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Flow diagrams for process plants — General rules

Schémas de procédé pour les unités de fabrication/de production — Règles générales

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Contents

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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 10628 was prepared by Technical Committee ISO/TC 10, *Technical drawings, product definition and related documentation*.

Annexes A to D of this International Standard are for information only.

Introduction

The purpose of this International Standard is to provide guidelines for the development of flow diagrams for process plants. Flow diagrams for process plants are used principally in the chemical, petrochemical, petroleum, pharmaceutical, food and beverages, and environmental industries.

They can also be used in other industries, for example the mining and metallurgical industries, where they are used to describe production processes and auxiliary systems.

Depending on the amount of information to be furnished a distinction should be made between a block diagram, a process flow diagram and a piping and instrument diagram (P & ID).

Standardization of diagrams will simplify the preparation and understanding of such diagrams by specialists.

Flow diagrams for process plants — General rules

1 Scope

This International Standard establishes general rules for the preparation of flow diagrams for process plants. These diagrams represent the configuration and function of process plants and form integral parts of the complete technical documentation necessary for planning, mechanical engineering, erecting, managing, commissioning, operating, maintaining and decommissioning of a plant.

Flow diagrams help to simplify the exchange of information between the parties involved in the development, mechanical engineering, erection, operation and maintenance of such process plants.

This International Standard does not apply to electrotechnical diagrams.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard 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 128:1982, *Technical drawings — General principles of presentation.*

ISO 1000:1992, *SI units and recommendations for the use of their multiples and of certain other units.*

ISO 3098-1:1974, *Technical drawings — Lettering — Part 1: Currently used characters.*

ISO 3461-2:1987, *General principles for the creation of graphical symbols — Part 2: Graphical symbols for use in technical product documentation.*

ISO 3511-1:1977, *Process measurement control functions and instrumentation — Symbolic representation — Part 1: Basic requirements.*

ISO 3511-2:1984, *Process measurement control functions and instrumentation — Symbolic representation — Part 2: Extension of basic requirements.*

ISO 3511-4:1985, *Industrial process measurement control functions and instrumentation — Symbolic representation — Part 4: Basic symbols for process computer, interface, and shared display/control functions.*

ISO 4196:1984, *Graphical symbols — Use of arrows.*

ISO 5457:1980, *Technical drawings — Sizes and layout of drawing sheets.*

ISO 7200:1984, *Technical drawings — Title blocks.*

ISO 10209-1:1992, *Technical product documentation — Vocabulary — Part 1: Terms relating to technical drawings: general and types of drawings.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 10209-1 and the following definitions apply.

NOTE — In addition to terms used in the three official ISO languages (English, French and Russian), this part of ISO 10628 gives the equivalent terms in the German, Italian and Spanish languages; these are published under the responsibility of the member body(ies) for Germany (DIN), Italy (UNI) and Spain (AENOR).

However, only the terms given in the official languages can be considered as ISO terms.

3.1 process: Sequence of chemical, physical or biological operations for the conversion, transport or storage of material or energy.

3.2 process step: Part of a process which is predominantly self-sufficient and consists of one or several unit operations.

3.3 unit operation: Simplest operation in a process according to the theory of process technology.

3.4 works: System of industrial complexes and the associated infrastructure in one location.

3.5 industrial complex: Number of discrete or interconnected process plants, together with the associated buildings.

3.6 process plant: Facilities and structures necessary for performing a process.

NOTE — Different processes or process steps can be carried out in the same process plant or plant section (see 3.7) at different times.

3.7 plant section: Part of a process plant that can, at least occasionally, be operated independently.

3.8 equipment: Single parts of a plant, such as vessels, columns, heat exchangers, pumps, compressors.

3.9 flow diagram: Diagram representing the procedure, configuration and function of a process plant or plant section.

