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Brazing — Fluxes for brazing — Classification and technical delivery conditions

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Foreword

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This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 13, *Brazing materials and processes*.

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Official interpretations of ISO/TC 44 documents, where they exist, are available from this page: https://committee.iso.org/sites/tc44/home/interpretation.html.

Brazing — Fluxes for brazing — Classification and technical delivery conditions

1 Scope

This document specifies the classification of fluxes used for brazing metals and characterizes these fluxes on the basis of their properties and use, and gives technical delivery conditions and health and safety precautions.

This document covers two classes of flux, FH and FL. Class FH is used for the brazing of heavy metals (steels, stainless steels, copper and its alloys, nickel and its alloys, precious metals, molybdenum and tungsten). Class FL is used for the brazing of aluminium and its alloys.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Classification

4.1 General

The form of the fluxes shall be classified according to Table 1 A, B or C. The effective temperature range can be determined according to Annex A.

4.2 Fluxes for brazing heavy metals (Class FH)

4.2.1 General

Class FH covers nine types of flux. The code for each type consists of the class letters FH followed by two digits.

4.2.2 Type FH10

Fluxes with an effective temperature range from about 550 °C up to about 800 °C. They contain boron compounds, simple and complex fluorides and are used at brazing temperatures above 600 °C. These are general purpose fluxes. The residues are usually corrosive and have to be removed by washing or pickling.

4.2.3 Type FH11

Fluxes with an effective temperature range from about 550 °C up to about 800 °C. They contain boron compounds, simple and complex fluorides and chlorides and are used at brazing temperatures above

600 °C. These fluxes are mainly used for brazing nonferrous metal with small amount of Al and Ti or refractory metal oxides, aluminium bronze and aluminium silicon type metals. The residues are usually corrosive and shall be removed by washing and pickling.

4.2.4 Type FH12

Fluxes with an effective temperature range from about 550 °C up to about 850 °C. They contain boron compounds, elemental boron and simple and complex fluorides and are used at brazing temperatures above 600 °C. These fluxes are mainly used for brazing stainless and other alloy steels and hard metals. The residues are usually corrosive and shall be removed by washing and pickling.

4.2.5 Type FH20

Fluxes with an effective temperature range from about 700 °C up to about 1 000 °C. They contain boron compounds and fluorides and are used at brazing temperatures above 750 °C. These are general purpose fluxes. The residues are usually corrosive and shall be removed by washing and pickling.

4.2.6 Type FH21

Fluxes with an effective temperature range from about 750 °C up to about 1 100 °C. They contain boron compounds and are used at brazing temperatures above 800 °C. These are general purpose fluxes. The residues are usually non-corrosive but can be removed mechanically or by pickling.

4.2.7 Type FH22

Fluxes with an effective temperature range from about 700 °C up to about 1 050 °C. They contain boron compounds, elemental boron as well as simple and complex fluorides and are used at brazing temperatures above 750 °C. These fluxes are mainly used for brazing stainless and other alloy steels and hard metals. The residues are usually corrosive and shall be removed by washing and pickling.

4.2.8 Type FH23

Fluxes with an effective temperature range from about 700 °C up to about 1 200 °C. They contain borates and are general purpose fluxes. The residues are boron compounds.

4.2.9 Type FH30

Fluxes with an effective temperature from about 1 000 °C upwards. They generally contain boron compounds, phosphates and silicates and are intended mainly for use with copper and nickel brazing filler metals. The residues are usually non-corrosive but can be removed mechanically or by pickling.

4.2.10 Type FH40

Fluxes with an effective temperature range from about 600 °C up to about 1 000 °C. They generally contain chlorides and fluorides but are boron-free and are intended for applications where the presence of boron is not permitted. The residues are usually corrosive and shall be removed by washing or pickling.

4.3 Fluxes for brazing light metals (Class FL)

4.3.1 General

Class FL covers three types of flux. The code for each type consists of the class letters FL followed by two digits. These fluxes have effective temperatures from about 550 °C upwards.

4.3.2 Type FL10

These fluxes contain hygroscopic chlorides and fluorides, primarily lithium compounds. The residues are corrosive and shall be removed by washing or pickling.

4.3.3 Type FL20

These fluxes contain non-hygroscopic fluorides. The residues are generally non-corrosive and can be left on the workpiece.

4.3.4 Type FL30

These fluxes contain non-hygroscopic fluorides and caesium fluoroaluminates. The residues are generally non-corrosive and can be left on the workpiece. They can be used for aluminium alloys with up to 0,5 weight-% Mg.

An overview of all fluxes is given in Table 1.

