Data

Crankshaft standard dimension and repair stages	Crankshaft bearing journal diameter	Width of thrust bearing journal	Crank pin diameter		Width of pins
Standard dimension	63.965 / 63.950	27.000 / 27.021	51.965[1] / 51.945	47.965[2] / 47.945	50.000 / 50.100
1st repair stage	63.715 / 63.700	up to 27.50	51.715[1] / 51.695	47.715[2] / 47.695	up to 50.30
2nd repair stage	63.465 / 63.450		51.465[1] / 51.445	47.465[2] / 47.445	
3rd repair stage	63.215 / 63.200		51.215[1] / 51.195	47.215[2] / 47.195	
4th repair stage	62.965 / 62.950		50.965[1] / 50.945	46.965[2] / 46.945	

Permissible crankshaft journal and crank pin runout		0.0025
Permissible deviation of the connecting rod journal surface axis to the reference axis of the crankshaft journals I and V, from parallel		0.01
Permissible radial runout of the rear crankshaft flange[3])		0.02
Permissible axial runout of the rear crankshaft flange[3])		0.012
Permissible axial runout of the crankshaft bearing journals[3])	Journals II, IV	0.07
	Journals III	0.10
Permissible deviation of the front crankshaft journal[4])	from the cylindrical shape	0.005
	from axial runout[3])	0.030
Permissible deviation of the bearing surfaces of the thrust bearing	from radial runout[3])	0.02
Fillet radii at the crankshaft and connecting rod bearing journals		2.5–3
Crankshaft bearing journal diameter front		31.984–32.000
Bearing surface dia. for radial sealing ring rear, ground without helix		99.928 / 99.874
Scleroscope hardness of crankshaft bearing journals and crank pins	when new	71–81
	limit value	60[5])

[1]) Engines 116 and 117 except [2].

[2]) 116.960/961 (AUS) (J) (S) (USA) 116.962/963 and 117.962/963.

[3]) With crankshaft resting on outer crankshaft bearing journals I and V and one full turn.

[4]) When measuring in the installed position, eliminate end float by pressing against the crankshaft journal.

[5]) Limit value should be available at least on 2/3 of journal circumference.

Special tool

Impact hardness tester (scleroscope)	 11004-6210	000 589 20 21 00

Note

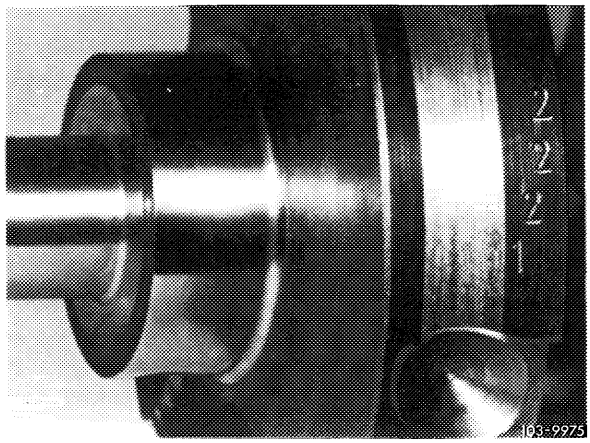
During repair the crankshaft need not be balanced.

When checking and reconditioning the crankshaft proceed according to the following diagram.

Group number for crank pin diameter (standard dimension)

1 = 51.945–51.954 mm and 47.945–47.954 mm
2 = 51.955–51.965 mm and 47.955–47.965 mm