NOTE — Depending on the information and presentation, a distinction should be made between the three types of flow diagram for process plants, namely:

— block diagram (see 4.1);
— process flow diagram (see 4.2);
— piping and instrument diagram (P & ID) (see 4.3).

3.10 reference designation: Code for identification of equipment in the functional position of the process.

4 Classification, information content and presentation of flow diagrams

Every kind of flow diagram shall respect the functional requirements.

The graphical presentation shall conform to the rules given in clause 5. The routes and the direction of flow shall be indicated by lines and arrows.

4.1 Block diagram

The block diagram depicts a process or process plant by means of rectangular frames including the relevant inscriptions, interconnected by flow lines (see figures B.1 and B.2 for examples).

The frames may represent:

— processes;
— process steps;
— unit operations;
— process plants or groups of process plants;
— plant sections;
— equipment.

The flow lines may represent streams of materials or energy flows (see figure 1 for an example).

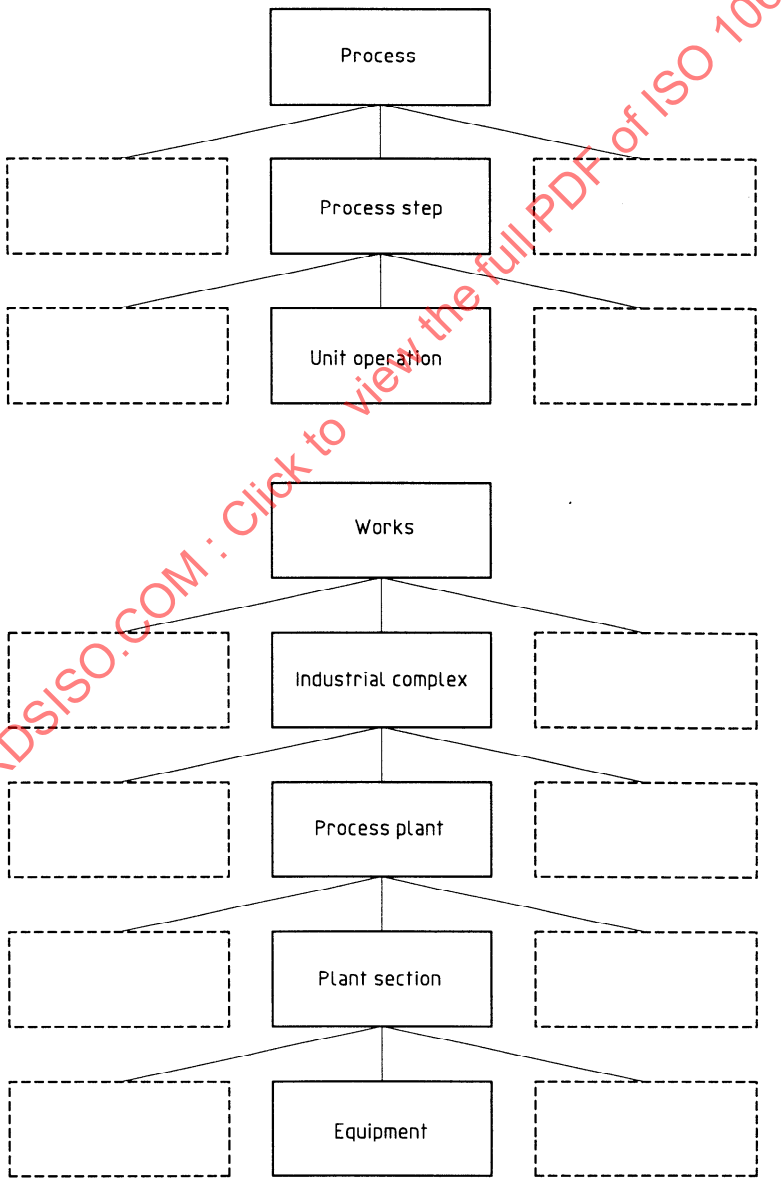


Figure 1

4.1.1 Basic information

The block diagram shall contain at least the following information:

a) denomination of frames;
b) denomination of ingoing and outgoing material flows and energy flows;
c) direction of main flows between frames.

