

PAS 777:2013

Specification for the qualification and labelling of used automotive engines and any related transmission units

authenticity 信頼性 autenticidade
condition 状態 condição
provenance 起源 proveniência
traceability 追跡可能性 traçabilidade



Sun Partners Co.,Ltd

KAIHO SANGYO Co., Ltd.



会宝産業株式会社



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Foreword

This Publicly Available Specification (PAS) was sponsored by Kaiho Sangyo Company Limited and Sun Partners Company Limited, of Japan. Its development was facilitated by BSI Standards Limited. It came into effect in October 2013.

The overall purpose of this document is to provide a specification for the qualification and labelling of used automotive engines and any related transmission units, using a robust, auditable procedure that can be applied in any part of the world.

Acknowledgement is given to the following organizations involved in the development of this PAS through nomination of members of the steering group:

- Autoparts Ijichi Co. Ltd, Japan
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- Salvage Wire Ltd, UK
- Thatcham Research, UK

Acknowledgement is also given to the members of a wider Expert Review Panel who were consulted in the development of this PAS.

The British Standards Institution retains ownership and copyright of this PAS.

This PAS will be reviewed at intervals not exceeding two years, and any amendments arising from the review will be published in an amended PAS and publicized in *Update Standards*.

The PAS process enables a specification to be rapidly developed in order to fulfil an immediate need in industry. A PAS may be considered for further development as a British Standard, or constitute part of the UK input into the development of a European or International Standard.

This PAS is not to be regarded as a British Standard. It will be withdrawn upon publication of its contents in, or as, a British Standard.

Use of this document

It has been assumed in the preparation of this PAS that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

This document should not be used to support a statement of engine quality.

NOTE See introduction, Page iii.

Contractual and legal considerations

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Introduction

Background

As the global community attempts to ensure the sustainability of 21st century civilization, whilst at the same time reversing the degradation of the environment that has been an unintended impact of that civilization, it is inevitable that consideration will be given to the increased reuse of the products and artefacts that have been the primary drivers of modern life.

Increased reuse of these items is expected to not only reduce the negative impact on the environment caused by overconsumption of resources and subsequent product disposal, but also have positive impact on both the economy and the environment through savings in energy consumption, materials and other production costs.

Prominent amongst such products is the automotive vehicle engine and transmission unit, and here for a variety of reasons, there is growing interest in extending the useful life of complete engines and related transmission units through 'reuse' rather than through the recycling of components and materials.

For reuse to be a credible and accepted option, it is necessary that the individual or organization considering such reuse should be in possession of sufficient, reliable information about the ownership, use history and current condition of the engine and any related transmission units to enable decision to be made as to whether viable, on-going functionality can be expected.

PAS objectives

This PAS sets out a process for the collation, recording and presentation of relevant engine and related transmission unit data that can be validated to provide provenance for used automotive engines and any related transmission units. The information to be provided is considered essential to a sound understanding of the potential life and performance of the engine and related transmission unit, and the methods specified for gathering and presenting that information are robust, repeatable and transparent.

The PAS therefore focuses on the quality of the information to be provided with the engine and transmission unit, and establishes conditions that need to be fulfilled for a used engine and related transmission unit to be placed on the market with provenance. An engine and related transmission unit that is the subject of an information set that fulfils the specified conditions of this PAS can therefore be considered as qualified in accordance with PAS 777.

Use of the specified process will enable reliable demonstration of the accuracy and validity of the collated data in a manner that can be independently verified when required.

The Qualification Characteristics Matrix Outcome (QCMO) provided in PAS 777 is an attempt to provide for some uniformity and traceability in what is in fact a judgement as to the general condition of the engine at the time of qualification.

Some of the QCMO characteristics are therefore quality related but in the PAS 777 context are not to be considered quality specific.

PAS development and future

The development of PAS 777 was facilitated by British Standards through application of a well established and accepted consensus based process based on the process used in much of the world's standards development activity. BSI has also used internationally accepted standards drafting principles in its presentation.

Based on initial technical information provided by Japanese company Kaiho Sangyo and further developed by a group of international industry experts (see *Foreword*) the draft PAS was submitted to scrutiny by a panel of invited experts as well as made available for public comment, before being finalized for publication.

This process has therefore created a *specification for the qualification and labelling of used automotive engines and any related transmission units* that can help to establish confidence in the international trading of used automotive engines and related transmission by ensuring that the provenance provided with each engine and transmission is sufficient and reliable.

PAS 777 does not provide a method for specifying the quality of any particular used engine or any related transmission unit. It does however provide for information to be made available with each engine and any related transmission unit that will permit judgements as to potential engine and transmission value, to be reliably made.

It is envisaged that given its international background and the methods employed for its development and presentation, PAS 777 will be suitable for submission for consideration as a potential future ISO Standard, should such progression be thought beneficial.

1 Scope

This PAS specifies the procedure to be followed in establishing the nature and provenance of essential information to be provided when a used automotive engine and any related transmission unit is to be offered for reuse and establishes rules for the presentation of that information in a consistent and auditable manner.

