TC 61

INTERNATIONAL STANDARD

ISO 1873-1

Third edition
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Plastics — Polypropylene (PP) and propylene-copolymer thermoplastics —

Part 1: Designation

Plastiques — Thermoplastiques à base de polypropylène (PP) et de copolymères de propylène —

Partie 1: Désignation

Reference number
ISO 1873-1:1991(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 1873-1 was prepared by Technical Committee ISO/TC 61, *Plastics*.

This third edition cancels and replaces the second edition (ISO 1873-1:1986), of which it constitutes a technical revision.

ISO 1873 consists of the following parts, under the general title *Plastics — Polypropylene (PP) and propylene-copolymer thermoplastics*:

— *Part 1: Designation*

— *Part 2: Preparation of test specimens and determination of properties*

Annex A forms an integral part of this part of ISO 1873.

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Plastics — Polypropylene (PP) and propylene-copolymer thermoplastics —

Part 1:
Designation

1 Scope

1.1 This part of ISO 1873 establishes a system of designation for propylene (PP) thermoplastic materials, which may be used as the basis for specifications.

1.2 The types of polypropylene plastic are differentiated from each other by a classification system based on appropriate levels of the designatory properties:

a) isotactic index,

b) melt flow rate,

and information about basic polymer parameters, intended application, method of processing, important properties, additives, colour and fillers.

NOTE 1 It is recognised that "isotactic index" may not be a suitable designatory property for all polypropylene and propylene-copolymer materials because of on-going developments. It is intended to review other properties and modify this part of ISO 1873 at the next five-year review.

1.3 This designation system is applicable to all propylene homopolymers and to copolymers of propylene and blends containing at least 50 % (*m*/*m*) of the aforementioned polymers.

It applies to materials ready for normal use in the form of powder, granules or pellets and to materials unmodified and modified by colourants, additives, fillers, etc.

This part of ISO 1873 does not apply to propylene-based rubber.

1.4 It is not intended to imply that materials having the same designation give necessarily the same performance. This part of ISO 1873 does not provide engineering data, performance data or data on processing conditions which may be required to specify a material for a particular application or method of processing.

If such additional properties are required, they shall be determined in accordance with the test methods specified in ISO 1873-2, if suitable.

1.5 In order to specify a thermoplastic material for a particular application or reproducible processing, *additional requirements may be coded in Data* Block 5 (see clause 3).

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 1873. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 1873 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1043-1:1987, *Plastics — Symbols — Part 1: Basic polymers and their special characteristics.*

ISO 1043-2:1988, *Plastics — Symbols — Part 2: Fillers and reinforcing materials.*

ISO 1133:1991, *Plastics — Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics.*

ISO 1873-2:1989, *Plastics — Polypropylene (PP) and propylene-copolymer thermoplastics — Part 2: Preparation of test specimens and determination of properties.*

3 Designation system

The designation system for thermoplastics is based on the standardized pattern given in figure 1.

The designation consists of an optional Description Block, reading Thermoplastics, and an Identity Block comprising the International Standard number and an Individual Item Block. For unambiguous designation, the Individual Item Block is subdivided into 5 data blocks comprising the following information:

Data Block 1: Identification of the plastic by its symbol PP in accordance with ISO 1043-1, and information about the polymerization process and the composition of the polymer (see 3.1).

Data Block 2: Position 1: Intended application or method of processing (see 3.2).

Positions 2 to 8: Important properties, additives and supplementary information (see 3.2).

Data Block 3: Designatory properties (see 3.3).

Data Block 4: Fillers or reinforcing materials and the nominal content thereof (see 3.4).

Data Block 5: Any additional information required for specification purposes.

The first character of the Individual Item Block shall be a hyphen.

The five data blocks shall be separated from each other by commas.

If a data block is not used, this shall be indicated by doubling the separation sign, i.e. by two commas (,,).

3.1 Data Block 1

In this data block, after a hyphen, the plastic is identified by the symbol PP in accordance with ISO 1043-1, followed by a hyphen and a single code-letter giving additional information about the polymer as specified in table 1.

