

Australian/New Zealand Standard™

AS/NZS 2891.5:2015

Methods of sampling and testing asphalt

Method 5: Compaction of asphalt by Marshall method and determination of stability and flow—Marshall procedure

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CE-006, Asphalt and Sprayed Surfacing, to supersede AS 2891.5—2004, *Methods of sampling and testing asphalt—Determination of stability and flow—Marshall procedure*.

The term ‘informative’ has been used in this Standard to define the application of the appendices to which it applies. An ‘informative’ appendix is only for information and guidance.

METHOD

1 SCOPE

This Standard sets out the method for preparing specimens of asphalt (either produced in the laboratory or at a mixing plant) by the Marshall procedure and determining stability and flow values of the specimens using the Marshall apparatus. It is applicable to asphalt mixes not exceeding 20 mm nominal size.

2 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS	
2008	Bitumen for pavements
2193	Calibration and classification of force-measuring systems
AS/NZS	
2891	Methods of sampling and testing asphalt
2891.1.1	Method 1.1: Sampling—Loose asphalt
2891.2.1	Method 2.1: Sample preparation—Mixing, quartering and conditioning of asphalt in the laboratory
2891.9.1	Method 9.1 Determination of bulk density of compacted asphalt—Waxing procedure
2891.9.2	Method 9.2: Determination of bulk density of compacted asphalt—Presaturation method
2891.9.3	Method 9.3: Determination of bulk density of compacted asphalt—Mensuration method

Austroroads

AGPT/T190 Specification framework for polymer modified binders

New Zealand Transport Agency

NZTA M/1 Specification for roading bitumens

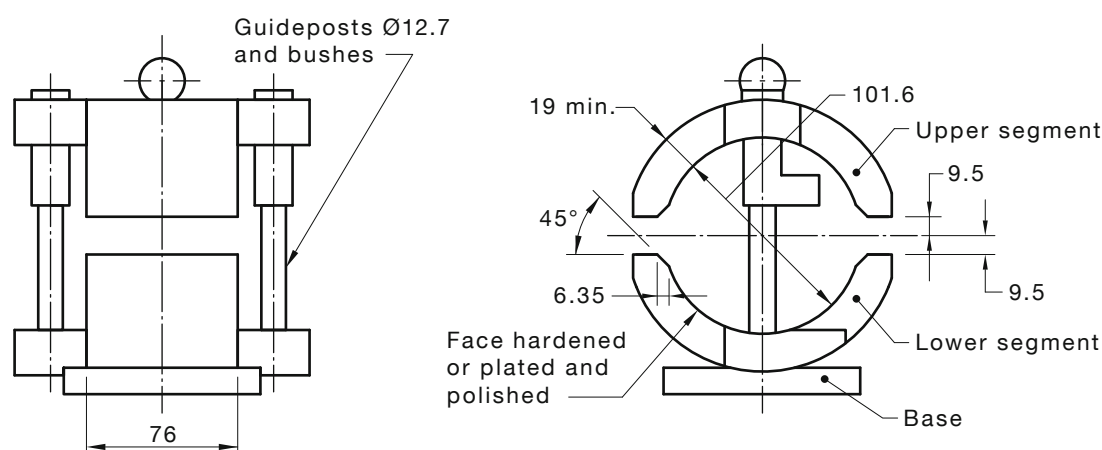
3 DEFINITIONS

For the purpose of this Standard, the definitions in AS/NZS 2891.1.1 apply.

4 APPARATUS

The following apparatus is required:

- (a) *Balance* Of suitable capacity with a limit of performance not exceeding ± 0.5 g.
- (b) *Breaking head* Consisting of upper and lower cylindrical segments having an inside cylinder face accurately machined. The lower segment is to be mounted on a base having two perpendicular guide rods or posts extending upwards. Guide bushes on the upper segment are to be in such a position as to direct the segments together without binding or loose motion of the guide rods. The breaking head shall have an internal diameter of 101.6 ± 0.2 mm. A typical breaking head is shown in Figure 1.



NOTE: Frequent checks on the inner radius of segments and on the alignment of guideposts are necessary as high loads may permanently distort the breaking head.