This procedure identifies the content and nature of information commonly accepted as adequately describing the condition of used automotive engines and supporting the provenance of any related transmissions, setting out the set of predetermined characteristics necessary for their effective labelling.

This PAS only provides for the qualification and labelling of engines and the provenance of any related transmissions submitted for qualification in vehicle. This PAS should not be used to support a statement of engine quality.

This PAS has been developed on the basis of internationally sourced expertise to provide a system for the labelling of used automotive engines and any related transmission units that can be uniformly adopted world-wide.

This PAS does not include provision for making value judgements as to the quality of particular automotive engines or transmission units.

2 Normative cross references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN ISO/IEC 17021 Conformity assessment - Requirements for bodies providing audit and certification of management systems

3 Terms and definitions

For the purposes of this PAS, the following terms and definitions apply:

3.1 used automotive engine

power unit that has been started in a car, van, bus or truck, or in agricultural and heavy industrial plant

NOTE Aero engines and engines for water-borne vessels and two-wheeled vehicles are excluded.

3.2 labelling

attachment (to a used automotive engine) of the qualification information specified in this PAS

NOTE labelling may be undertaken through the physical fixing of all or part of the specified information to the automotive engine, by the provision of a reference code or bar code that will enable the specified information to be accessed, or by a combination of the two.

3.3 provenance

information supporting statements in respect of the origin and identification of a qualified used engine and any related transmissions

3.4 qualification

process of collating and validating the information required by this PAS to support the labelling of used automotive engines and any related transmission, in accordance with its requirements

3.5 qualification characteristics matrix (QCM)

matrix recording used engine characteristics against six criteria specified in this PAS

3.6 qualification characteristics matrix outcome (QCMO)

result derived from a characteristics matrix recording the engine characteristics of a used engine qualified in accordance with this PAS

3.7 qualification number

unique reference assigned by the qualifier for the identification of one particular used engine

3.8 qualify

fulfil the necessary conditions to be eligible (for labelling in accordance with this PAS)

3.9 starting response

observed response of a used engine at ignition

3.10 transmission

mechanism by which power from an automotive engine is transmitted to other components e.g. to the axle(s) of an automotive vehicle

3.11 use cycle

period between any two transfers of ownership for a given engine

4 Qualification and labelling requirements

4.1 Establishing the right to transfer ownership of a used engine and any related transmission unit

4.1.1 General principle

A precondition for the qualification procedure to be undertaken is that the entity making the used engine and related transmission unit available for qualification and transfer is able to demonstrate that it has the legal right to transfer their ownership to another party.

4.1.2 Supporting evidence required

The entity undertaking the qualification of a used engine and any related transmission unit shall confirm that the entity submitting them for qualification has the legal right to do so, by sight of the documentation required by the regulatory vehicle registration system applying in the country or region of operation or, where no such registration system exists, by such other means as may satisfy it that ownership of that engine and transmission unit can be legitimately transferred.

Record of the information provided by the documentation or other means used to satisfy this requirement shall be retained as part of the documentation required to support the qualification (see Clause 9).

4.2 Qualification

Qualification shall be demonstrated in accordance with the relevant procedure set out in **Clause 5** of this PAS so as to provide specified information as to the condition of the used automotive engine unit under consideration, on the basis of the specified characteristics, in an auditable manner.

4.3 Labelling

Labelling shall be undertaken in accordance with Clause 6.

5 Requirements for the qualification of used engines and the provenance of any related transmissions

5.1 Qualification precondition

For qualification in accordance with this PAS to be possible, the engine and any related transmission unit submitted for consideration shall be received installed in the vehicle in which it has been used.

5.2 Qualification procedure

5.2.1 Overview

The engine and any related transmission unit under consideration shall be examined in accordance with the step sequence set out in 5.2.2 to 5.2.6.

NOTE Guidance as to the appropriate competence of personnel undertaking qualification, is provided in Annex D.

5.2.2 Allocate a qualification number

Allocate to the used engine and any related transmission under consideration, a unique number derived from the qualifying entity's master record of qualification numbers. This number shall be the primary identifier for the qualification of the particular engine and any related transmission.

5.2.3 Identify the engine and any related transmission under consideration

Identify the used engine and any related transmission under consideration by observing and recording against the qualification number allocated at 5.2.2, the car make, model, chassis/ frame number, engine code and engine number. If the engine number cannot be read or does not match existing, available records for that vehicle, the engine cannot be qualified in accordance with this PAS.

5.2.4 Determine the oil level

Visually inspect the level of oil in the engine sump, recording the findings for inclusion in the labelling.

5.2.5 Determine the Qualification Characteristics Matrix Outcome (QCMO)

- a) Determine and record the information about the used engine under consideration for characteristics 1, 2a) or 2b), 3 and 4 of the matrix provided in Annex A, on the basis of the descriptions provided for each characteristic in 5.3.
- b) Determine and record the information about the used engine under consideration for characteristics 2b) and 5 of the matrix provided in Annex A where these are to be included as additional information on the label. See descriptions provided for these characteristics in 5.3.
- c) Determine the QCMO by reading off the values indicated by the status recorded for each of the included characteristics and their incorporation in the labelling as required by Clause 6.