4.1.2 Additional information

The block diagram may also contain:

a) denomination of the main flows between the frames;
b) flow rates of the ingoing and outgoing materials;
c) flow rates of the ingoing and outgoing energy;
d) flow rates of the main flows between the frames;
e) characteristic operating conditions.

4.2 Process flow diagram

The process flow diagram depicts a process or a process plant by means of graphical symbols, interconnected by flow lines (see figures B.3 and B.4 for examples).

The graphical symbols represent equipment and the lines represent flows of mass or energy or energy carriers.

4.2.1 Basic information

The process flow diagram shall use graphical symbols (see annex C for the basic series) and shall at least contain the following information:

a) kind of equipment necessary for the process, except drives;
b) reference designations for equipment, except drives;
c) route and direction of the ingoing and outgoing material and energy flows;
d) denomination and flow rates of ingoing and outgoing materials;
e) denomination of energy flows or flows of energy carriers;
f) characteristic operating conditions.

4.2.2 Additional information

The process flow diagram uses graphical symbols (see annex C for the basic and/or detailed series) and may also contain the following information:

a) denomination of flows and flow rates of process fluids between the process steps;
b) flow rates or amounts of energy or energy carriers;
c) essential valves in the logical process position with respect to their function;
d) functional demands for process measurement and control at essential points;
e) supplementary operating conditions;
f) denomination of equipment and characteristic data of equipment, indicated on the drawing or in separate lists;
g) denomination of drives and characteristic data of drives, indicated on the drawing or in separate lists;
h) elevation of platforms and approximate relative vertical position of equipment.

4.2.3 Representation

Equipment, flow lines and valves should be represented by graphical symbols in accordance with annex C, primarily those from the basic series.

The equipment should be designated in accordance with annex D.

The functional demands for process measurement and control shall be indicated in accordance with ISO 3511-1, ISO 3511-2 and ISO 3511-4.

4.3 Piping and instrument diagram (P & ID)

The piping and instrument diagram (P & ID), based on the process flow diagram, represents the technical realization of a process by means of graphical symbols for equipment and piping together with graphical symbols for process measurement and control functions (see figures B.5 and B.6 for examples).

The utility flow diagram (UFD) is a special type of piping and instrument diagram. It is a schematic representation of the utility systems within a process plant showing all lines and other means required for the transport, distribution and collection of utilities. The process equipment in the UFD can be represented as a box with an inscription (e.g. the identification number) and with utility connections (see figure B.7 for an example).

4.3.1 Basic information

The piping and instrument diagram shall use graphical symbols (see for example annex C for the basic and/or detailed series) and shall contain at least the following information:

a) function or type of equipment, including drives, conveyors as well as installed spares;

b) identification number of equipment, including drives, conveyors as well as installed spares;

c) characteristic data of equipment, given in separate lists if necessary;

d) indication of nominal diameter, pressure rating, material and type of piping, for example by pipeline number, piping class or identification number;

e) details of equipment, piping, valves and fittings, thermal insulation;

f) process measurement and control functions with identification number;

g) characteristic data of drives, given in separate lists if necessary.

4.3.2 Additional information

The piping and instrument diagram may also contain the following information:

a) denomination of flow rates or amounts of energy or energy carriers;

b) route and direction of flow of energy or energy carriers;

c) type of essential primary elements and sensors;

d) essential construction materials for equipment;

e) elevation of platforms and approximate relative vertical position of equipment;

f) reference designation for valves and fittings;

g) denomination of equipment.

4.3.3 Representation

The representation of all equipment, valves and fittings should comply with annex C.

The equipment, valves and fittings should be designated in accordance with annex D.

Auxiliary systems may be represented by rectangular frames with reference to separate diagrams.