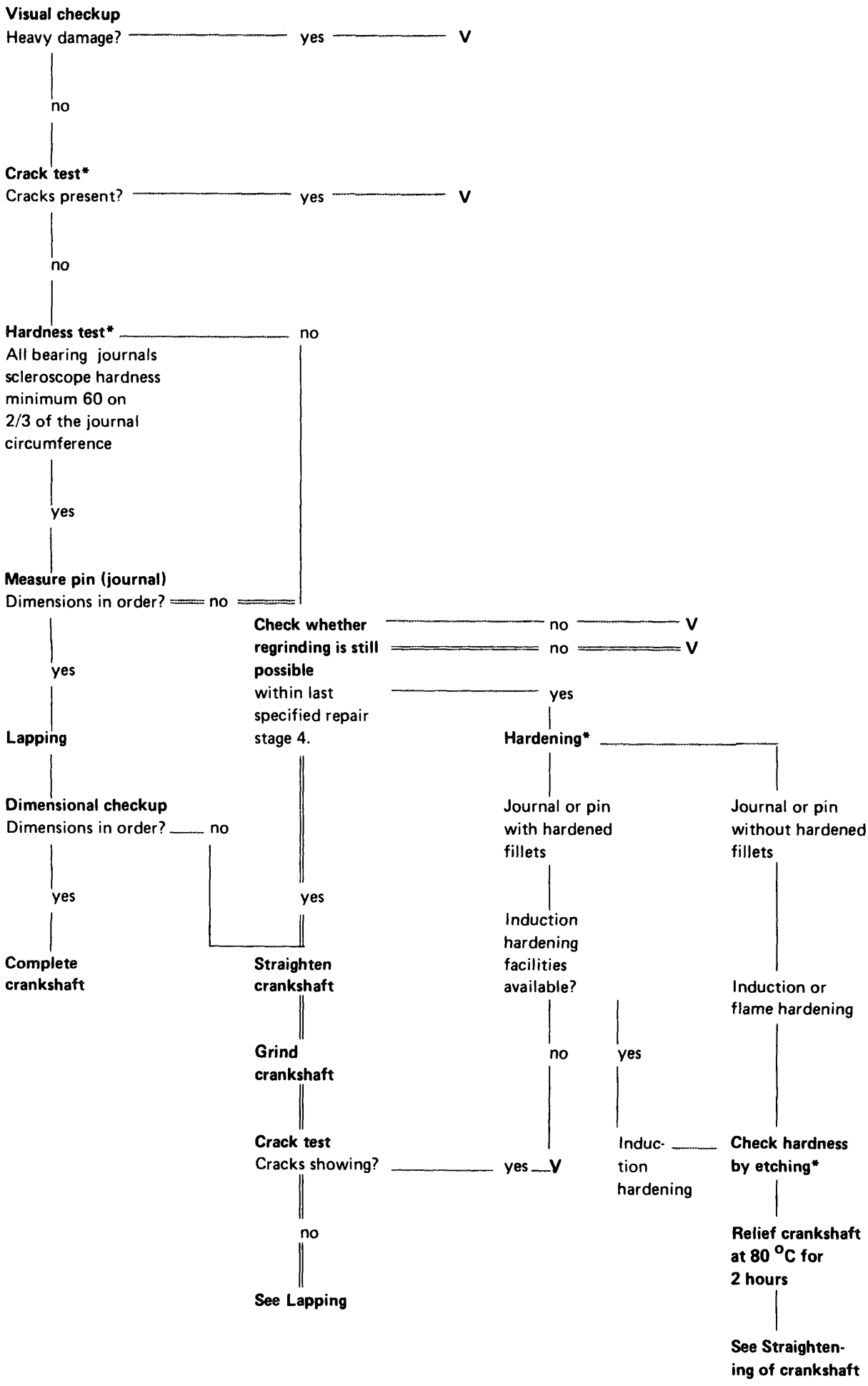
The stamped-in figure at bottom applies to the 1st crank pin.



Diagram

* See section „Explanation on diagram".

V = Scrapping.

