

AS 1788.1—1987

Australian Standard[®]

Abrasive wheels

Part 1: Design, construction, and safeguarding

This Australian standard was prepared by Committee SF/12, Abrasive Wheel Safety. It was approved on behalf of the Council of the Standards Association of Australia on 10 December 1986 and published on 2 February 1987.

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Australian Standard®

Abrasive wheels

Part 1: Design, construction, and
safeguarding

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PREFACE

This standard was prepared by the Association's Committee on Abrasive Wheel Safety, to supersede (in part) AS 1788—1975, SAA Abrasive Wheels Safety Code.

This standard specifies safety requirements for the design and construction of abrasive wheels and the manufacture and installation of abrasive wheels and ancillary equipment. Particular requirements are given for the construction of guards for all equipment fitted with abrasive wheels and for the construction of flanges for use with abrasive wheels.

The selection, care, and use of abrasive wheels is dealt with in AS 1788.2, Abrasive Wheels, Part 2—Selection, Care, and Use.

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STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard

for

ABRASIVE WHEELS

PART 1—DESIGN, CONSTRUCTION, AND SAFEGUARDING

SECTION 1. SCOPE AND GENERAL

1.1 SCOPE. This standard sets out requirements for the design and construction of abrasive wheels (excluding natural sandstones) and includes requirements for safety guards, flanges, chucks, and revolving cups. Requirements for the proper storage, handling, and identification of abrasive wheels are also included.

Application and operating requirements are included in AS 1788.2.

1.2 APPLICATION. The design, manufacture, and construction of abrasive wheels and ancillary equipment shall comply with the requirements of the following Sections of this standard:

[Section 2 Wheel shapes and speeds](#)

[Section 3 Materials](#)

[Section 4 Design and construction](#)

[Section 5 Specific requirements for construction of guards](#)

[Section 6 Specific requirements for construction of flanges](#)

[Section 7 Mounted wheels](#)

[Section 8 Handling and storage](#)

[Section 9 Marking of abrasive wheels](#)

1.3 RELATIONSHIP WITH REGULATIONS. The requirements of this standard do not take precedence over the regulations of a Regulatory Authority that may apply in any area.

1.4 NEW DESIGN AND INNOVATIONS. Any novel materials, designs, methods of assembly, procedures, etc which do not comply with a specific requirement of this standard, or are not mentioned in it, but which give equivalent results to those specified, are not necessarily prohibited. The SAA Committee on Abrasive Wheel Safety can act in an advisory capacity concerning equivalent suitability, but specific approval remains the prerogative of the Authority.

1.5 INTERPRETATIONS. Questions concerning the meaning, application, or effect of any part of this standard may be referred to the SAA Committee on Abrasive Wheel Safety for explanation. The authority of the committee is limited to matters of interpretation and it will not adjudicate in disputes.

1.6 REFERENCED DOCUMENTS. The following standards are referred to in this standard:

- | | |
|---------|--|
| AS 1204 | Structural Steels—Ordinary Weldable Grades |
| AS 1594 | Hot-rolled Low Carbon Steel Plate, Sheet and Strip |

- | | |
|-----------|--|
| AS 1668 | SAA Mechanical Ventilation and Air-conditioning Code
Part 2—Ventilation Requirements |
| AS 1788.2 | Abrasive Wheels, Part 2—Selection, Care, and Use |
| AS 1830 | Iron Castings—Grey Cast Iron |
| AS 1831 | Iron Castings—Spheroidal or Nodular Graphite Cast Iron |
| AS 1832 | Iron Castings—Malleable Cast Iron |
| AS 1833 | Iron Castings—Austenitic Cast Iron |
| AS 2074 | Steel Castings |
| AS B172 | Bonded Abrasive Products
Part I—Designation and Marking
Part IV—Shapes, Sizes and Identification of Mounted Wheels (Inch Series) |
| ISO 2933 | Bonded Abrasive Products—Grinding Wheel Dimensions (Part III) |

1.7 DEFINITIONS. For the purpose of this standard, the following definitions apply:

1.7.1 Abrasive wheel—a revolving cutting tool consisting of abrasive grains held together by organic, inorganic, or vitrified bonding materials.

1.7.2 Accompanying documents—documents accompanying the equipment and containing all important information for the user, in particular that relevant to safety.

1.7.3 Blotters—compressible material generally used between an abrasive wheel and its flanges. The purpose of blotters is to distribute the clamping pressure of the flanges evenly on the wheel.

1.7.4 Bonded wheel.

1.7.4.1 Organic bonded wheel—a wheel which is bonded by means of an organic material (e.g. resinoid, rubber, shellac, or similar bonding agent).

1.7.4.2 Inorganic bonded wheel—a wheel which is bonded by means of inorganic material (e.g. sodium silicate, magnesium oxychloride, or metal).

1.7.4.3 Vitrified bonded wheel—a wheel which is bonded by means of vitrified material (e.g. clay, glass, porcelain or other related materials).

1.7.5 Chuck—a device to hold abrasive segments or certain types of wheels, and mounted on the machine spindle or machine face plate.

1.7.6 Cup-back bushing—a moulding applied to certain wheel shapes acting to increase the strength of the back section of the wheel.

1.7.7 Exhaust zones—the effective area of the ventilation system used for control of dust or fumes.

1.7.8 Flanges—collars, discs, or plates between which wheels are mounted, and are referred to as adaptor, sleeve, or back-up types.