NOTE See Annex C for an example of a graphical representation of the QCMO.

5.2.6 Determine the physical condition

Visually inspect the used engine and the transmission unit if it is to be included in the qualification. The findings of this inspection shall be included in the labelling.

5.3 Procedure for determination of QCMO values

5.3.1 Distance travelled/runtime

Read off the number of kilometres/ miles/ hours as recorded on the vehicle meter and record in the relevant cell of the QCM provided at Annex A.

5.3.2 Engine testing

All engines conforming to this PAS shall be subject to static run testing or, in the absence of this, a compression test. Where static run testing is not possible, reasons for this shall be recorded.

NOTE At the discretion of the qualifying entity, a compression test (2b) can be undertaken in addition to the static run test (2a) and the outcome included in the labelling.

5.3.2.1 Static run testing

Start the engine and assess the start capability from a combination of, ease of firing, engine noise, observation of smoke from exhaust during starting and the idling state of the engine after starting, and record in the relevant cell of the QCM provided at Annex A.

5.3.2.2 Compression testing

Determine the difference between the actual compression reading of the engine under consideration and the standard value for that engine, measured in accordance with engine manufacturer's instructions or dispersion of relative value of compression between cylinders measured in the same condition multiple times, and record in the relevant cell of the QCM provided at Annex A.

5.3.3 Internal condition

Assess the amount and condition of the engine oil and coolant present in the engine by visual inspection and by examination of the quantity, constituency and colour of residues adhering to the oil filler cap (see example images in Annex B). Record findings in the relevant cell of the QCM provided at Annex A.

5.3.4 External condition

Undertake a visual inspection of the engine under consideration looking for critical or physical engine damage, including oil and/or coolant loss and indication of overheating. Record the findings in the relevant cell of the QCM provided at Annex A.

5.3.5 Corrosion

At the discretion of the qualifying entity the degree of corrosion present on the engine may be assessed (see example images in Annex B) and the findings recorded in the relevant cell of the QCM provided at Annex A, for inclusion in the QCMO for labelling purposes.

6 Requirements for labelling qualified engines and the provenance of any related transmissions

6.1 General labelling requirements

Engines for which qualification in accordance with this PAS is claimed, shall have been removed from the vehicle or other device in which they have been used and have either:

6.1.1 affixed to a readily observable surface, a label presenting all of the information listed in a) through p) of **6.1.2**; or,

6.1.2 affixed to a readily observable surface, a reference number or bar code providing access to the information listed in a) through p).

- a) serial number;
- b) car make;
- c) car model;
- d) manufacturers model code;
- e) date of vehicle registration;
- f) frame/chassis number;
- g) engine number;
- h) engine code
- i) fuel type;
- j) oil level;
- k) Qualification characteristics matrix outcome (QCMO):
 - 1) Distance travelled/ runtime;
 - 2) engine testing 2a) or 2b) (see **5.3.2**);
 - 3) internal condition;
 - 4) external condition;
- l) Optional characteristics:
 - 2b) compression (where provided as additional information);
 - 5) Corrosion.

NOTE The information required at k1 to k4 and l) can also be displayed graphically (see example Annex C).

- m) Physical condition – damage;
- n) Physical condition – missing components;
- o) name and location of qualifying entity;
- p) qualification and labelling date;

NOTE 1 Attention is drawn to the necessity in some countries for emission value or rating to be included in the information provided, particularly where there is such legislative requirement in the country of operation.

NOTE 2 The information provided on a label meeting the requirements of PAS 777, including the characteristics of the QCMO, should be regarded as a validated report of the condition of the engine at the time of qualification. This is intended to assist potential purchasers in reaching a decision as to whether or not a particular engine will be suitable for their purposes and is not of itself a statement of engine quality.

NOTE 3 After qualification and labelling, the engine and any related transmission should be suitably protected against corrosion and physical damage during storage and adequately packaged (with all orifices sealed) commensurate with the mode and distance of the intended transportation method. It may also be necessary that the packaging conforms to the requirements of the freight company and/or country of destination, when transferred for reuse.

6.2 Transmission labelling requirement

Where the transmission is to be included in the qualification, the information required for both labelling methods (**6.1.1** and **6.1.2**) shall include transmission type and the information supporting provenance relating to the engine shall be understood to apply to the transmission. A duplicate of the label affixed to the engine shall be affixed to the transmission.

7 Transfer of ownership

Where the qualifying entity is party to the transference of ownership of a qualified engine and any related transmission, it shall record and retain with the records specified in Clause 9, information as to the date of sale and transfer of ownership and the identities of the transferor and transferee.