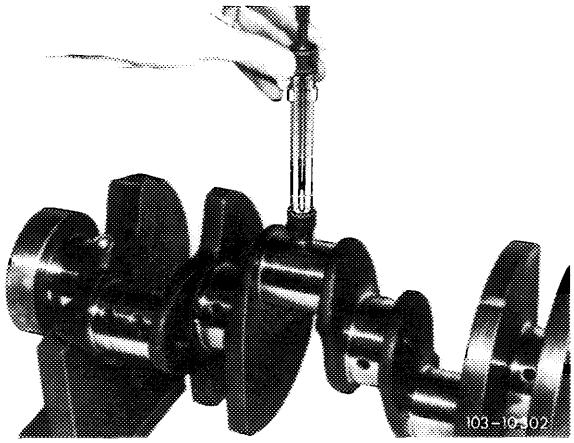

Visual checkup
Heavy damage?
yes
V
no
Crack test*
Cracks present?
yes
V
no
Hardness test*
All bearing journals scleroscope hardness minimum 60 on 2/3 of the journal circumference
no
yes
Measure pin (journal)
Dimensions in order?
no
yes
Lapping
Dimensional checkup
Dimensions in order?
no
yes
Complete crankshaft
Check whether regrinding is still possible within last specified repair stage 4.
no
V
no
V
yes
Hardening*
Journal or pin with hardened fillets
Induction hardening facilities available?
no
yes
Induc-tion hardening
Journal or pin without hardened fillets
Induction or flame hardening
Check hardness by etching*
Relief crankshaft at 80 °C for 2 hours
See Straighten-ing of crankshaft
yes
Straighten crankshaft
Grind crankshaft
Crack test
Cracks showing?
yes
V
no
See Lapping

Explanation of diagram

Crack test

Clean crankshaft. Bearing journals and pins should be free of oil and grease. Magnetise crankshaft and apply fluorescent powder (fluxing). A color penetration method may also be used (immersion in bath or using spray can).

Flux agent: Paint or UV-oil,
cleaning agent,
developer



Hardness test

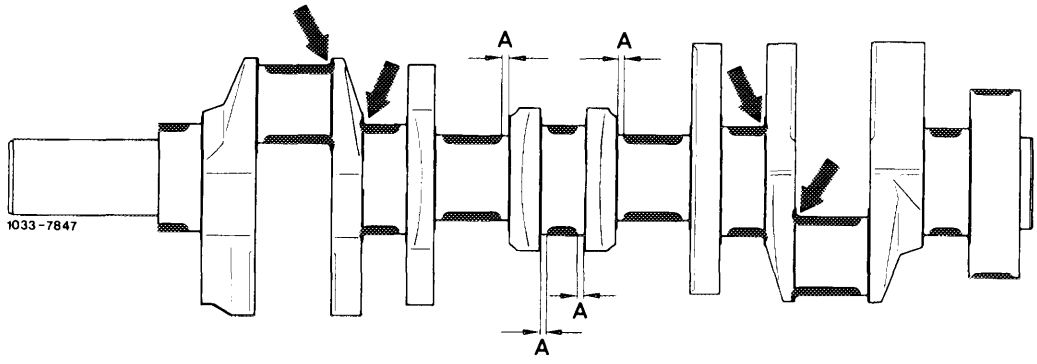
Test hardness with impact hardness tester (scleroscope).

The minimum hardness should be available on 2/3 of the journal and pin circumference.

Hardening

Journals and pins without hardened fillets can be inductance hardened or flame hardened. On the other hand, journals and pins with hardened fillets (arrow) must always be inductance hardened. If this is not possible, scrap the crankshaft.

When hardening journals and pins without hardened fillets, the distance A between hardened runout and fillet radius (4—5 mm) must be maintained.



The running surface for the rear radial sealing ring is hardened and ground without helix (previously 60° helix).

Checking the hardening results

For perfect hardening, check adjustment of hardening equipment by means of metallographic etching (grinding).

Pertinent tests can be made with scrapped crankshafts.

Check hardening by etching surface of journals and pins with a 2% solution of alcoholic nitric acid (HNO_3).

No dark areas should appear on journal or pin surfaces.

Unhardened fillets will become dark.

Hardened fillets, on the other hand, should be as bright as the surface of pin or journal.

A journal or pin which has already passed metallographic inspection may be used for comparison.

After the test, carefully wash off nitric acid with alcohol.

Corrosion protection

Crankshafts which are not immediately installed again should be lubricated with engine initial operation oil (SAE 30).