DIMENSIONS IN MILLIMETRES

FIGURE 1 TYPICAL BREAKING HEAD

- (c) *Compaction hammer* Mechanical or hand and consisting of a 98.5 mm diameter flat circular tamping face and a 4.53 ± 0.02 kg sliding weight with a free fall of 457 ± 1 mm. A suitable design for a hand compaction hammer is shown in Figure 2. Designs for mechanical compaction hammers may vary as long as the essential dimensions are met.

NOTE: Although the design, dimensions, mass and height of mass drop for hammers may comply with this specification, variations in efficiency may mean density achieved in compacted specimens with the same number of blows may vary between compaction apparatus. It is up to individual users to ensure the compaction apparatus is operating correctly and efficiently. This may be achieved through inter laboratory assessments or proficiency testing schemes.

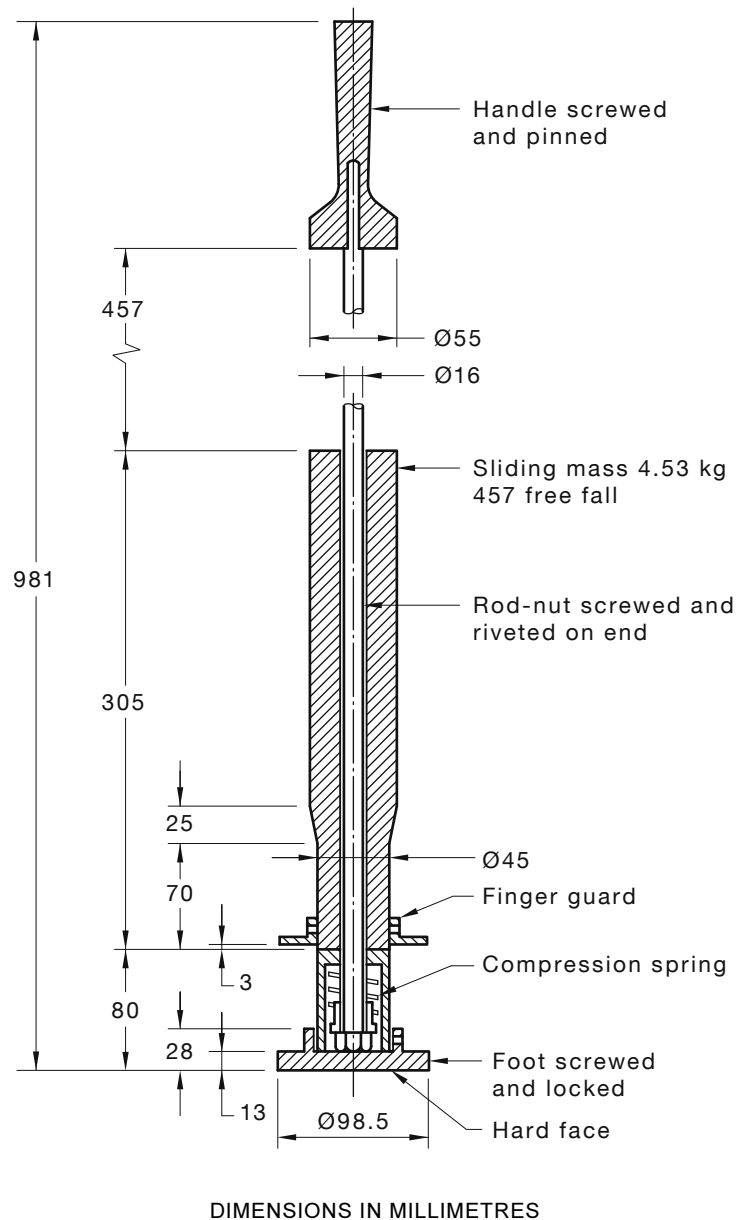
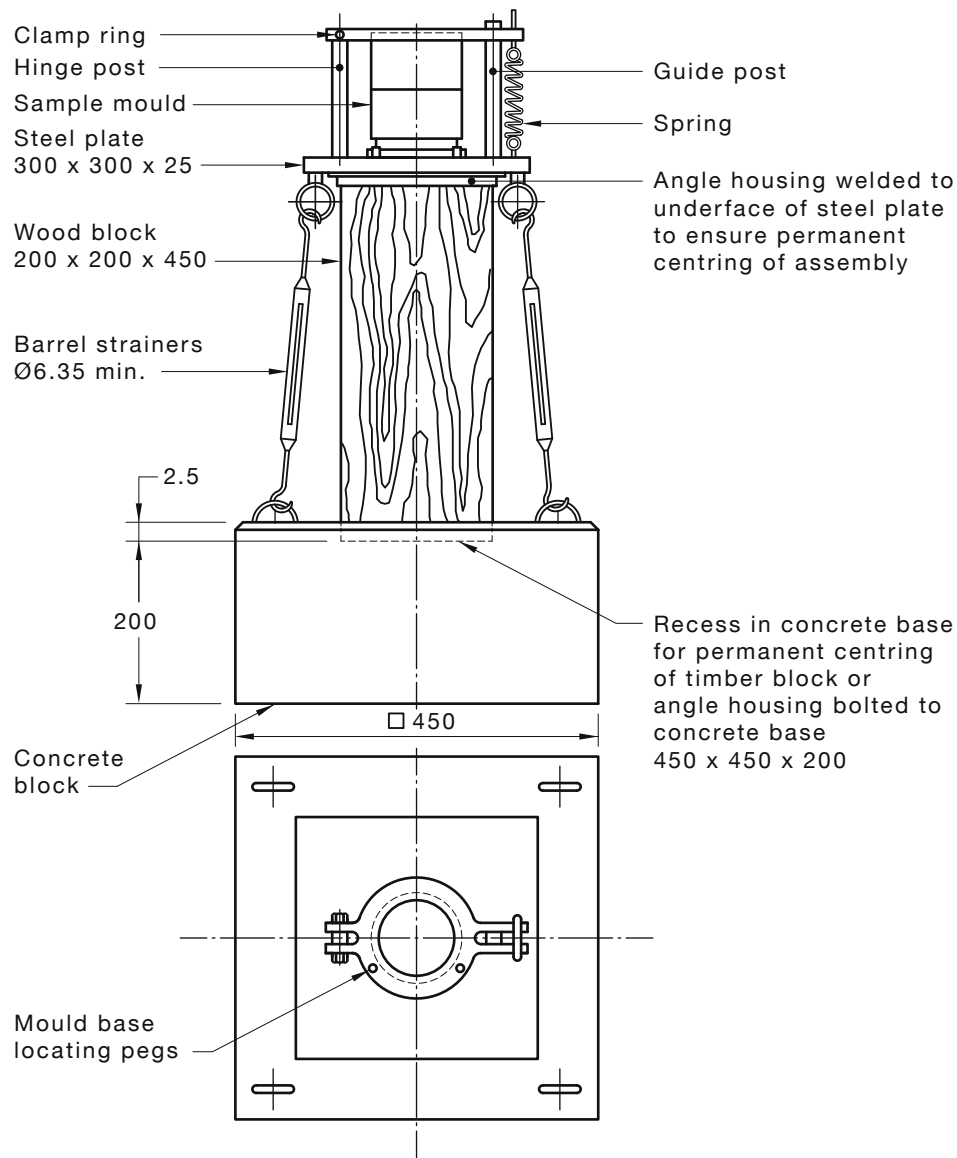


FIGURE 2 TYPICAL HAND COMPACTION HAMMER

- (d) *Compaction pedestal* Consisting of a wooden block approximately 200 mm × 200 mm × 450 mm capped by a steel plate approximately 300 mm × 300 mm × 25 mm. A typical compaction pedestal is shown in Figure 3. The air dry density of the wooden block shall be 670 kg/m³ to 770 kg/m³. The plate shall be level and securely attached to the block, which in turn shall be secured to a solid concrete floor or slab. A suitable framework shall be secured to the pedestal to ensure that the compaction hammer is kept vertical. Wooden block dimensions for length may vary to accommodate multi-head compactors.