1.7.9 Grinding face—the surface of the abrasive wheel upon which grinding is performed. (See Fig. 1.1.)

1.7.10 Grinding operations.

1.7.10.1 Centreless grinding—the precision grinding of the outer surface of any cylindrical work piece which is rotated by a regulating wheel and supported by a work blade. (See Fig. 1.2.)

1.7.10.2 Coping—the sawing or grooving of any non-metallic material with an abrasive wheel.

1.7.10.3 Cutting off—the slicing or parting of any material or part (See Fig. 1.3.)

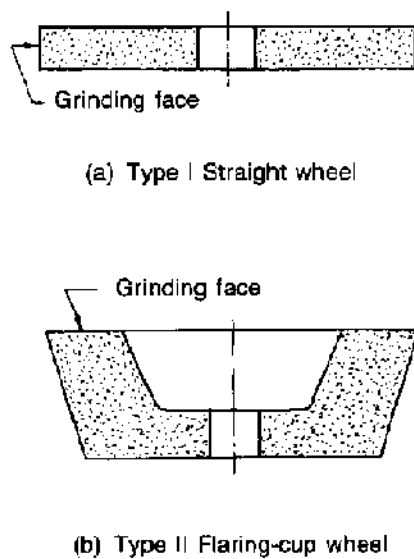


Fig. 1.1. GRINDING FACE



Fig. 1.2. TYPICAL THROUGH-FEED CENTRELESS GRINDING OPERATION

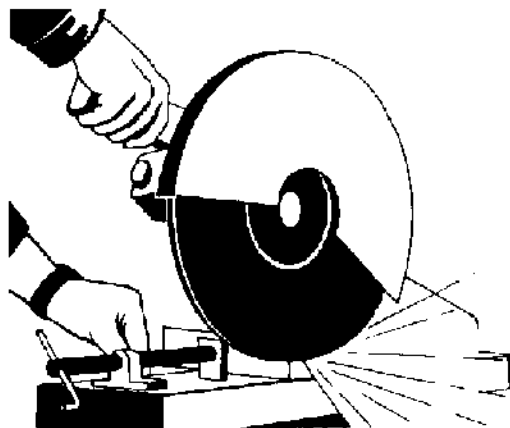


Fig. 1.3. CUTTING OFF

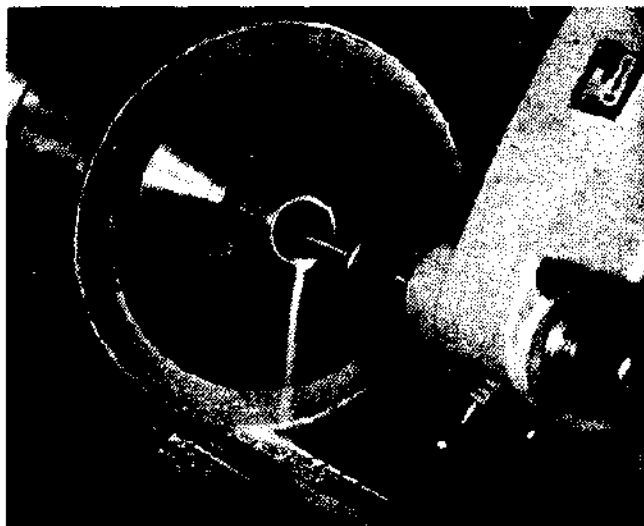


Fig. 1.4. INTERNAL GRINDING

1.7.10.4 Cylindrical grinding—the precision grinding of the outer surface of any cylindrical work piece.

1.7.10.5 Internal grinding—the precision grinding of the inside surface of the hole in a work piece. (See Fig. 1.4.)

1.7.10.6 Off-hand grinding—the grinding of any material or part which is held in the operator's hand.

1.7.10.7 Portable grinding—a grinding operation where the grinding machine is hand-held and may be easily moved from one location to another. (See Fig. 1.5.)



Fig. 1.5. PORTABLE GRINDING

1.7.10.8 Precision grinding—grinding operations performed by machines used to finish work parts to specific dimensions and finish.

1.7.10.9 Snagging—grinding which removes relatively large amounts of material without regard to close tolerance or surface finish.

1.7.10.10 Surface grinding—the precision grinding of a plane surface.

1.7.10.11 Tool grinding—the precision grinding or sharpening of various types of cutting tools.

1.7.10.12 Tuck pointing—removal, by grinding, of cement, mortar or other non-metallic jointing materials.

1.7.11 Guard—an enclosure designed to retain the pieces of the abrasive wheel should it be broken in operation.

1.7.12 Maximum operating speed—the safe maximum rotational frequency of an abrasive wheel. (Unit symbol: r/min)

1.7.13 Peripheral speed—the distance travelled by a point on the outside surface of an abrasive wheel divided by time. (Unit symbol: m/s)

NOTES:

1. The peripheral speed of an abrasive wheel can be calculated from the following equation:

$$u = 5236 \times 10^{-8} \times d \times n$$

where

u = peripheral speed, in metres per second

d = diameter of the wheel, in millimetres

n = rotational frequency, in revolutions per minute.

2. A speed conversion table is given in Appendix A.

1.7.14 Reducing bush—inserts or devices used to reduce the hole size in an abrasive wheel so that it can be mounted correctly on a smaller diameter spindle (See Fig. 1.6.)