8 Requirements for claiming conformance with PAS 777

8.1 General

Qualifiers of engines and any related transmission unit using a procedure for which conformance with this standard is claimed shall do so in hard copy, electronic media or any other medium appropriate for inclusion in the documentation that is provided to the acquirer of the qualified engine and any related transmission unit.

8.2 Basis of claim

8.2.1 General

The claim shall identify the type of conformity assessment undertaken as one of:

- a) certification in accordance with **8.2.2**;
- b) other-party assessment in accordance with **8.2.3**; or
- c) self-assessment in accordance with **8.2.4**.

8.2.2 Certification

The engine and transmission unit qualification and labelling procedure shall be assessed against the requirements of this PAS by an independent third-party certification body that is able to demonstrate its compliance with BS EN ISO/IEC 17021.

8.2.3 Other-party assessment

The engine and transmission unit qualification and labelling procedure shall be assessed against the requirements of this PAS by a party other than the assessor, using a method of assessment that has been structured to conform to the relevant sections of BS EN ISO/IEC 17021.

8.2.4 Self-assessment

In undertaking self-assessment, the engine and transmission unit qualifier shall be able to demonstrate how the qualification and labelling procedures used, meet the requirements of this PAS and make available supporting documentation to the acquirer of the qualified and labelled engine and transmission unit.

8.3 Identification of the basis of the claim

All claims of conformity with PAS777 shall include identification of the basis of the claim, using the appropriate form of disclosure, as follows.

- a) For claims of conformity based on certification in accordance with **8.2.2**:
 “Engine qualified and labelled by [include unambiguous identification of the entity undertaking engine qualification] to PAS777, *Specification for the qualification and labelling of used automotive engines and any related transmission units*, [identification of certifying body] certified”.
- b) For claims of conformity based on other-party assessment in accordance with **8.2.3**:
 “Engine qualified and labelled by [include unambiguous identification of the entity undertaking engine qualification] to PAS777, *Specification for the qualification and labelling of used automotive engines and any related transmission units*, [identification of assessment body] declared”.
- c) For claims of conformity based on self-assessment in accordance with **8.2.4**:
 “Engine qualified and labelled by [include unambiguous identification of the entity undertaking engine qualification] to PAS777, *Specification for the qualification and labelling of used automotive engines and any related transmission units*, self-declared”.

NOTE *Additional information provided in association with a qualification in conformance with PAS 777, should not be presented in a manner that could imply that it is part of the qualification.*

9 Requirements for retention of records and documentation

The entity undertaking the qualification and labelling of used engines and any related transmission units by a process for which compliance with this PAS is claimed, shall retain, filed under the allocated qualification number (**5.2.2**), all records supporting the labelling (Clause 6) and including the name of the qualifying operative, for each qualified engine and any related transmission unit, for a period in line with legislative requirements in the country of operation or two years, whichever is the longer. The qualifying entity shall make them available for inspection upon request from a legitimately interested party.

Annex A (normative) Qualification Characteristics Matrix (QCM)

A.1 Use of the characteristics matrix to determine the Qualification Characteristics Matrix Outcome.

The value for each of the characteristics specified in the matrix below shall be recorded against the relevant grade for that characteristic as determined by the qualifier and included in the labelling information as specified in 6.1.2. Annex B provides guidance on the determination of relevant grades for characteristics 3, 4 and 5.

Table A.1 – The Qualification Characteristics Matrix

Criteria	0 point	1 point	2 point	3 point	4 point	5 point	
1 Distance travelled/ runtime	passenger vehicle	over 300,000km	250,001~300,000km	200,001 to 250,000km	150,001 to 200,000	100,001 to 150,000km	under 100,000km
	truck (2ton/3ton)	Over 550,000km	450,000 to 550,000km	350,000 to 449,999km	250,000 to 349,999km	150,000 to 249,999km	under 149,999km
	truck (over 4 tons)	Over 2,000,000km	1,500,000 to 2,000,000km	1,000,000 to 1,499,999km	500,000 to 999,999km	300,000 to 499,999km	under 299,999km
	heavy industrial plant	Over 30,000h	25,001 to 30,000h	20,001 to 25,000h	15,001h to 20,000h	10,001h to 15,000h	Under 10,000h
NOTE to characteristic 1: Distance travelled in km can be replaced by equivalent in miles when appropriate.							

Table A.1 – The Qualification Characteristics Matrix (continued)

Criteria	0 point	1 point	2 point	3 point	4 point	5 point
2 Engine testing	2a) static engine testing	engine does not start and abnormal noise observed	engine does not start but no abnormal noise observed	engine does start but smoke and/or abnormal noise observed	engine does start but disorder in idling (no presence of smoke or abnormal noise)	satisfactory no presence of smoke or abnormal noise
	2b) compression	all cylinders have no compression	dispersion of measured value between 20 to 30%	dispersion of measured value between 10 to 20%	dispersion between 5 to 10%	all cylinder measure within 5% of dispersion
3 Internal Condition (Indication of internal wear)	Absence of engine oil and coolant. Deposit clinging to inside of oil filler cap heavily contaminated (Thick, milky appearance) (See B.1.1)	Engine oil level very low. Thick sludge filling the oil filler cap (See B.1.2).	Coolant level very low. Deposits accumulated on inside of oil filler cap totally obscuring the bottom of the cap (See B.1.3)	Evidence of cross-contamination between engine oil and coolant within the engine. Inside of oil filler cap obscured by deposits. (See B.1.4)	Engine oil and coolant levels to manufacturers specification but some indication of contamination. Slight deposit on inside of oil filler cap but the bottom of the cap can be observed (See B.1.5)	Engine oil and coolant levels to manufacturers specification and no visible indication of contamination. No deposit on inside of oil filler cap (See B.1.6)