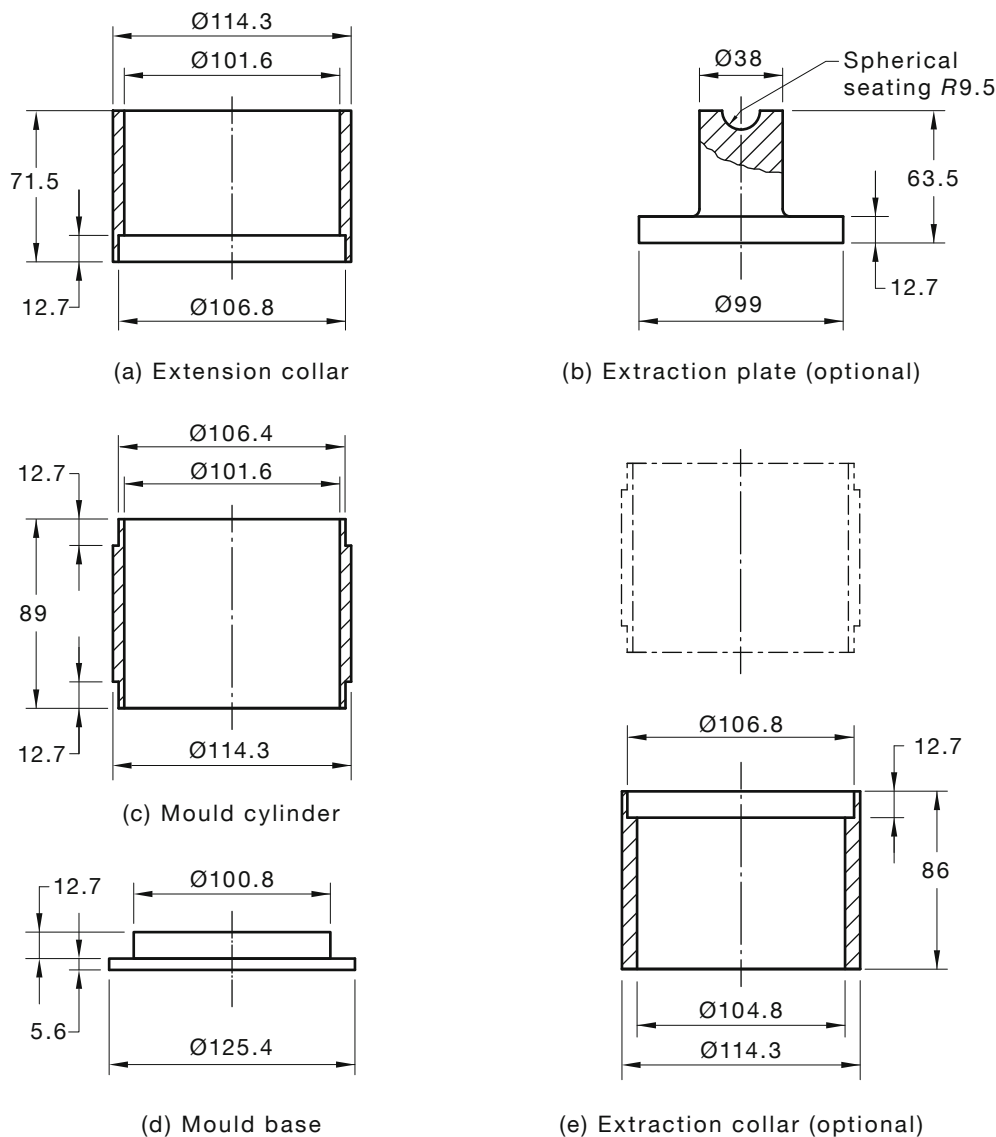
NOTE: Certain designs of dual head compactors are supplied fitted to a steel plate approximately 400 mm × 400 mm × 25 mm and are bolted directly to a dense concrete block approximately 400 mm × 400 mm × 450 mm which is secured to the solid concrete floor or slab. This type of pedestal has been found to be an acceptable alternative.