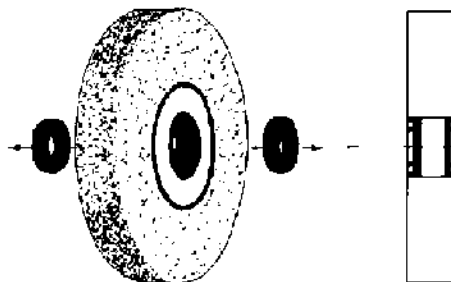


Fig. 1.6. TYPICAL REDUCING BUSH

1.7.15 Regulating wheel—the wheel on centreless grinding operations located opposite the abrasive wheel. The regulating wheel controls the rotational rate and through feed rate of the workpiece. (See Fig. 1.7.)

1.7.16 Reinforced wheel—a class of organic wheel which contains strengthening fabric or filament. The term does not cover wheels using such mechanical additions as steel rings, steel cup-backs, or wire winding or tape winding. (See Fig. 1.8.)

1.7.17 Regulatory Authority—a Minister of the Crown, a government department or other public authority having power to issue regulations, orders or other instructions having the force of law in respect of any subject covered by this standard.

1.7.18 Rotational frequency—the number of revolutions of the abrasive wheel divided by time. (Unit symbol: r/min)

1.7.19 Shall and should—the word ‘shall’ is to be understood as mandatory, and the word ‘should’ as non-mandatory, advisory, or recommended.

1.7.20 Steel rings—a moulding added to certain organic bonded abrasive wheels during manufacture. Where used, the rings add rigidity to the wheel as it approaches discard size and help retain the pieces of the wheel should accidental breakage occur at stub size.

1.7.21 Tape winding (or wire winding)—a winding used on the periphery of cylinder, cup, or segmental disc wheels to help retain the pieces of the wheel should accidental breakage occur. Adequate guards are always used with this type of wheel.

NOTE: Any winding should be removed when the grinding face wears close. If not removed, the winding will become a hazard as it is worn through and unwinds.

1.7.22 Wheel shape—the designation of particular forms of abrasive wheels with respect to dimensional and operational limitations.

1.7.23 Wheel speed—an operating speed computed from the unloaded speed of the machine spindle.

NOTE: In Table 2.1 wheel speeds are classified in metres per second (m/s). Machine spindle speeds, however, are usually indicated in revolutions per minute (r/min). A clear understanding of how these two are related is therefore necessary. See also [Clause 1.7.13](#).

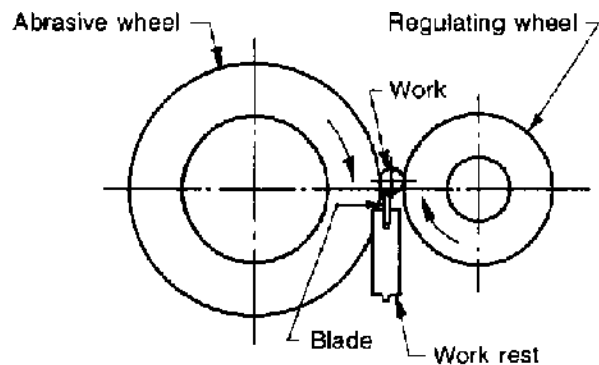


Fig. 1.7. REGULATING WHEEL

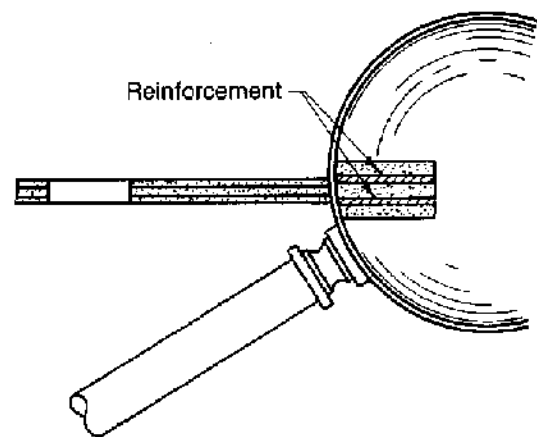


Fig. 1.8. REINFORCED ORGANIC BONDED WHEEL

SECTION 2. WHEEL SHAPES AND SPEEDS

2.1 WHEEL SHAPES.

2.1.1 Straight wheel, Type 1 (See Fig. 2.1). Type 1 wheel shape is characterized by diameter, thickness, and hole size. For precision cylindrical, centreless, or surface grinding, the hole diameter (H) shall be less than two-thirds of the wheel diameter (D). For all other applications, the maximum hole size shall not exceed one-half of the wheel diameter. Inorganic wheels used in snagging operations should have a maximum hole size of less than one-quarter of the wheel diameter.

Type 1 wheels shall be mounted between flanges (see Section 6).

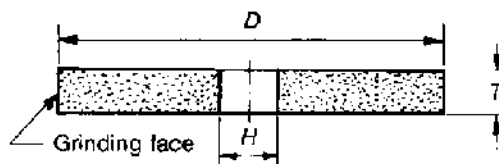


Fig. 2.1. STRAIGHT WHEEL —TYPE 1

2.1.2 Cylinder wheel, Type 2 (See Fig. 2.2). Type 2 wheel shape is characterized by diameter, wheel thickness, and rim thickness. For all applications, rim height (T) shall be equal to or greater than rim thickness (W).