Designation						
Description Block (optional)	Identity Block					
	International Standard Block	Individual Item Block				
		Data Block 1	Data Block 2	Data Block 3	Data Block 4	Data Block 5

Figure 1 — Data block designation system

Table 1 — Code-letters used for polymer composition in Data Block 1

Code-letter	Definition
H	Propylene homopolymer
B	Thermoplastic propylene "block" copolymer having, copolymerized with propylene, not more than 50 % (*m*/*m*) of another olefinic monomer (or monomers) having no functional group other than the olefinic group
R	Thermoplastic propylene random copolymer having, copolymerized with propylene, not more than 50 % (*m*/*m*) of another olefinic monomer (or monomers) having no functional group other than the olefinic group
Q	Blends of polymers with at least 50 % (*m*/*m*) of propylene plastic H (homopolymer), B ("block" copolymer) and/or R (random copolymer)

3.2 Data Block 2

In this data block, information about the intended application or method of processing is given in position 1 and information about important properties, additives and colour in positions 2 to 8. The code-letters used are specified in table 2.

If information is presented in positions 2 to 8 and no specific information is given in position 1, the letter X shall be inserted in position 1.

3.3 Data Block 3

In this data block, the isotactic index is represented by a two-figure code-number (see 3.3.1) and the range of the melt flow rate by one letter and three figures (see 3.3.2). The two codes are separated from each other by a hyphen.

If a property value falls on or near a range limit, the manufacturer shall state which range will designate the material. If subsequent individual test values lie on, or either side of, the range limit because of manufacturing tolerances, the designation is not affected.

NOTE 2 Not all the combinations of the values of the designatory properties are provided by currently available materials.

3.3.1 Isotactic index

The isotactic index is defined as the percentage by mass of type H, B or R propylene plastics that is not soluble in cold *p*-xylene, as determined under the conditions specified in annex A.

The possible values of the isotactic index are divided into four ranges, each represented by a two-figure code-number, as specified in table 3. They shall always refer to the base polymer.

For type Q propylene plastics (see 3.1), the code-number 00 shall be used.

Table 2 — Code-letters used in Data Block 2

Code-letter	Position 1	Positions 2 to 8
A		Processing stabilized
B	Blow moulding	Antiblocking
C	Calendering	Coloured
D		Powder; dry blend
E	Extrusion of pipes, profiles and sheet	Expandable
F	Extrusion of film and thin sheeting	Special burning characteristics
G	General use	Pellets; granules
H	Coating	Heat-ageing stabilized
K	Cable and wire coating	Metal deactivated
L	Monofilament extrusion	Light and/or weather stabilized
M	Injection moulding	
N		Natural (not coloured)
O		No indication
P		Impact modified
Q	Compression moulding	
R	Rotational moulding	Moulding release agent
S	Powder coating or sintering	Lubricated
T	Tape manufacture	Improved transparency
X	No indication	
Y	Textile yarns	Increased electrical conductivity
Z		Antistatic

3.3.2 Melt flow rate

The melt flow rate (MFR) shall be determined in accordance with ISO 1133 under the test conditions specified in table 4.

The possible values of the MFR are divided into 11 ranges, each represented by a three-figure code-number, as specified in table 5. The test conditions used shall be represented by a single code-letter, as specified in table 4, immediately preceding the MFR range code-number.

3.4 Data Block 4

In this data block, the type of filler or reinforcing material is represented by a single code-letter in position 1 and its physical form by a second letter in position 2 (see table 6 and ISO 1043-2), if requested. Subsequently (without a space), the mass content may be represented by a two-figure code-number in positions 3 and 4, as specified in table 7.

Mixtures of materials or forms may be indicated by combining the relevant codes by the sign "+"; for example a mixture of 25 % (*m*/*m*) glass fibre (GF) and 10 % (*m*/*m*) mineral powder (MD) would be designated GF25+MD10.