The process measurement and control functions shall comply with ISO 3511-1, ISO 3511-2 and ISO 3511-4.

5 Draughting rules

5.1 General draughting rules

The standardized draughting rules shall be used for the representation of flow diagrams for process plants.

5.1.1 Drawing sheet sizes

Drawing sheet sizes conforming to ISO 5457 (sheet type X) shall be used. Considering the various copying techniques available, long sizes and sizes larger than A0 should be avoided.

5.1.2 Title block

The basic title block for drawings and lists (with additional fields) as shown in ISO 7200 shall be used.

5.2 Layout of flow diagrams

Dimensions of the graphical symbols for equipment (except pumps, drives, valves and fittings) should reflect the actual relative dimensions with respect to scale and elevation.

Devices to be expected at the uppermost level of the plant shall appear at the top of the drawing, and those being expected at the lowest level shall appear at the bottom of the drawing.

The graphical symbols for process related measurement and control functions for equipment and piping, as well as piping and valves themselves, shall be shown in the logical position with respect to their functions.

5.3 Connecting lines

5.3.1 Line widths

Line widths will be related to the grid module for flow diagrams M = 2,5 mm.

To obtain a clear representation, different line widths shall be used. Lines representing main flows or main piping shall be highlighted.

The following line widths, chosen from ISO 128, should be used:

a) 1 mm (0,4 M) for main flow lines;

b) 0,5 mm (0,2 M) for
   - graphical symbols for equipment, except valves and fittings and piping accessories,
   - rectangular frames for illustrating unit operations, process equipment, etc.,
   - subsidiary flow lines,
   - energy carrier lines and auxiliary system lines;

c) 0,25 mm (0,1 M) for
   - graphical symbols for valves and fittings and piping accessories,
   - symbols for process measurement and control functions, control and data transmission lines,
   - reference lines,
   - other auxiliary lines.

Line widths less than 0,25 mm (0,1 M) shall not be used.

5.3.2 Line spacing

The space between parallel lines shall not be less than twice the width of the widest line (see ISO 128), with a minimum value of 1 mm.

A space of greater than 10 mm is desirable between flow lines.

5.3.3 Direction of flow

In general, the main direction of flow proceeds from left to right and from top to bottom.

Inlet and outlet arrows conforming to ISO 4196 are used for indicating the inlet and outlet of flows of essential substances.

Arrows are incorporated in the line for indicating the direction of the flows within the flow diagram. If necessary for proper understanding, arrows may be used at the inlets to equipment (except for pumps) and upstream of pipe branches.

If a diagram consists of several sheets, it is recommended that lines representing incoming and outgoing flows and piping be drawn in such a manner that the lines continue at the same level when the individual sheets are horizontally aligned.

5.3.4 Connections

Connections between flow lines or pipelines shall be drawn as shown in figures 2 and 3.

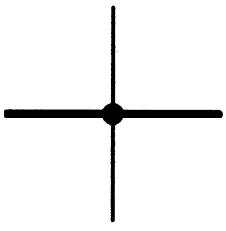


Figure 2

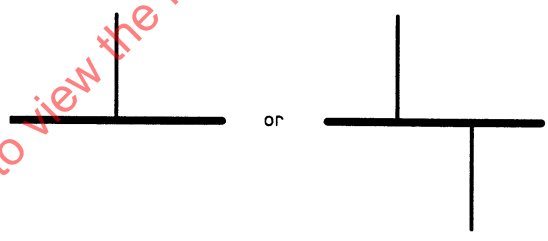


Figure 3

Figures 4 and 5 show two ways of representing flow lines or pipelines, which are not connected.

The style of figure 5 is preferred.