DIMENSIONS IN MILLIMETRES

FIGURE 3 TYPICAL COMPACTION PEDESTAL

- (e) *Mixing apparatus* Such as steel tray, steel trowel, spatulas and scoop.
- (f) *Oven* Forced draught, thermostatically controlled, capable of maintaining temperatures up to 200°C within 3°C of the set temperature.
- (g) *Circular paper discs* Cut to fit the mould.
- (h) *Specimen mould assembly* Consisting of a mould base, a mould cylinder and an extension collar made of material that will not deform. The mould cylinder and extension collar shall have a diameter of 101.6 ± 0.2 mm and a height suitable to produce specimens with a conforming height. Typical dimensions of a mould assembly are shown in Figure 4.



DIMENSIONS IN MILLIMETRES

FIGURE 4 TYPICAL SPECIMEN MOULD ASSEMBLY

- (i) *Specimen extraction equipment* Such as that shown in Figure 4, together with an extraction jack.
- (j) *Testing machine* Gear driven at a constant speed to give a rate of travel of plates of 51 ± 3 mm/min when the force is being applied and capable of applying forces up to at least 22 kN. The machine shall be fitted with one or both of the following measurement systems:
 - (i) Load measuring device meeting the readability, accuracy and repeatability requirements of a Class B device as required in AS 2193.
 - (ii) A flow gauge placed on a guide post of the breaking head capable of measuring the vertical deformation of the specimen from the onset of load to 0.1 mm. Alternatively, a revolution counter reading directly from the drive shaft may be used in conjunction with the appropriate calibration factor for the drive pulley, provided compensation is allowed for deflection in the load measuring device.
- (k) *Water bath* At least 150 mm deep with a perforated shelf about 50 mm from the bottom, with mechanical agitator, maintained at a temperature of $60 \pm 1^\circ\text{C}$.

- (l) *Water bath thermometer* Or other suitable temperature-measuring device capable of measuring a temperature of 60°C, readable and accurate to 1°C or less.
- (m) *Thermometer* Or other suitable temperature-measuring device, covering the range 0°C to 200°C readable and accurate to 1°C or less.
- (n) *Steel ruler or external vernier callipers* To measure the height of specimens for the stability test.

5 COMPACTION TEMPERATURES

Unless otherwise specified, the temperatures for the mix to be compacted shall be in accordance with Tables 1, 2 or 3.

NOTE: Refer to Appendix A and Appendix B for guidance in establishing compaction temperatures for binders not included in Tables 1, 2 or 3 or for warm mix asphalt.

TABLE 1
COMPACTION TEMPERATURES FOR AS 2008 BINDERS

Class	Stone mastic asphalt	Dense graded asphalt	Open graded asphalt
C170	N/A	142 ±3°C	N/A
C320	150 ±3°C	150 ±3°C	125 ±3°C
C450	150 ±3°C	150 ±3°C	N/A
C600	N/A	155 ±3°C	N/A
M1000	N/A	155 ±3°C	N/A

TABLE 2
COMPACTION TEMPERATURES FOR AUSTROADS
AGPT/T190 BINDERS

Binder class	Stone mastic asphalt	Dense graded asphalt	Open graded asphalt
A10E	160 ±3°C	160 ±3°C	135 ±3°C
A15E	160 ±3°C	160 ±3°C	135 ±3°C
A20E	160 ±3°C	160 ±3°C	135 ±3°C
A25E	N/A	160 ±3°C	135 ±3°C
A35P	N/A	160 ±3°C	135 ±3°C

TABLE 3
COMPACTION TEMPERATURES FOR NZTA M/1 BINDERS

Bitumen grade	Stone mastic asphalt	Dense graded asphalt	Open graded asphalt
40–50	157 ±3°C	157 ±3°C	118 ±3°C
60–70	150 ±3°C	150 ±3°C	113 ±3°C
80–100	142 ±3°C	142 ±3°C	107 ±3°C

6 SPECIMEN PREPARATION

6.1 Laboratory prepared mix

Laboratory prepared mix shall be prepared as follows:

- (a) Preheat the specimen mould assembly in the oven.