Table 3 — Code-numbers used for isotactic index in Data Block 3

Code-number	Range
95	> 90
85	> 80 to 90
75	> 70 to 80
65	> 60 to 70
55	> 50 to 60
45	⩽ 50

Table 4 — Test conditions for determination of melt flow rate

Code-letter	Temperature °C	Nominal "load" kg
M	230	2,16
T	190	5,00

Table 5 — Code-numbers used for melt flow rate in Data Block 3

Code-number	MFR range g/10 min
000	⩽ 0,10
001	> 0,10 to 0,20
003	> 0,20 to 0,40
006	> 0,40 to 0,80
012	> 0,80 to 1,5
022	> 1,5 to 3,0
045	> 3,0 to 6,0
090	> 6,0 to 12
200	> 12 to 25
400	> 25 to 50
700	> 50

Table 6 — Coding system for fillers and reinforcing materials in Data Block 4

Code-letter	Material (Position 1)	Form (Position 2)
B	Boron	Balls; beads; spheres
C	Carbon[1]	
D		Powder
F		Fibre
G	Glass	Ground; ground fibres also
H		Whiskers
K	Chalk ($CaCO_3$)	
L	Cellulose[1]	
M	Mineral[1]; metal[2]	
S	Organic synthetics[1]	Scales; flakes
T	Talcum	
W	Wood[1]	
X	Not specified	Not specified
Z	Others[1]	Others

1) These materials may be defined after position 4 of the data block, for example by chemical symbol or additional codes to be agreed upon.

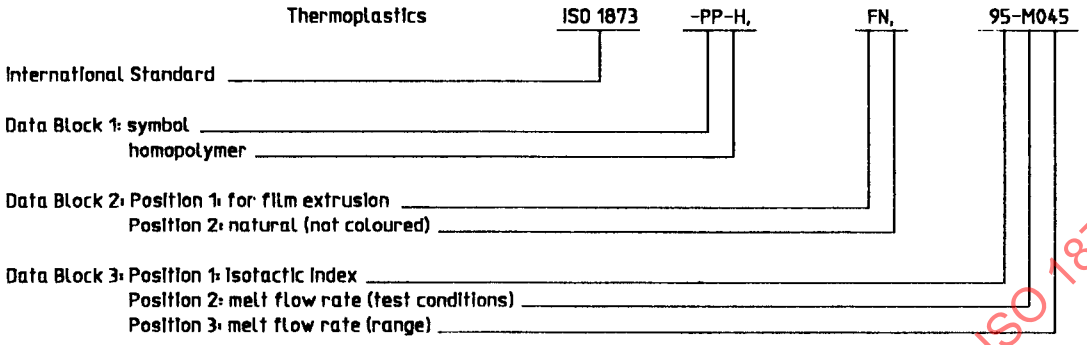
2) Metal filler shall be identified by the chemical symbol (in capital letters) after the mass content, for example steel whiskers may be designated "MH05FE".

Table 7 — Coding system for the mass content in Data Block 4

Code-number	Mass content % (m/m) (Positions 3 and 4)
05	$\leqslant$ 7,5
10	> 7,5 to 12,5
15	> 12,5 to 17,5
20	> 17,5 to 22,5
25	> 22,5 to 27,5
30	> 27,5 to 32,5
35	> 32,5 to 37,5
40	> 37,5 to 42,5
45	> 42,5 to 47,5
50	> 47,5 to 55
60	> 55 to 65
70	> 65 to 75
80	> 75 to 85
90	> 85