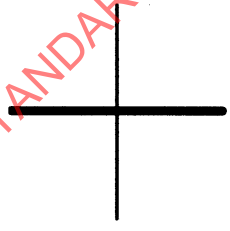


Figure 4

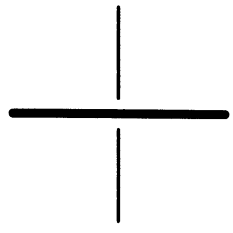


Figure 5

5.3.5 Connections of auxiliary system lines

Auxiliary system lines (e.g. energy carrier lines) shall be shown by dashed lines with indication of the direction of flow and reference to the type of energy carrier and, if possible, the drawing number (see figures B.5 and B.6).

5.4 Inscriptions

5.4.1 Type of lettering

Type B vertical lettering, in accordance with ISO 3098-1:1974, is recommended.

5.4.2 Height of lettering

The height of letters shall be:

a) 5 mm for reference designations of major equipment;

b) 2,5 mm for other inscriptions.

5.4.3 Arrangement of inscriptions

a) Equipment

Reference designations for equipment should be located close to the relevant graphical symbol, but not inside it.

Further details (e.g. designation, nominal capacity, pressure, material) may either be placed under the reference designations or shown in separate tables.

b) Flow lines or piping

Designation of flow lines or piping shall be written above, and parallel to horizontal lines and to the left of, and parallel to, vertical lines.

If the beginning and end of flow lines or piping are not immediately recognizable, corresponding elements should be indicated by identical letters.

c) Valves and fittings

Reference designation of valves and fittings shall be written next to the graphical symbol and parallel to the direction of flow.

d) Process measurement and control functions

The representation shall be in accordance with ISO 3511-1, ISO 3511-2 and ISO 3511-4.

e) Flow rates, operating conditions, thermophysical properties

Flow rates, operating conditions and thermophysical properties shall be entered either in rectangular frames or in a separate table. The frames shall be connected to the reference points by means of reference lines and shall be placed parallel to and above horizontal lines and to the left or right of vertical lines. If the data are shown in tabular form, serial numbers corresponding to the data list shall be written in the frames.

f) SI units in accordance with ISO 1000 shall be used.

Annex A
(informative)

Equivalent terms in other languages

This annex gives the equivalent terms in the French, Russian, German, Italian and Spanish languages for the terms defined in clause 3.

English	French	Russian	German	Italian	Spanish
process	procédé	технологический процесс	Verfahren	processo	proceso
process step	étape de procédé	стадия процесса	Verfahrensabschnitt	fase	etapa de proceso
unit operation	opération de base	основная операция	Grundoperation	operazione di base	operacion basica
works	usine	завод	Werk	stabilimento	fabrica
industrial complex	complexe industriel	производственный комплекс	Anlagenkomplex	complesso industriale	complejo industrial
process plant	unité de fabrication/de production	технологическая установка	verfahrenstechnische Anlage	impianto di produzione	planta de proceso
plant section	section, unité, partie d'installation/atelier	цех, отделение	Teilanlage	reparto	seccion de planta, unidad
equipment	équipement	оборудование	Anlageteil	unità	equipo
flow diagram	schémas de procédé = PCF	схема технологических установок	Fließbild	schema di impianto	diagrama de flujo de plantas de proceso
block diagram	schéma de principe	блок-схема	Grundfließbild	schema a blocchi	diagrama de bloques
process flow diagram	Plan de circulation des fluides (PCF) = schéma de procédé	технологическая схема	Verfahrensfließbild	schema di processo	diagrama de proceso
piping and instrument diagram (P & ID)	plan de tuyauterie et d'instrumentation (TI) ou schéma détaillé	схема трубопроводов и КИП	Rohrleitungs- und Instrumentenfließbild, RI-Fließbild	schema tubazioni e strumenti, schema P & ID	diagrama de tuberias instrumentacion, diagrama T & I (P & ID)

Annex B
(informative)

Examples of flow diagrams for process plants

The figures in this annex illustrate the types of diagram described in this International Standard but their technical content does not form an integral part of this International Standard.