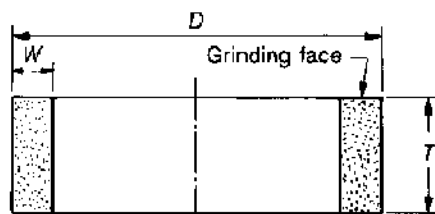


Fig. 2.2. CYLINDER WHEEL —TYPE 2

2.1.3 Abrasive discs (See Fig. 2.3). Abrasive discs are characterized by diameter, thickness, and hole size. Wheel thickness (T) shall be less than rim thickness (W).

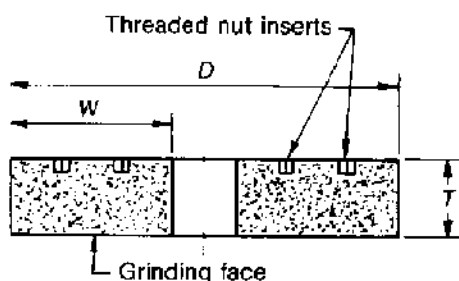


Fig. 2.3. NUT INSERTED ABRASIVE DISC

2.1.4 Taper-sided wheel, Type 4 (See Fig. 2.4). Type 4 wheel shape is characterized by diameter, wheel thickness, grinding face thickness, and hole size. Type 4 wheels have the same limitations on hole size as Type 1 wheels (see Clause 2.1.1 and Section 6).

Grinding face thickness (U) shall be equal to or greater than one-half of the wheel thickness (T). Dimension (J) shall be large enough to accommodate suitable flanges as indicated in Section 6.

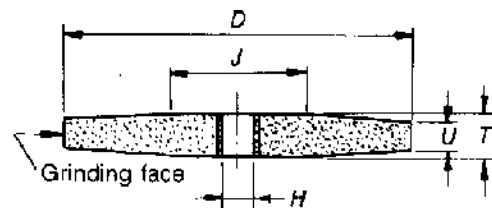


Fig. 2.4. TAPER-SIDED WHEEL —TYPE 4

2.1.5 Recessed-one-side wheel, Type 5 (See Fig. 2.5). Type 5 wheel shape is characterized by diameter, thickness, hole size, recess diameter, and recess depth. Type 5 wheels are subject to the same limitations of hole size as Type 1 wheels. In addition, recess depth (F) shall not exceed one-half of the wheel thickness (T), and diameter of recess (P) shall be large enough to accommodate a suitable flange. Type 5 wheels shall be mounted between flanges (see Section 6).

NOTE: Recessed wheels allow a wider faced grinding wheel to be used where the available mounting thickness (E) is less than the required overall thickness (T). The recess allows grinding clearance for the nut and flange.

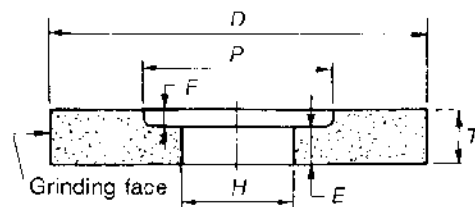


Fig. 2.5. RECESSED-ONE-SIDE WHEEL —TYPE 5

2.1.6 Straight cup wheel, Type 6 (See Fig. 2.6).

Type 6 wheel shape is characterized by diameter, thickness, hole size, rim thickness, and back thickness. Minimum back thickness (E) should be not less than one-quarter of the wheel thickness (T). For unthreaded hole wheels, the inside flat (K) shall be large enough to accommodate a suitable flange (see Section 6).

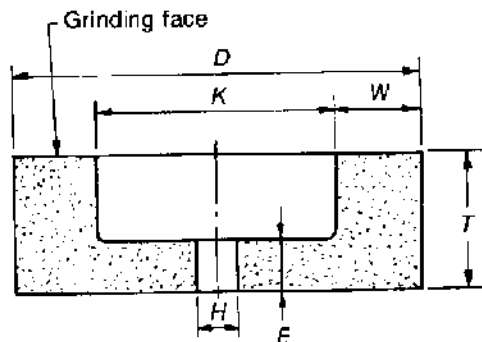


Fig. 2.6. STRAIGHT-CUP WHEEL—TYPE 6

2.1.7 Double recessed wheel, Type 7 (See Fig. 2.7).

Type 7 wheel shape is characterized by diameter, thickness, hole size, recess diameter, and recess depth for both sides of the wheel. Type 7 wheels are subject to the same limitations of hole size as Type 1 wheels. In addition, the combined recess depth (F plus G) should not exceed one-half of the wheel thickness (T).

Type 7 wheels shall be mounted between flanges (see Section 6).

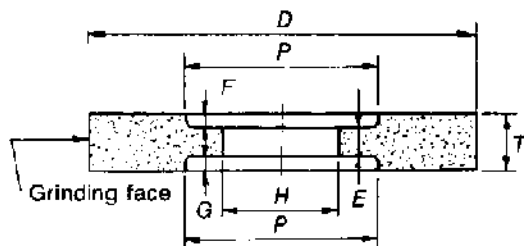


Fig. 2.7. DOUBLE RECESSED-WHEEL—TYPE 7

2.1.8 Flaring cup wheel, Type 11 (See Fig. 2.8).

Type 11 wheel shape is characterized by diameters (D) and (J), thickness, hole size, rim thickness, and back thickness. Minimum back thickness (E) should be not less than one-quarter of the wheel thickness (T). For unthreaded hole wheels, the inside flat (K) shall be large enough to accommodate a suitable flange (see Section 6).