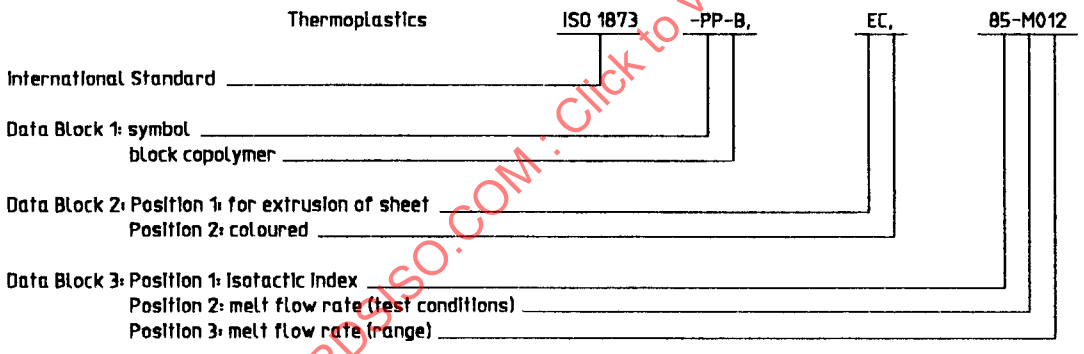
4 Examples of designation

4.1 A propylene homopolymer (PP-H), intended for film extrusion (F), natural (not coloured) (N), having an isotactic index of 94 % (*m/m*) (95) and a melt flow rate (MFR) at 230/2,16 (M) of 3,4 g/10 min (045), would be designated:



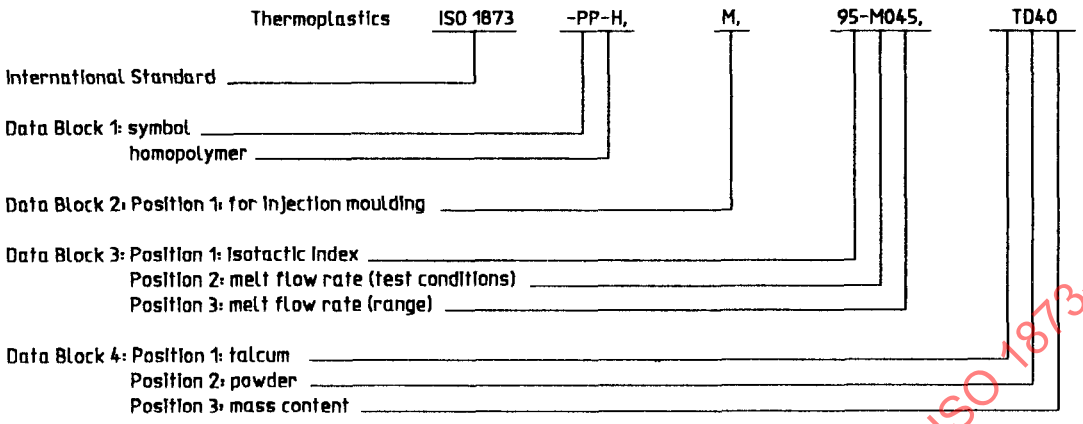
Designation: ISO 1873-PP-H,FN,95-M045

4.2 A block copolymer (B) intended for the extrusion of sheets (E), having an isotactic index of 88 % (*m/m*) (85) and a melt flow rate (MFR) at 230/2,16 (M) of 0,9 g/10 min (012) and without special modification but coloured, would be designated:



Designation: ISO 1873-PP-B,EC,85-M012

4.3 A 40 % (m/m) talc-filled (TD40) homopolymer (H), intended for injection moulding (M), based on a polymer of isotactic index 92 % (m/m) (95) having a melt flow rate (MFR) at 230/2,16 (M) of 3,5 g/10 min (045), would be designated:



Designation: ISO 1873-PP-H,M,95-M045,TD40

Annex A
(normative)

Determination of polypropylene solubility in cold *p*-xylene (isotactic index)

A.1 Scope

This annex specifies a method of test for the identification and designation of polypropylene homo- and copolymers.

A.2 Definitions

For the purposes of this International Standard, the following definitions apply:

A.2.1 solubility in cold *p*-xylene: The proportion of polypropylene that remains in solution after a 1 % solution of polypropylene in *p*-xylene, which is clear at the boiling point, is cooled down to room temperature (23 °C).

A.2.2 isotactic index: The percentage by mass of polypropylene which is not soluble in cold *p*-xylene.

A.3 Apparatus and materials

A.3.1 For preparing the solution.

A.3.1.1 Two-neck ground-glass flask (flat bottom), of capacity 1 litre.

A.3.1.2 Heater-stirrer

A.3.1.3 Reflux condenser

A.3.1.4 Nitrogen inlet tube, designed to maintain a nitrogen blanket at the top of the reflux condenser (see figure A.1).

A.3.1.5 Ground-glass thermometer.

