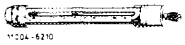
Data

Crankshaft, normal size and repair stages	Crankshaft journal dia.	Thrust bearings width of flanged shell bearings	Corresponding thrust washer thickness	Journal width	Crankpin dia.	Crankpin width
Normal size	69.96 / 69.96	33.80 / 33.90	2.15 / 2.20	34.00 [1] / 34.03 — 34.10 [1] / 34.13	51.96 / 51.95	32.00 / 32.10
1st repair stage	69.71 / 69.70	34.40 / 34.60 basic	2.25 or 2.35 or 2.40	34.20 [1] / 34.23 or 34.40 [1] / 34.43 or 34.50 [1] / 34.53	51.71 / 51.70	up to 32.30
2nd repair stage	69.46 / 69.45				51.46 / 51.45	
3rd repair stage	69.21 / 69.20				51.21 / 51.20	
4th repair stage	68.96 / 68.95				50.96 / 50.95	

Permissible ovality of crankshaft journals and crankpins			0.005
Permissible conicity of crankshaft journals and crankpins			0.01
Permissible wobble of thrust bearing			0.02
Permissible eccentricity of flywheel flange			0.02
Fillets on crankshaft journals and crankpin			3.0 to 3.5
Permissible eccentricity of crankshaft journals, mounted at outer journals	Engines 615, 616	Journals II, IV	0.07
		Journal III	0.10
	Engine 617	Journals II, V	0.07
		Journals III, IV	0.10
Scleroscope hardness of crankshaft journals and crankpins		as new	74–84
		tolerance limit	60 [2]
Permissible unbalance of crankshaft			15 cmg

[1] Figures when using thrust washers. When using flanged shell bearings: journal width = 34.00–34.60 mm.
[2] At least 2/3 of the pin/journal circumference must show tolerance limit.

Special tool

Drop hardness tester		000 589 20 21 00

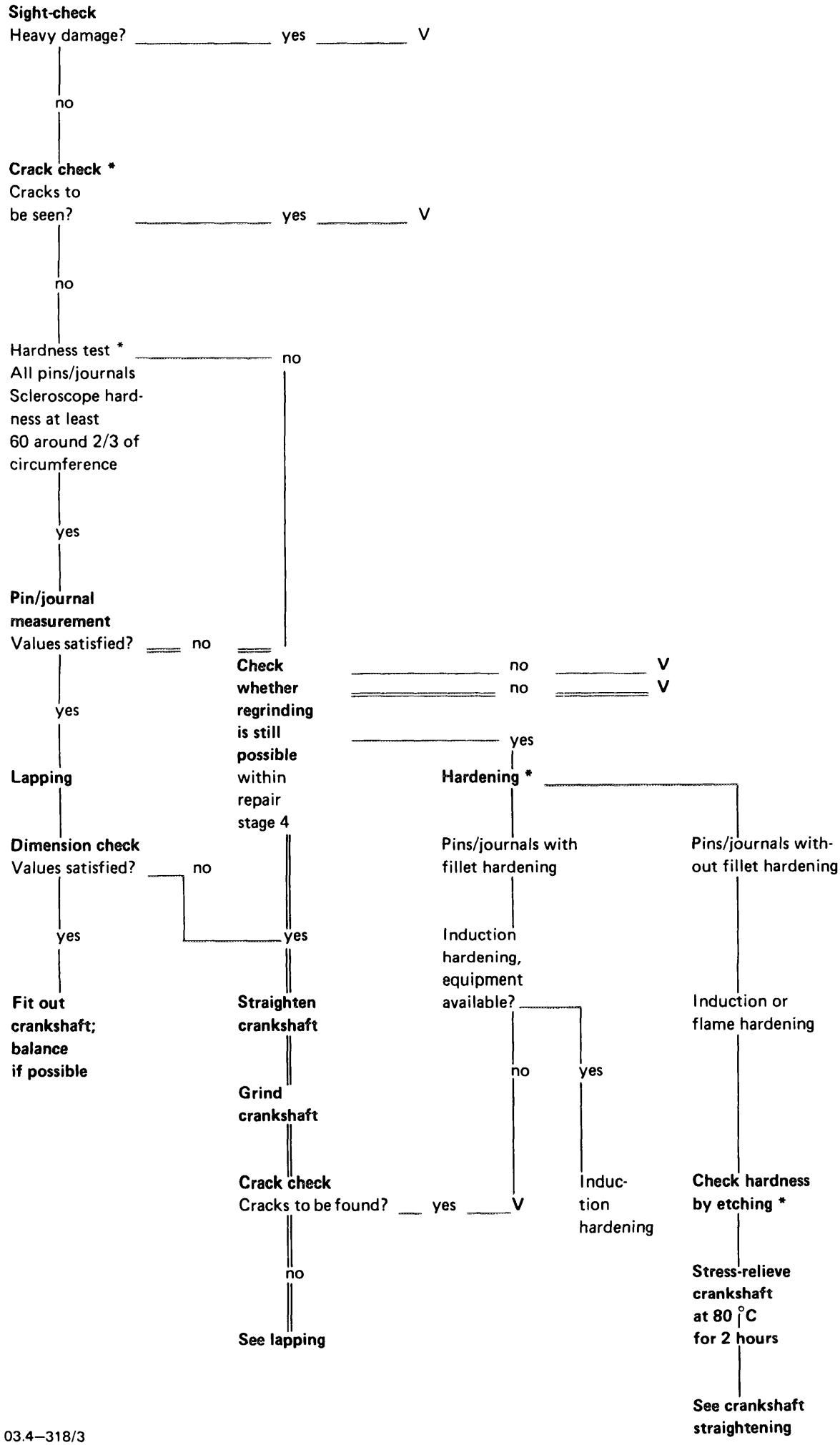
Note

For checking and reconditioning crankshafts proceed in the order of the overleaf diagram.

