, and check the surface for the uniform overlay with a scale, etc. set thereon. At the same time, check the sprayed surface for abnormalities like cracks, etc.

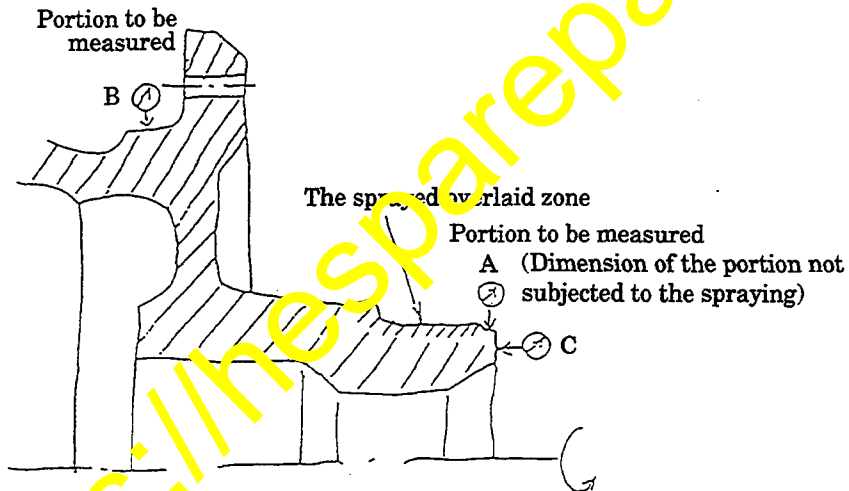
Notes

- ① No contact with cloth, hands, etc. must be allowed on the sprayed surface.
 - ② When the spraying is to be continued, it should be carried on before the surface cools down.
 - ③ Where the surface has cooled down, perform the preheating again before the spraying.
- 7) Remove the masking tape, etc. and check the sprayed surface.

Note: The sprayed overlay must be free from cracks and abnormal porous layer.

7. Finish-machining

- 1) Set a reconditioned part on the lathe.
- 2) Perform the centering



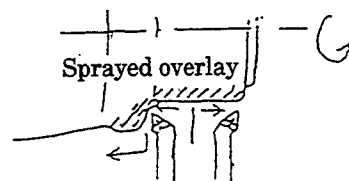
- ★ ① Overall peripheral runout at A and B: 0.070 mm
- ② End face C runout: within 0.015 mm

- 3) Finish the reconditioned part to the dimensions on the drawing under the following machining conditions.

Machining conditions

Type of applicable cutting tool	Tool tip nose R (mm)	Peripheral speed (m/min)	Amount of feed (mm/rev)	Depth of cut (mm/cycle)	The cutting tool feed direction
For the cast iron machining (K10)	0.4	20	0.1 – 0.2	0.2	See below.

Note: The cutting tool feeding direction



The cutting tool is fed from the midpoint onto the left & right sides, alternately.

- 4) Finish the tool-machined surface with the sandpaper.

★ Sandpaper: CC#240

Notes

- ① In case of the finishing with the sandpaper, be careful not to allow the hand or fingers to be drawn into the rotation of the workpiece.
- ② The finished surface roughness checking must be made by means of a comparison with the "Surface roughness standard sample".

★ Cylinder external surface roughness standard sample: 799-101-8150

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