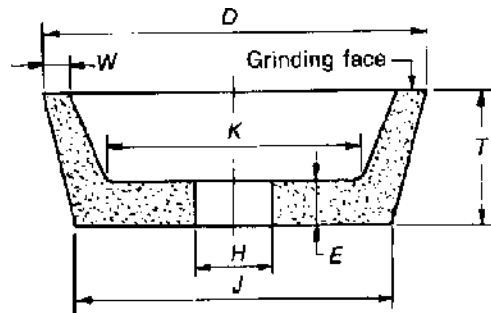


Fig. 2.8. FLARING CUP WHEEL—TYPE 11

2.1.9 Dish wheel, Type 12 (See Fig. 2.9). Type 12 wheel shape is characterized by diameter, thickness, rim thickness, back thickness, and face thickness. Minimum back thickness (E) should be equal to or greater than one-half of the wheel thickness (T). For unthreaded hole wheels, the inside flat (K) shall be large enough to accommodate a suitable flange (see Section 6).

NOTE: Dish wheel differs from a flaring cup wheel (Type 11) in that it always has a face thickness (U). Rim thickness (W) of a Type 11 wheel becomes rim thickness (A) of a Type 12 wheel.

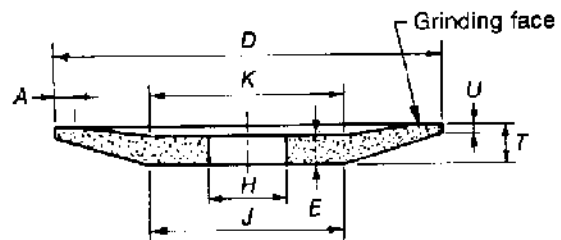


Fig. 2.9. DISH WHEEL—TYPE 12

2.1.10 Saucer wheel, Type 13 (See Fig. 2.10).

Type 13 wheel shape is characterized by diameter, thickness, hole size, and back thickness. For unthreaded hole wheels, diameters (K) and (J) shall be large enough to accommodate suitable flanges (see Section 6). Wheel thickness (U) shall be uniform throughout and equal to back thickness (E).

NOTE: A saucer wheel differs from a dish wheel (Type 12) in that the cross-section is equal throughout. i.e. $U = E$.

The face is always half-round with $R = U/2$.

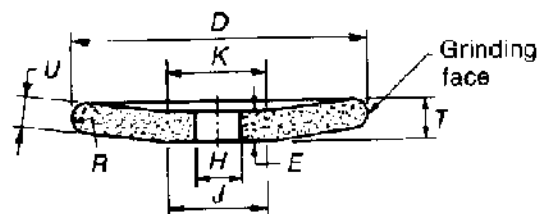


Fig. 2.10. SAUCER WHEEL—TYPE 13

2.1.11 Cone and plug wheels, Types 16, 17, 18, 18R and 19.

2.1.11.1 General. Types 16 to 19 wheel shapes are characterized by diameter, thickness, threaded bushing diameter and depth. All types of cone and plug wheels shall have a blind hole threaded bushing (B).

2.1.11.2 Cone wheel, Type 16 (See Fig. 2.11). Type 16 wheel shape has a curved side with a nose radius.

NOTE: Type 16 wheel shape is sometimes referred to as 'bullet shape'.

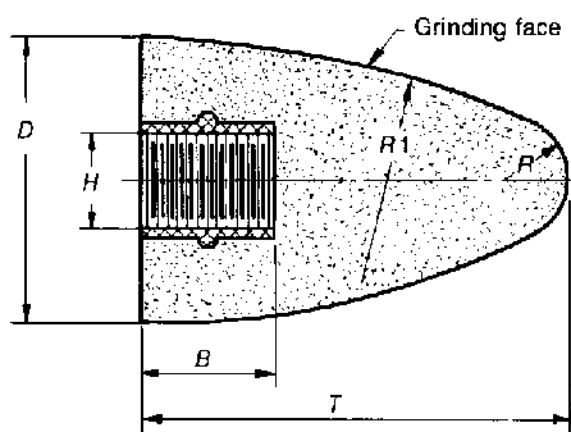


Fig. 2.11. CONE WHEEL —TYPE 16

2.1.11.3 Cone wheel, Type 17 (See Fig. 2.12). Type 17 wheel shape has straight sides with or without a nose radius.

NOTE: When the cross-section of the abrasive at the bottom of the blind hole threaded bushing is inadequate, Type 19 wheel shape should be used.