Diagram

*See section "Explanations to diagram".

V = Discard.


Sight-check
Heavy damage?
yes
V
no
Crack check *
Cracks to be seen?
yes
V
no
Hardness test *
All pins/journals Scleroscope hardness at least 60 around 2/3 of circumference
no
yes
Pin/journal measurement
Values satisfied?
no
yes
Lapping
Dimension check
Values satisfied?
no
yes
Fit out crankshaft; balance if possible
Check whether regrinding is still possible within repair stage 4
no
no
V
V
yes
Straighten crankshaft
Grind crankshaft
Crack check
Cracks to be found?
yes
V
no
See lapping
Hardening *
Pins/journals with fillet hardening
Induction hardening, equipment available?
no
yes
Induction hardening
Pins/journals without fillet hardening
Induction or flame hardening
Check hardness by etching *
Stress-relieve crankshaft at 80 °C for 2 hours
See crankshaft straightening

Explanations to diagram

Crack check

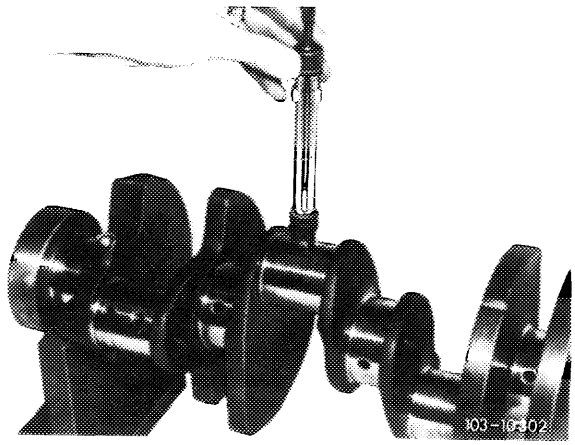
Clean crankshaft, making sure that pins and journals show no signs of oil or grease.
Magnetize crankshaft and apply fluorescent powder (fluxing). It is also possible to employ a paint penetration method (dipping in bath or spraying from can).

Materials: Paint or fluorescent powder,
cleaning agent,
developer

Hardness test

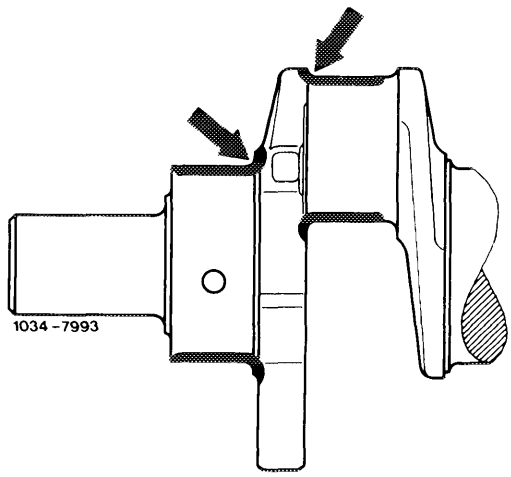
Check hardness using hardness tester (scleroscope hardness).

Minimum hardness of 60 must be obtained around 2/3 of pin/journal diameter.

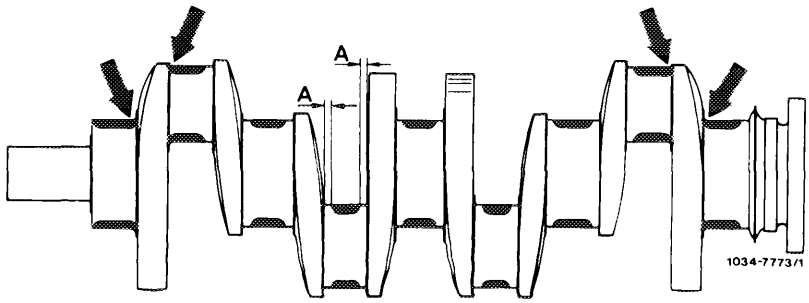


Hardening

Pins/journals without hardened fillets can be treated by induction or flame-hardening. In contrast, pins/journals with hardened fillets (arrows) must always be hardened by induction.
Failing this, discard crankshaft.



For hardening pins/journals not having hardened fillets, be sure to obtain distance A between fillet and end of hardened section (5–6 mm).



Checking hardness

To obtain satisfactory hardness, it is essential to adjust the hardening system by means of microsections.

These sections can be taken from hardening experiments on discarded crankshafts.

Check hardening effect by etching pin/journal surface with a 2 % alcohol solution of nitric acid (HNO_3).

No dark spots must appear on the pin/journal surface.

The unhardened fillets go dark.

In contrast, the hardened fillets must be as light as the pin/journal surfaces.

To compare the effects it is advisible to etch a metallographically checked pin/journal.

Finally wash off the nitric acid carefully with alcohol.

Corrosion protection

Crankshafts which are not put back immediately must be lubricated with engine oil (SAE 30 running-in oil).