Table A.1 – The Qualification Characteristics Matrix (continued)

Criteria	0 point	1 point	2 point	3 point	4 point	5 point
4 External condition (including indication that engine has overheated)	Damage to/ distortion of, engine block, engine does not function and significant displacement or loss of engine oil and/ or coolant. e.g: Engine block not sealed and evidence of widely dispersed cooling water can be observed (See B.2.1)	Engine function impaired and clear evidence of displacement or loss of engine oil and/ or coolant. e.g: Engine block not sealed and evidence of widely dispersed cooling water can be observed (See B.2.2)	Engine functional but evidence of displacement or loss of engine oil and/ or coolant and damage to ancillary parts e.g: Engine block sealed but scattered traces of dispersed cooling water can be observed (See B.2.3)	Engine functional but minor damage to ancillary parts with evidence of poor engine oil and/ or coolant retention. e.g: Engine block sealed but extensive rust deposits observed inside the radiator hose (See B.2.4)	Engine fully functional but evidence of wear commensurate with known use, little or no evidence of engine oil and/ or coolant loss e.g: Engine block sealed but indication of rust observable inside the radiator hose. (See B.2.5)	Engine fully functional and generally in an 'as new' condition. No evidence of engine oil and/ or coolant loss. (See B.2.6)
5 Corrosion	Extreme corrosion (See B.3.1)	100% (See B.3.2)	70% (See B.3.3)	50 to 70% (See B.3.4)	10% to 50% (See B.3.5)	less than 10% (See B.3.6)

NOTES TO TABLE A1

NOTE 1 This Table may be copied for use by qualifiers in their application of PAS 777:2013.

NOTE 2 The information provided in a QCMO and used in connection with engine qualification labelling meeting the requirements of PAS 777, should be regarded as part of a validated report of the condition of the engine at the time of qualification. This is intended to assist potential purchasers in reaching a decision as to whether or not a particular engine will be suitable for their purposes and is not of itself a statement of engine quality.

Annex B (informative)

Example images to assist with determination of engine status in the Qualification Characteristics Matrix (QCM)

B.1 Images relating to criterion 3 – internal condition

B.1.1 Milky condition observed at the bottom of the cap



B.1.2 Thick sludge coating the inside the cap



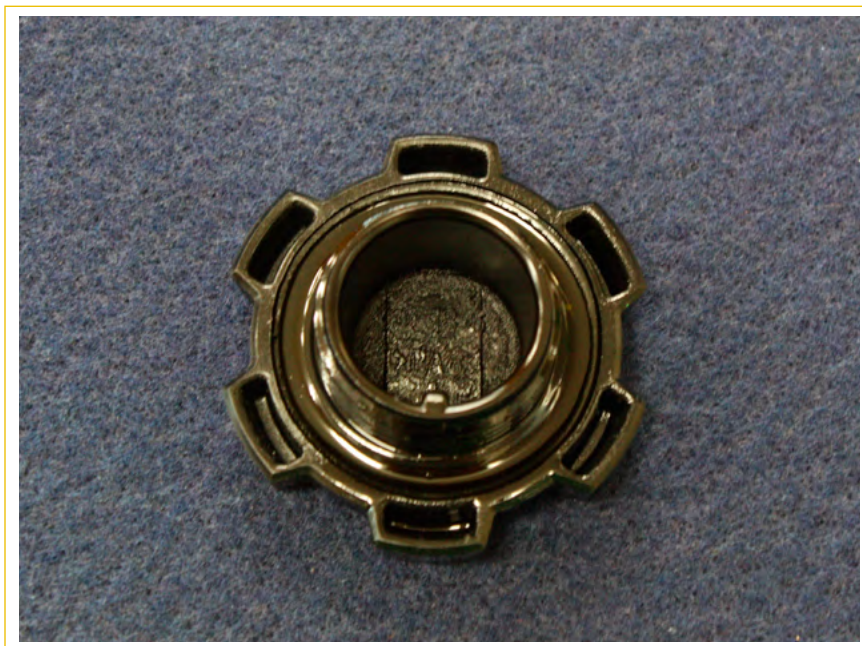
B.1.3 Quantity of sludge reduced by comparison with B.1.2 but the bottom of the cap still not visible



B.1.4 Some sludge present but the bottom of the cap is visible at one or more points



B.1.5 Small quantity of sludge visible but more than half the bottom of the cap can be seen