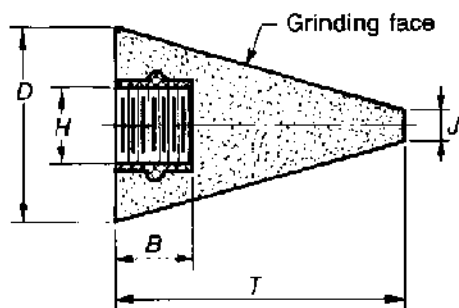


Fig. 2.12. CONE WHEEL —TYPE 17

2.1.11.4 Plug wheel, Type 18 (See Fig. 2.13). Type 18 wheel shape is cylindrical in shape with a flat end.

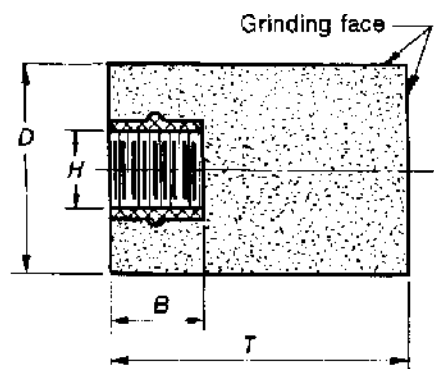


Fig. 2.13. PLUG WHEEL —TYPE 18

2.1.11.5 Plug wheel, Type 18R (See Fig. 2.14). Type 18R wheel shape is cylindrical in shape with a curved grinding end.

NOTE: The curved grinding end is always half-round with $R = D/2$.

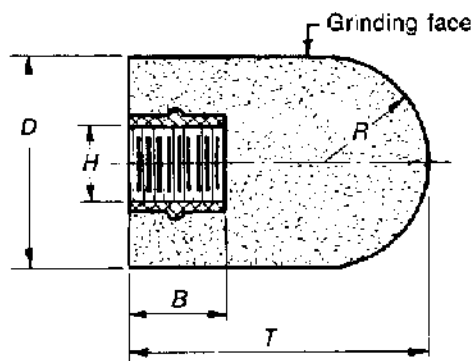


Fig. 2.14. PLUG WHEEL —TYPE 18R

2.1.11.6 Plug wheel, Type 19 (See Fig. 2.15). Type 19 wheel shape is a combination of cone and plug type shapes and is usually required where the base diameter (D) in a Type 17 wheel shape would not provide an adequate cross-section of abrasive.

NOTE: The cylindrical portion (S) is normally equal to or greater than the depth of the blind hole threaded bushing (B).

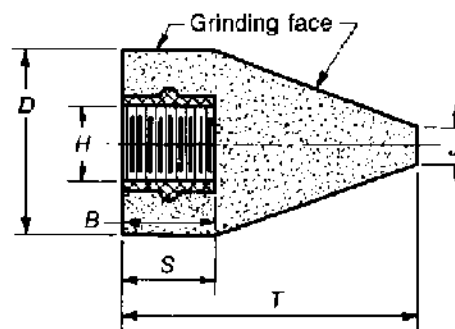


Fig. 2.15. LUG WHEEL —TYPE 19

2.1.12 Relieved and or recessed wheels, Types 20, 21, 22, 23, 24, 25 and 26.

2.1.12.1 General. Types 20 to 26 wheel shapes are characterized by diameter, thickness, hole size, recess diameter, and recess depth, and in addition may be tapered on one or both sides. Types 20 to 26 wheels are subject to the same limitations of mounting as Type 5 wheels (see [Clause 2.1.5](#)).

For Types 20 to 26 wheel shapes (see [Figs 2.17 to 2.23](#)) the tapered relief depths (N and O) shall be considered as recesses and added to the straight recess depth or depths (F and G) for determination of total wheel recess depth. Total recess depth should not exceed one-half of the wheel thickness (T).

2.1.12.2 Peripheral grinding wheel, Type 20 (See [Fig. 2.16](#)). Type 20 wheel shape has one side straight or flat and the other side relieved to a flat.

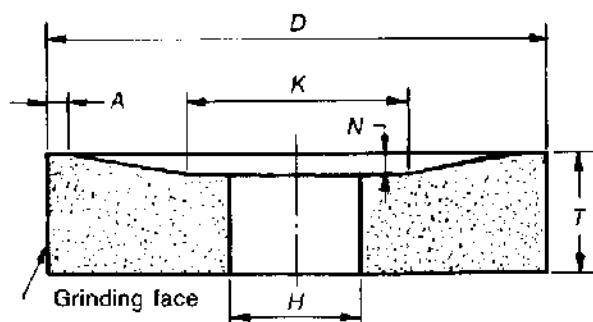


Fig. 2.16. PERIPHERAL GRINDING WHEEL — TYPE 20

2.1.12.3 Peripheral grinding wheel, Type 21 (See [Fig. 2.17](#)). Type 21 wheel shape has both sides relieved to a flat.

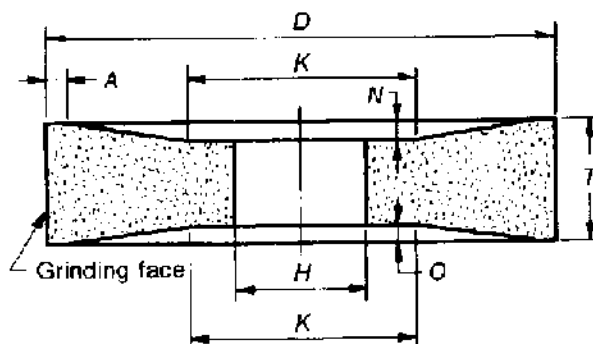


Fig. 2.17. PERIPHERAL GRINDING WHEEL — TYPE 21

2.1.12.4 Peripheral grinding wheel, Type 22 (See [Fig. 2.18](#)). Type 22 wheel shape has one side recessed and the other side relieved to a flat.