NOTE 3 If a digital temperature measurement device is used, the thermocouple can be inserted down the reflux condenser. In this case, a one-neck ground-glass flask or conical flask is sufficient [see figure A.1 b)].

A.3.2 For cooling the solution.

A.3.2.1 Water bath

A.3.2.2 Chipped ice

A.3.3 For filtering the solution.

A.3.3.1 Funnel

A.3.3.2 Filter paper, 5 µm average pore diameter, for qualitative analysis.

A.3.4 For drying operations.

A.3.4.1 Aluminium dish, of capacity approximately 100 ml.

A.3.4.2 Drying system, e.g. a heating plate, capable of reaching 120 °C, with nitrogen gas inlet.

A.3.5 For measurements.

A.3.5.1 Balance, accurate to 0,1 mg.

A.3.5.2 Graduated cylinder, of capacity 100 ml.

A.3.5.3 Graduated cylinder, of capacity 50 ml.

A.4 Procedure

WARNING — For safety reasons, the entire procedure shall be carried out in a hood.

A.4.1 Pour exactly 100 ml of *p*-xylene[1)] (analytical grade) into the two-neck ground-glass flask (A.3.1.1), fitted with the reflux condenser (A.3.1.3) and the nitrogen inlet tube (A.3.1.4). Weigh, to the nearest 1 mg (mass m_0) approximately 1 g of the polypropylene sample, and add it to the flask containing the *p*-xylene.

A.4.2 Heat the contents of the flask to boiling in 30 min, stirring under a nitrogen blanket. Allow the dissolution to continue at the boiling point for a further 30 min in order to ensure that all the polypropylene has dissolved.

A.4.3 Switch off the heater and stirrer and raise the flask. Allow the solution to stand for about 5 min. Then place the water bath (A.3.2.1) under the flask, lower the flask into the water and stir again vigorously.

1) Isomeric xylene mixtures may be used if the results obtained are the same.

Gradually add chipped ice (A.3.2.2) to the water bath to cool the solution, stirring vigorously at such a rate that the temperature is lowered to 23 °C in about 30 min. When the solution has reached 23 °C, allow it to stand for 3 h at this temperature without stirring. The water bath temperature shall not fall below 18 °C.

A.4.4 Filter the solution at room temperature through a folded filter paper (A.3.3.2) into the 50 ml graduated cylinder (A.3.5.3) until exactly 50 ml of filtrate has been collected.

If the filtration does not proceed quickly enough, the filter paper may be renewed.

A.4.5 Transfer part of the 50 ml of filtrate into the aluminium dish (A.3.4.1), previously weighed to the nearest 0,1 mg, after being dried to constant mass (mass m_1).

A.4.6 Place the weighed dish on the heating plate (A.3.4.2) at 120 °C, under a gentle flow of nitrogen. Add the remaining filtrate in small portions. After 1 h to 2 h, depending on the efficiency of the drying system, constant mass should be achieved (mass m_2).

A.5 Expression of results

A.5.1 Matter soluble in cold *p*-xylene

The amount of matter soluble in cold *p*-xylene, XS, expressed as a percentage by mass, is given by the formula

$$\frac{(m_2 - m_1) \times 100 \times 100}{m_0 \times 50}$$

$$= \frac{200(m_2 - m_1)}{m_0}$$

where

m_0 is the mass, in grams, of the test portion;

m_1 is the mass, in grams, of the empty dish used for the determination;

m_2 is the mass, in grams, of the dish and contents after evaporation of the 250 ml of *p*-xylene solution;

100 is the total volume, in millilitres, of *p*-xylene poured into the flask;

50 is the volume, in millilitres, of filtrate evaporated to dryness during the determination.

A.5.2 Isotactic index

From the definition in A.2.2, the isotactic index, II, is given by the formula

$$100 - XS$$

where XS is as defined in A.5.1.

A.5.3 Repeatability

Duplicate results by the same analyst should not be considered suspect unless they differ by more than 10 % (m/m).

A.6 Test report

The test report shall contain the following information:

a) a reference to this annex;

b) complete identification of the plastic tested;

c) any deviations from the specified procedure;

d) the result of the test, as specified in clause A.5;

e) the date of the test.