B.1.6 No sludge

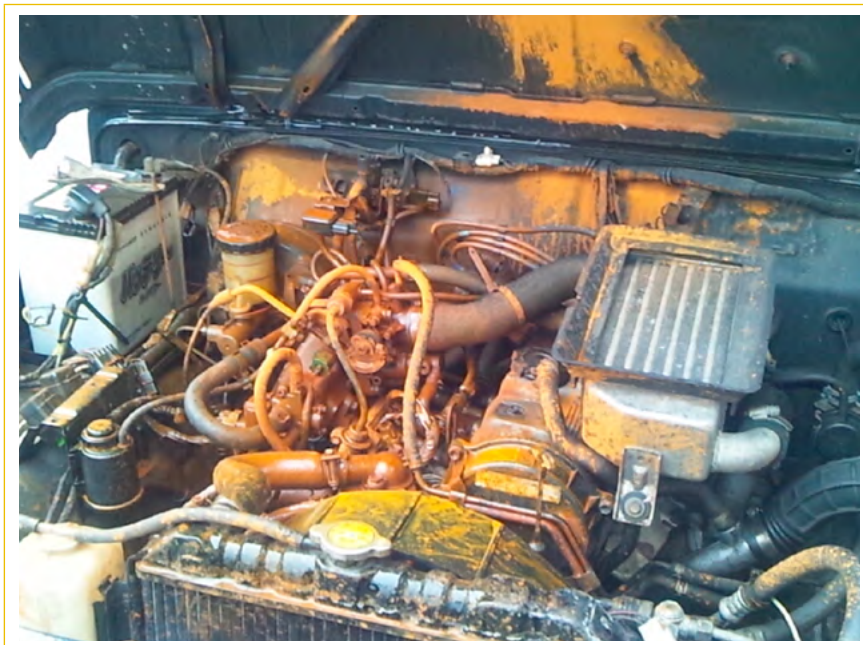


B.2 Images relating to criterion 4 - External condition including evidence of overheating

B.2.1 Engine block not sealed and crank does not turn

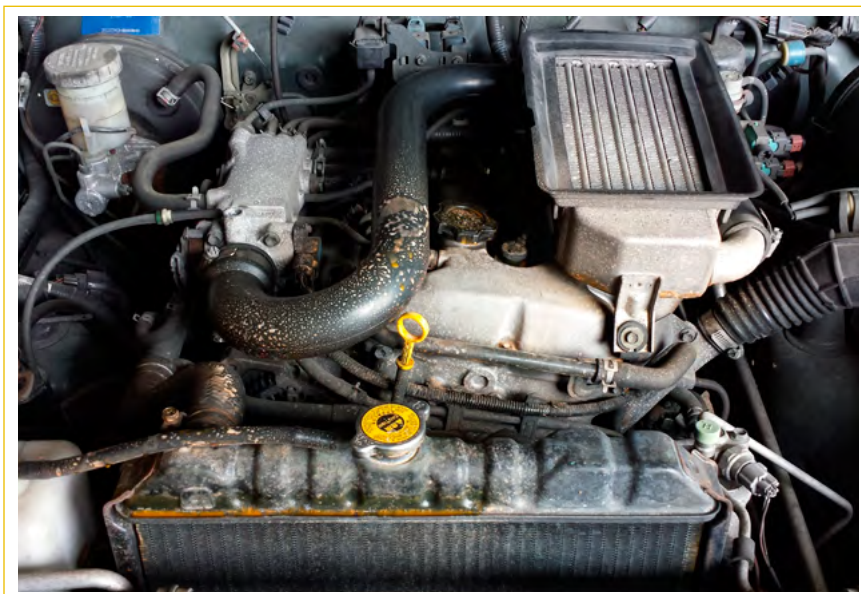


B.2.2 Engine block not sealed and evidence of widely dispersed coolant can be observe



NOTE In B.2.1 and B.2.2 the images are different views of the same engine and condition. The differentiation is determined by whether or not the crank turns (turns, 1 point, does not turn, 0 point).

B.2.3 Engine block sealed but scattered traces of dispersed coolant can be observed



B.2.4 Engine block sealed but extensive rust deposits can be observed inside the radiator hose



B.2.5 Engine block sealed but indication of rust observable inside the radiator hose



B.2.6 Engine block sealed and no discolouration observed inside the radiator hose



B.3 Images relating to criterion 5 – corrosion

B.3.1 Extreme corrosion



Description:
Corroded to an extent that renders the engine unusable.