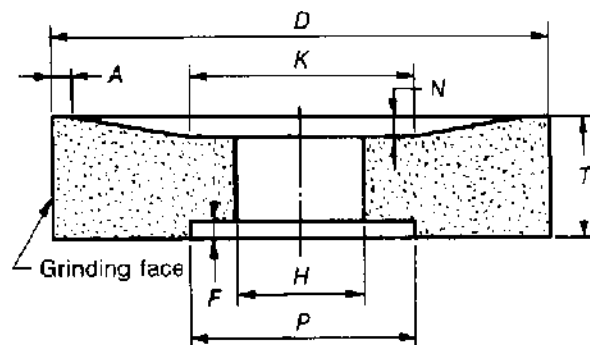


Fig. 2.18. PERIPHERAL GRINDING WHEEL — TYPE 22

2.1.12.5 Peripheral grinding wheel, Type 23 (See [Fig. 2.19](#)). Type 23 wheel shape has one side straight or flat and the other side relieved to a recess.

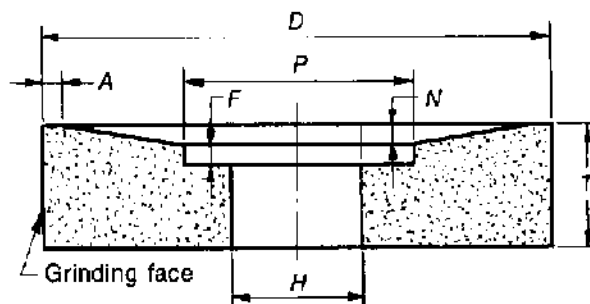


Fig. 2.19. PERIPHERAL GRINDING WHEEL — TYPE 23

2.1.12.6 Peripheral grinding wheel, Type 24 (See [Fig. 2.20](#)). Type 24 wheel shape has one side recessed and the other side relieved to a recess.

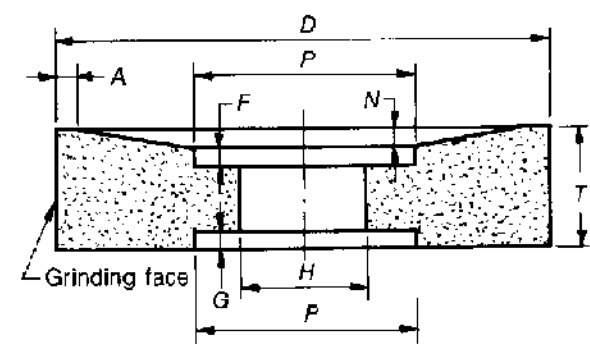


Fig. 2.20. PERIPHERAL GRINDING WHEEL — TYPE 24

2.1.12.7 Peripheral grinding wheel, Type 25 (See Fig. 2.21). Type 25 wheel shape has one side relieved to a flat and the other side relieved to a recess.

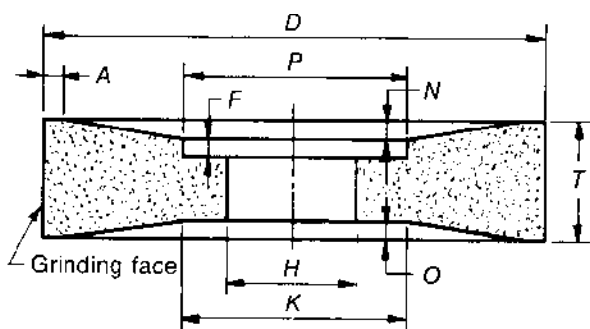


Fig. 2.21. PERIPHERAL GRINDING WHEEL—TYPE 25

2.1.12.8 Peripheral grinding wheel, Type 26 (See Fig. 2.22). Type 26 wheel shape has both sides relieved to a recess.

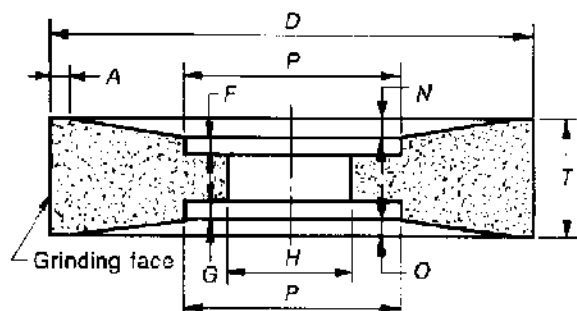


Fig. 2.22. PERIPHERAL GRINDING WHEEL—TYPE 26

2.1.13 Depressed centre wheels, Types 27 and 28 (See Fig. 2.23). Types 27 and 28 wheel shapes are characterized by diameter, thickness, and hole size. Type 27 wheels are manufactured with flat grinding rims permitting grinding and cutting operations. Type 28 wheels have saucer-shaped rims. Both types are reinforced, organic bonded wheels having offset hubs. Flanges for Type 27 wheel shapes should be manufactured so as to accept wheels made to ISO 2933.

