

A Product of the
Cooperative Engineering Program

SAE J1590 OCT89

**Internal Combustion
Engines — Piston
Rings — Material
Specifications**

SAE Recommended Practice
Issued October 1989

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INTERNAL COMBUSTION ENGINES - PISTON RINGS - MATERIAL SPECIFICATIONS

This document is equivalent to ISO Standard 6621/3

1. SCOPE AND FIELD OF APPLICATION:

Differences, where they exist, are shown in Appendix A.

This document establishes a classification of materials intended for the manufacture of piston rings based on mechanical properties and the stresses that these materials are capable of withstanding.

This document applies to the manufacture of piston rings up to and including 200 mm diameter for reciprocating internal combustion engines. It also applies to piston rings for compressors working under similar conditions.

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2. REFERENCES:

<u>SAE DESIGNATION</u>	<u>ISO* EQUIVALENT</u>	
		INTERNAL COMBUSTION ENGINES - PISTON RINGS
J1588	6621/1	Vocabulary
J1589	6621/2	Measuring principles
J1590	6621/3	Material specifications
J1591	6621/4	General specifications
J1996	6621/5	Quality requirements
		INTERNAL COMBUSTION ENGINES - PISTON RINGS
J1997	6622/1	Rectangular rings
J1998	6622/2 TR	Rectangular rings with narrow ring width
J1999	6623	INTERNAL COMBUSTION ENGINES - PISTON RINGS - SCRAPER RINGS
		INTERNAL COMBUSTION ENGINES - PISTON RINGS
J2000	6624/1	Keystone rings
J2001	6624/2 TR	Half keystone rings
J2002	6625	INTERNAL COMBUSTION ENGINES - PISTON RINGS - OIL CONTROL RINGS
J2003	6626	INTERNAL COMBUSTION ENGINES - COIL SPRING LOADED OIL CONTROL RINGS
J2004	6627 TR	INTERNAL COMBUSTION ENGINES - EXPANDER/SEGMENT OIL CONTROL RINGS
	ISO/R 80	ROCKWELL HARDNESS TEST (B AND C SCALES) FOR STEEL

*TR refers to Technical Report

3. MECHANICAL PROPERTIES:

See Table 1.

TABLE 1 – Mechanical Properties

Class	Mechanical properties MPa or N/mm ²		Materials meeting the required mechanical properties			
	Typical modulus of elasticity	Minimum bending strength	Type of material	Minimum hardness	Specific details	Subclass
10	90 000 100 000	300	Grey cast iron	93 HRB	Non-heat-treated	11
		350		95 HRB		12
20	115 000 130 000	450	Grey cast iron	23 HRC	Heat-treated	21
		450		28 HRC		22
		450		40 HRC		23
		500		32 HRC		24
		650		37 HRC		25
30	145 000	550	Carbide cast iron	25 HRC	Heat-treated pearlitic	31
		500		30 HRC	Heat-treated martensitic	32
40	160 000	600	Malleable cast iron	95 HRB	Heat-treated pearlitic	41
		600		22 HRC	Heat-treated martensitic	42
		600		30 HRC	Heat-treated martensitic	43
		1 000		27 HRC	Heat-treated carbide	44
50	160 000	1 100	Spheroidal graphite cast iron	23 HRC	Heat-treated martensitic	51
		1 200		23 HRC	Heat-treated martensitic	52
		1 300		28 HRC	Heat-treated martensitic	53
		1 300		95 HRB	Pearlitic	54
		--		97 HRB	Ferritic	55
60	200 000	--	Steel	38 HRC	CrMoV – alloyed	61
				40 HRC	CrSi – alloyed	62
				48 HRC	CrSi – alloyed	63

NOTE: The hardness values are averages from three measurements on one ring, one being at the gap and one each 90 and 180 deg around from the gap. HRB and HRC hardness testing is in accordance with ISO/R 80.

The application of the hardness measuring methods HRB and HRC is restricted, due to the geometry and the material of piston rings. The hardness values stated are used only for grouping the materials into the individual subclasses. Other hardness measuring methods and their equivalent values shall be agreed upon between customer and manufacturer.

APPENDIX A

- A.1 This document has been established to harmonize the ISO and SAE piston ring documents. The U.S. Technical Advisory Group, with the support of the National Engine Parts Manufacturers Association, has worked with other national organizations on this worldwide document. Some of the wording and phrasing may differ slightly from U.S. terminology for translation purposes.

In preparing this SAE document, the Scope and Field of Application, and Reference sections of the ISO 6621/3 have been editorially revised and reorganized.

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RATIONALE:

Not applicable.

RELATIONSHIP OF SAE STANDARD TO ISO STANDARD:

This document is equivalent to ISO Standard 6621/3.

REFERENCE SECTION:

SAE J1588, Internal Combustion Engines - Piston Rings - Vocabulary
SAE J1589, Internal Combustion Engines - Piston Rings - Measuring Principles
SAE J1590, Internal Combustion Engines - Piston Rings - Material Specifications
SAE J1591, Internal Combustion Engines - Piston Rings - General Specifications
SAE J1996, Internal Combustion Engines - Piston Rings - Quality Requirements
SAE J1997, Internal Combustion Engines - Piston Rings - Rectangular Rings
SAE J1998, Internal Combustion Engines - Piston Rings - Rectangular Rings with Narrow Ring Width
SAE J1999, Internal Combustion Engines - Piston Rings - Scraper Rings
SAE J2000, Internal Combustion Engines - Piston Rings - Keystone Rings
SAE J2001, Internal Combustion Engines - Piston Rings - Half Keystone Rings
SAE J2002, Internal Combustion Engines - Piston Rings - Oil Control Rings
SAE J2003, Internal Combustion Engines - Piston Rings - Coil Spring Loaded Oil Control Rings
SAE J2004, Internal Combustion Engines - Piston Rings - Expander/Segment Oil Control Rings
ISO 6621/1
ISO 6621/2
ISO 6621/3
ISO 6621/4
ISO 6621/5
ISO 6622/1
ISO 6622/2
ISO 6623
ISO 6624/1

REFERENCE SECTION (Continued):

ISO 6624/2

ISO 6625

ISO 6626

ISO 6627

ISO/R 80

APPLICATION:

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