B.3.2 Examples of external corrosion at 100%



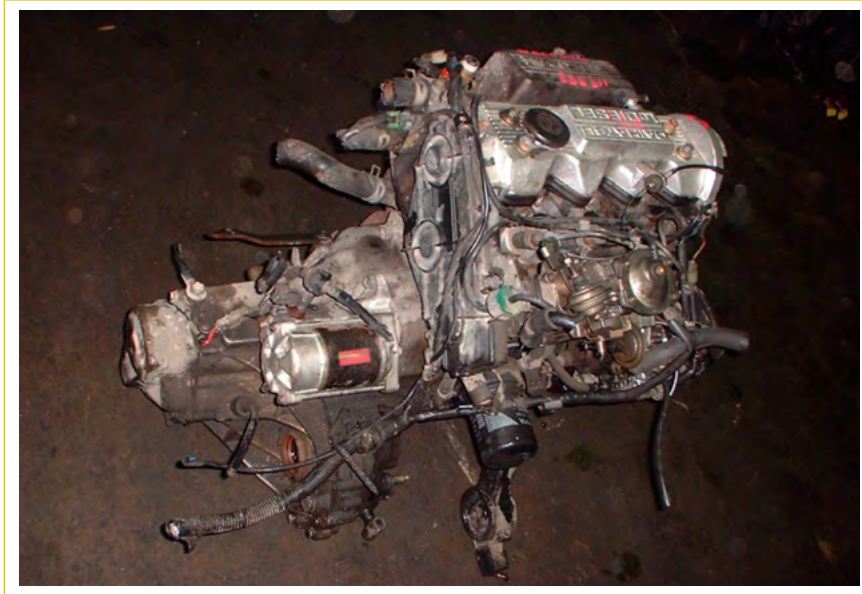
Description:
More or less continuous corrosion can be observed across the entire surface of the engine.

B.3.3 Examples of external corrosion at 70%



Description:
Discreet areas of corrosion observed at various points over the entire engine surface.

B.3.4 Examples of external corrosion at 50 to 70%



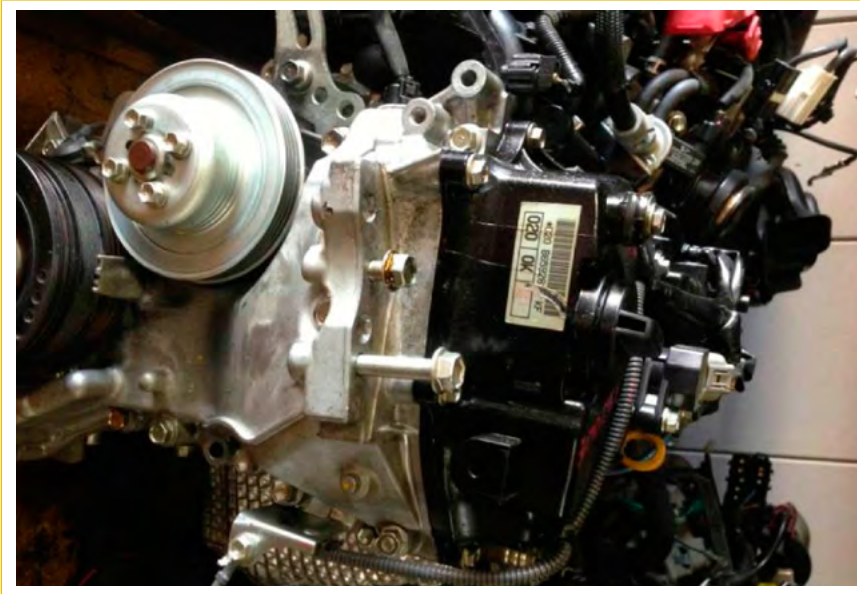
Description:
Patches of corrosion clearly visible on most components, including the engine block.

B.3.5 Examples of external corrosion at 10 to 50%



Description:
Corrosion not visible on the engine block, but can be observed on other components.

B.3.6 Examples of external corrosion at less than 10%



Description:
Minimal corrosion visible on any part of the engine.

Annex C (informative)

Graphic representation of the Qualification Criteria Matrix Outcome (QCMO)

C.1 Example of a graphic representation of a QCMO

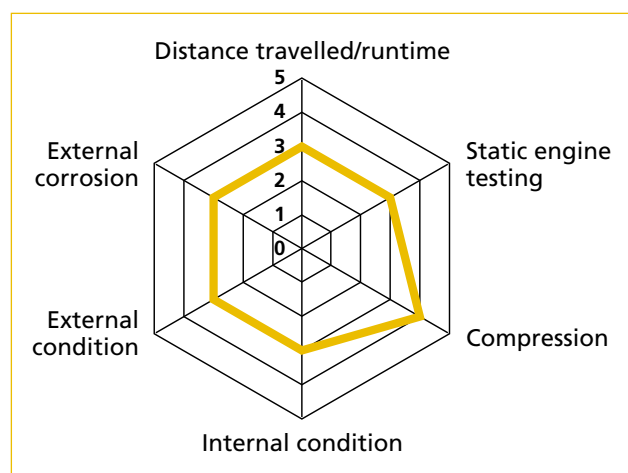
This Annex provides an example of a method for representing the QCMO from individual qualifications in graphic form that can provide, for the experienced eye, a means of comparison between qualified engines.

Table C1 shows four sets of possible values recorded in a QCMO matrix for four sample qualifications. These have each been plotted on a scaled diagram (C1, C2, C3, C4) to provide a graphic representation of the relevant QCMO for the used automotive engine under consideration in each sample.