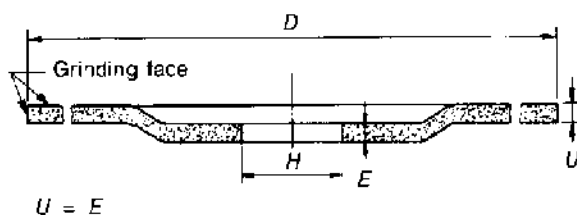


Fig. 2.23. DEPRESSED CENTRE WHEEL (FLAT RIM)—TYPES 27 AND 28

2.1.14 Cutting off wheels. Cutting off wheels are characterized by diameter, thickness, and hole size. Cutting off wheels are usually plain or reinforced organic bonded. Cutting off wheels shall be mounted between flanges (see Section 6).

Cutting off wheels shall be subject to the following maximum thicknesses:

Wheel diameter, mm	Maximum thickness, mm
≤ 150	5
$> 150 \leq 300$	6
$> 300 \leq 580$	10
> 580	13

Maximum hole size for cutting off wheels should be not larger than one-quarter wheel diameter.

2.1.15 Coping wheels. Coping wheels are peripheral cutting wheels and are characterized by diameter, thickness, and hole size. Coping wheels may be reinforced organic bonded. Coping wheels shall be mounted between flanges (see Section 6).

2.1.16 Tuck pointing wheels. Tuck pointing wheels, usually Type 1 reinforced organic bonded wheels, are characterized by diameter, thickness, and hole size. Tuck pointing wheels shall be mounted between flanges (see Section 6).

2.1.17 Notching wheels. Notching wheels are characterized and manufactured in the same manner as depressed centre wheels (see Clause 2.1.13), with the exception that grinding operations are performed on the periphery only.

NOTE: Notching wheels are generally thinner than normal depressed centre wheels as described in Clause 2.1.13, and therefore could be hazardous if grinding is performed using the face of the wheel.

2.1.18 Mounted wheels. Mounted wheels, usually 50 mm diameter or smaller, and of various shapes, may be either organic bonded or vitrified bonded abrasive wheels. They are secured to plain or threaded steel mandrels (see Fig. 2.24).

NOTE: For product requirements for mounted wheels, see Section 7.

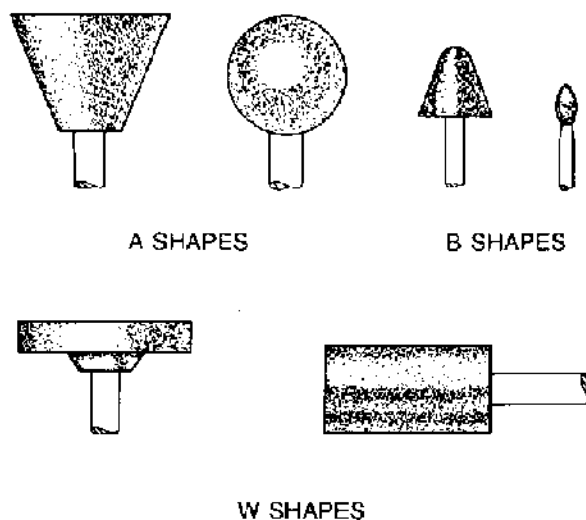


Fig. 2.24. TYPICAL MOUNTED WHEELS

2.1.19 Threaded hole wheels (See Fig. 2.25 and Fig. 2.26). Threaded hole wheels are designed for use on straight, vertical, right-angle head, or flexible shaft portable grinders. They shall have one central threaded bushing, securely anchored in place, and the bushing and abrasive should be in uniform contact with the back plate.

2.2 GENERAL OPERATING SPEEDS.

2.2.1 Standard speeds. The maximum operating speed

of each wheel shall be established and stated by the wheel manufacturer. Table 2.1 indicates the standard maximum peripheral speed of the various classes of wheels, other than mounted wheels.

NOTE: For mounted wheel speeds, see Section 7.

The abrasive wheel shall be marked in accordance with Section 9.

NOTE: The rotational frequency of a wheel may be increased as the diameter of a wheel is reduced through wear (see Clause 2.3).

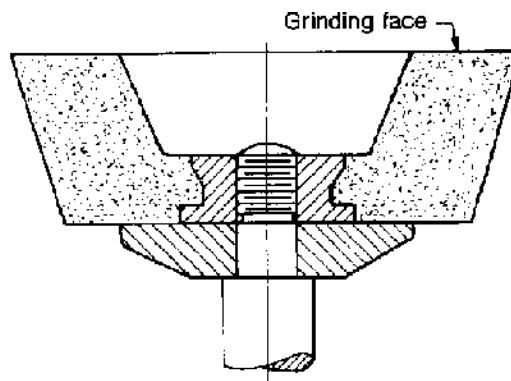


Fig. 2.25. THREADED HOLE CUP WHEEL WITH INSERTED BUSHING

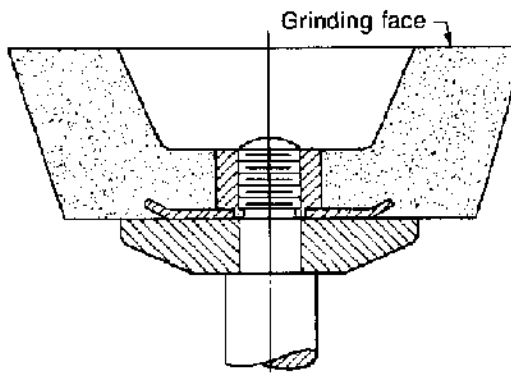


Fig. 2.26. THREADED HOLE CUP WHEEL WITH PRONG ANCHOR BUSHING