Table 1 — Overview of fluxes

Flux type	Flux basis	Effective temperature range[a,b] °C	Filler metal type[d]	Parent materials	Reaction and removal of flux residues	Form
FH10	Boron compounds, simple and complex fluorides	550 to 800	Ag, CuP	Steel, copper, copper alloys, nickel and nickel alloys	Corrosive; washing or pickling	**A** powder **B** paste **C** liquid
FH11	Boron compounds, simple and complex fluorides and chlorides	550 to 800	Ag, CuP	Copper alloys and other base materials containing up to 6 % aluminium and maximum 1 % Ti	Corrosive; washing or pickling	
FH12	Boron compounds, elemental boron, simple and complex fluorides	550 to 850	Ag	Stainless steels, alloyed steels and cemented carbides.	Corrosive; washing or pickling	
FH20	Boron compounds and complex fluorides	700 to 1 000	Ag, Cu, Ni	Steel, copper, copper alloys, nickel and nickel alloys	Corrosive; washing or pickling	
FH21	Boron compounds and boric acid	750 to 1 100	Ag, Cu, Ni	Steel, copper, copper alloys, nickel and nickel alloys	Non-corrosive, mechanically or pickling	
FH22	Boron compounds, elemental boron, simple and complex fluorides	700 to 1 050	Ag, Cu, Ni	Stainless steels, alloyed steels and cemented carbides.	Corrosive; washing or pickling	
FH23	Boron compounds, borates	700 to 1 200	Ag, Cu, CuP	Steel, copper, copper alloys, nickel and nickel alloys	Non-corrosive; washing or pickling	
FH30	Boron compounds, phosphates, silicates	Above 1 000	Cu, Pd, Au	Steel, nickel and nickel alloys, refractory metals	Non-corrosive, mechanically or pickling	
FH40	Chlorides and fluorides	600 to 1 000	Ag, Cu, CuP	Steel, stainless steel, copper, copper alloys, nickel and nickel alloys	Corrosive; washing or pickling	
FL10	Hygroscopic chlorides and fluorides	500 to 630	Al	Aluminium and its brazeable alloys.	Corrosive; washing or pickling	
FL20	Non-hygroscopic fluorides	570 to 660	Al	Aluminium and its brazeable alloys.	Non-corrosive, mechanically or pickling	
FL30	Non-hygroscopic fluorides Caesium fluoroaluminates	450 to 600	Al, Zn	Aluminium alloys containing up to 0,5 % magnesium.	Non-corrosive, mechanically or pickling	

[a] The determination of the effective temperature range is mandatory. The test method can be defined by the manufacturer. For an example, see Annex A.

[b] Flux shall be active in the temperature range. The effective range shall be determined for each product by the manufacturer.

[d] See ISO 17672.

5 Designation

Fluxes supplied in accordance with this document and the flux code detailed in Clause 4.

NOTE However, for each flux code, there are fluxes available commercially which behave significantly differently, e.g. in fluidity, resistance to overheating and out gassing. Therefore, in certain cases, it can be necessary to specify a flux by the trade name as well as the code detailed in Clause 4.

EXAMPLE Designation of a flux paste of class FH, type FH20 in accordance with this document:

Flux ISO 18496 — FH20 B

6 Technical delivery conditions

6.1 Forms of delivery

The following forms of delivery are possible:

a) powder;

b) paste;

c) liquid.

See Annex B for additional possible forms of delivery (seeB.2).

6.2 Packaging and marking

Fluxes and filler metal-flux mixtures supplied in accordance with this document shall be packed in suitable containers resistant to the flux they contain and shall be labelled with:

a) the supplier's name and address;

b) the trade name;

c) the designation in accordance with Clause 5;

d) the batch number;

e) the volume or net weight

f) any hazard warning as applicable.

7 Health and safety precautions

When working with fluxes, refer to the manufacturer safety data sheet (SDS) before use.

NOTE National legislation can exist regarding transportation, storage, use and disposal of fluxes.

Information on fluxes can be summarized in technical data sheets as shown in B.1.

Annex A
(informative)

Determination of the effective temperature range

A.1 General conditions

This annex describes a method to define the effective temperature range for FH fluxes. For FL fluxes, manufacturers shall define their own test method.

Parent material: Plate of material according to Table A.1

Size of parent material: 80 mm × 35 mm × 1 mm

Flux amount: 0,2 g

Size of filler metal: Diameter: 1,5 mm; Length: 10 mm

Table A.1 — Parent material for different flux types

Flux type	Parent material[a]
FH10	carbon steel plate (S235; 1008)
FH11	Cu-Al alloy CW301G
FH12	carbon steel plate (S235; 1008)
FH20	carbon steel plate (S235; 1008)
FH21	carbon steel plate (S235; 1008)
FH22	carbon steel plate (S235; 1008)
FH23	carbon steel plate (S235; 1008)
FH30	carbon steel plate (S235; 1008)
FH40	carbon steel plate (S235; 1008)

[a] S235 according to EN 10025; 1008 according to AISI; CW301G according to EN 1412.

A.2 Lower effective temperature

A.2.1 General

Filler metal: According to Table A.2

Temperature: Starting with the lowest temperature depending on the flux type

Table A.2 — Start temperatures for determining the lower effective temperature depending on the flux type

Temperature °C	Filler metal
520	ZnAg12[a]
550	ZnAg12
580	ZnAg12
610	ZnAg12
630	ZnAg12
660	Ag 156
680	Ag 156
700	Ag 145
730	Ag 140
750	Ag 244
780	Ag 244
800	Ag 225
830	Ag 220

[a] ZnAg12 = B-Zn88Ag-430/520 according to ISO 3677.

A.2.2 Procedure

The flux is to be applied onto the parent material as defined in Table A.1 and the filler metal is to be placed into the flux. This specimen is placed on a steel block inside a furnace with ambient air at desired temperature. The temperature is measured with a thermocouple placed inside the steel block, on which the specimen is placed. After 2 min the specimen is taken out the furnace and evaluated after cooling.

A.2.3 Evaluation

If the brazing filler metal melted and the wetting angle is below 30°, this temperature is to be recorded.

In case of non-melting or wetting angles above 30°, the temperature can be increased to the next testing level.

A.3 Upper effective temperature

A.3.1 General

Filler metal: According to Table A.3

Temperature: Starting with the lowest temperature depending on the flux type