Table C.1 – QCMO Values for four sample qualifications

Criteria	Sample A	Sample B	Sample C	Sample D
1 distance travelled/ runtime	3	5	4	2
2 static engine testing	3	4	4	4
3 compression	4	4	4	4
4 internal condition	3	3	4	2
5 external condition	3	4	2	4
6 external corrosion	3	3	4	2

Figure C.1 – Graphical representation of the QCMO for Table C1 Sample A



C.2 Further examples of graphic representation of QCMOs

Further examples of the graphic representation of QCMOs, based on the values recorded for samples B, C and D in Table C1, are provided in figures C2; C3 and C4.

Figure C.2 – Graphical representation of the QCMO for Table C1 Sample B

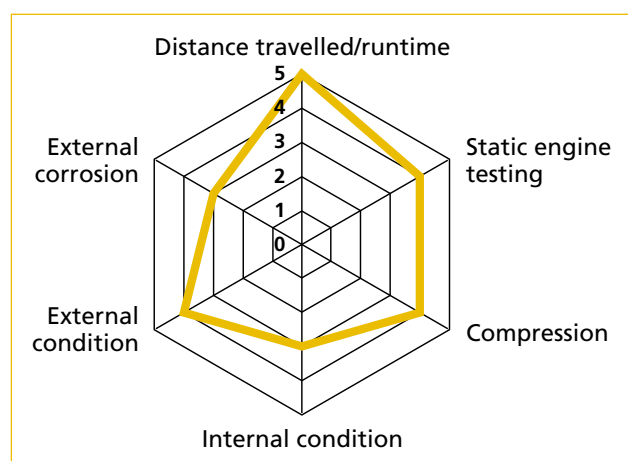


Figure C.3 – Graphical representation of the QCMO for Table C1 Sample C

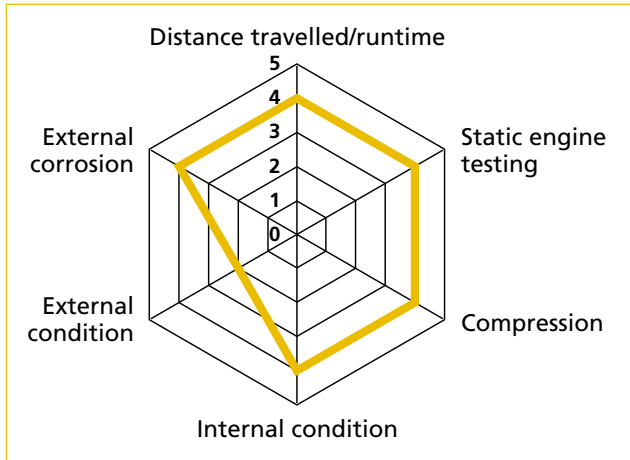
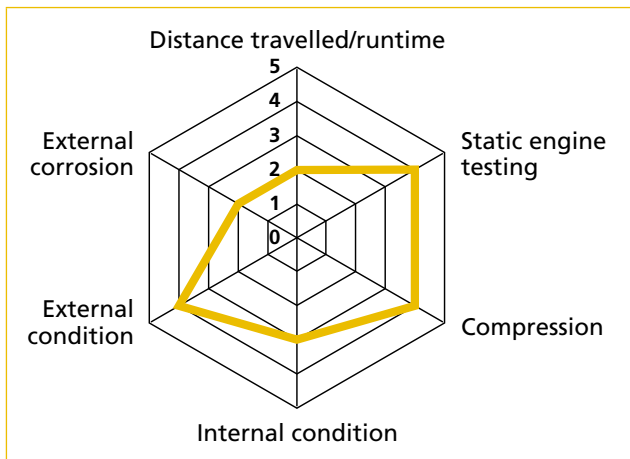


Figure C.4 – Graphical representation of the QCMO for Table C1 Sample D



Annex D (informative) Guidance as to the determination of qualifier competence

D.1 Introduction

This Annex seeks to provide guidance/ recommendation on appropriate knowledge, skills and competence for qualifiers of used automotive engines and any related transmissions.

D.2 Basic requirements

Qualifications to PAS 777 should be conducted by persons who have undertaken relevant training and are able to demonstrate competence in, the areas described in a) through d):

- a) design and construction of automotive engines;
- b) qualification criteria, equipment and methodology (including the records he/she is required to maintain);
- c) law and regulation applying in the country or region of operation relating to automotive engine and recycling of automotive engines;
- d) technological update of automotive engines.

D.3 Ongoing personal development

Qualifiers should receive training annually and the effectiveness of the training should be evaluated and records maintained.

D.4 Qualifier competence records

The entity undertaking the qualification and labelling of used engines by a process for which compliance with this PAS is claimed, should maintain records of the skill, experience, formal qualification and details of all training undertaken for all qualifiers employed, for a period not less than that applying to the documentation retained in support of the labelling specified in Clause 6.

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