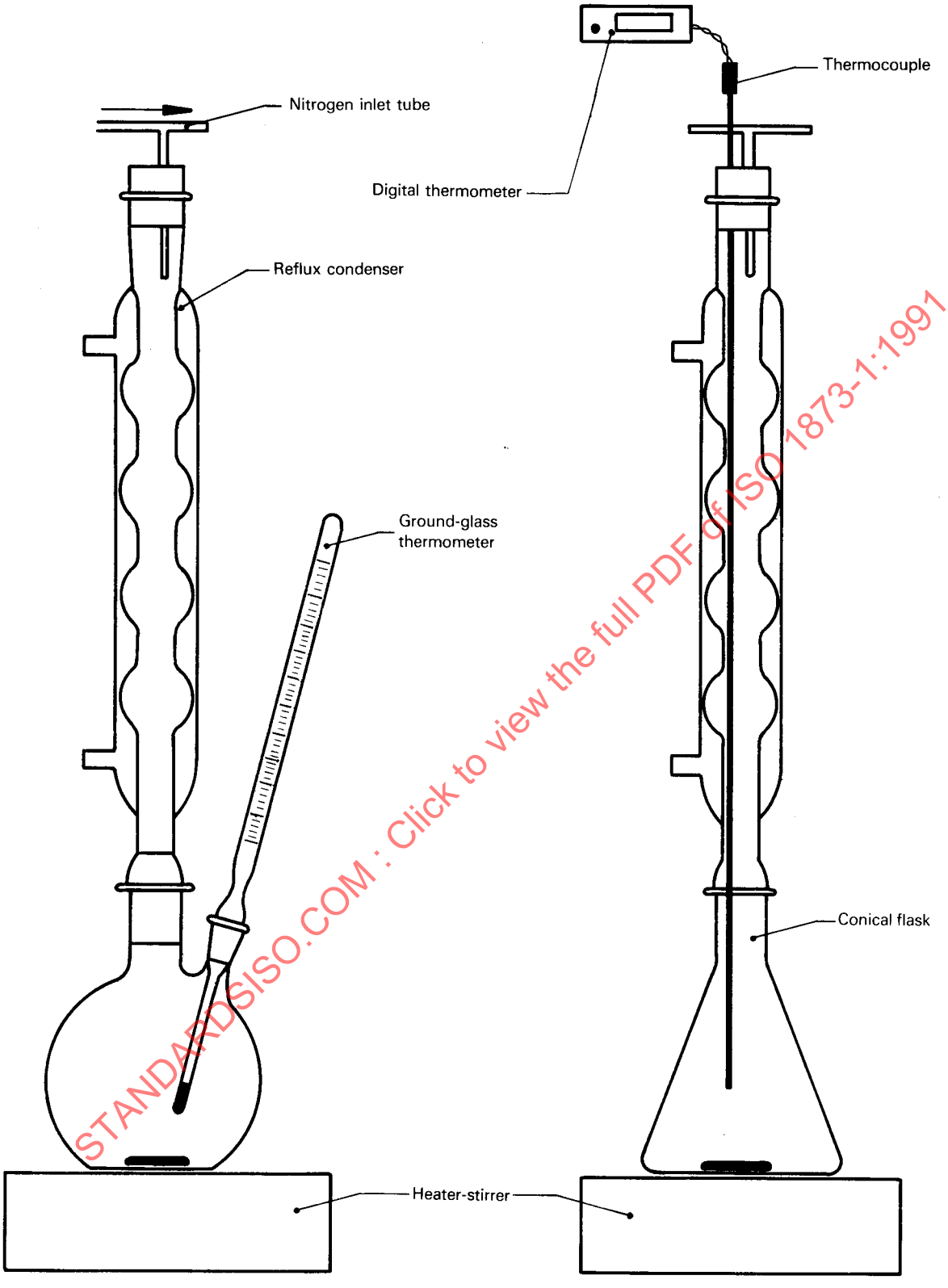


Figure A.1 — Apparatus for preparation of test solution