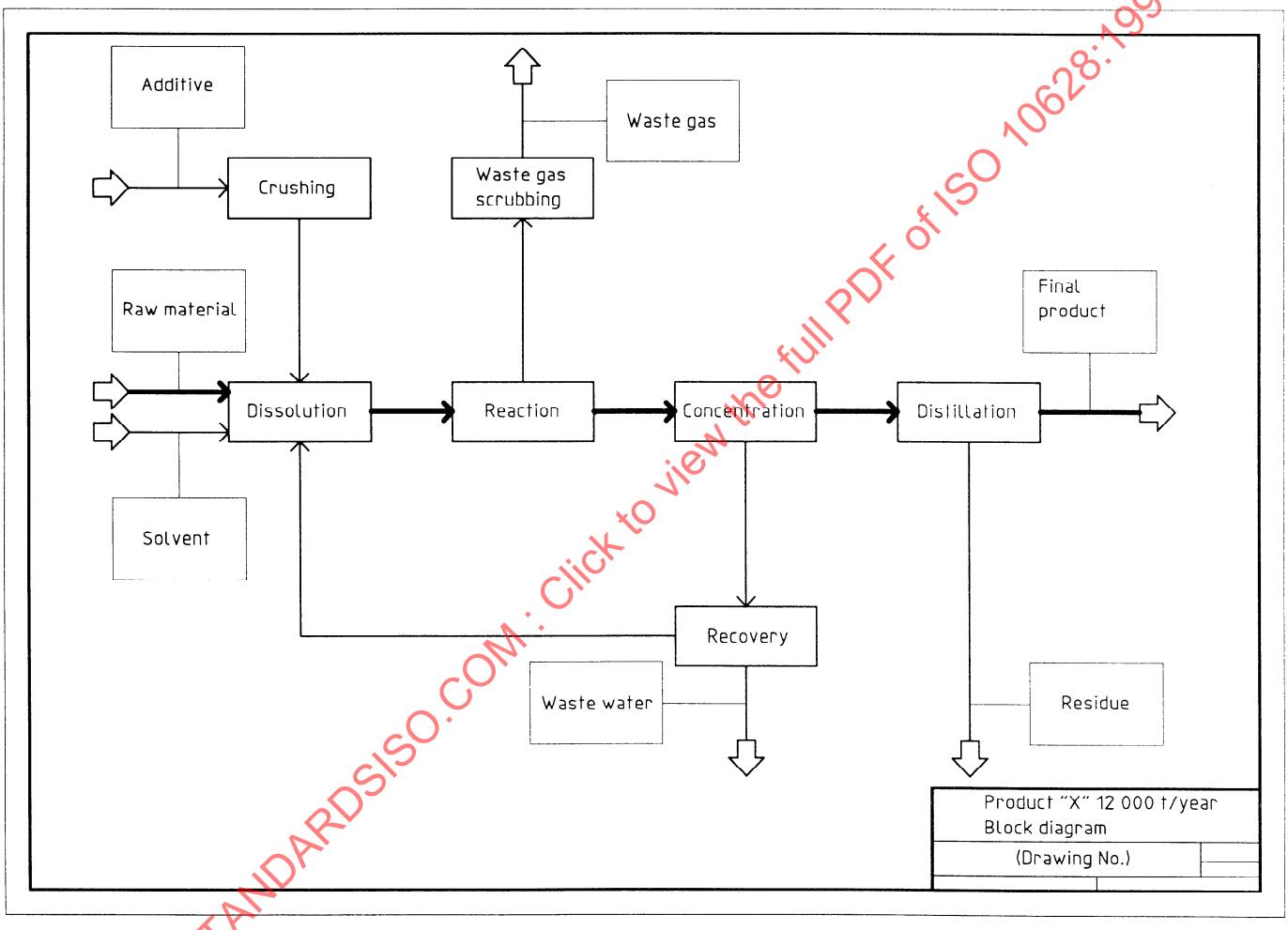


Figure B.1 — Block diagram with basic information

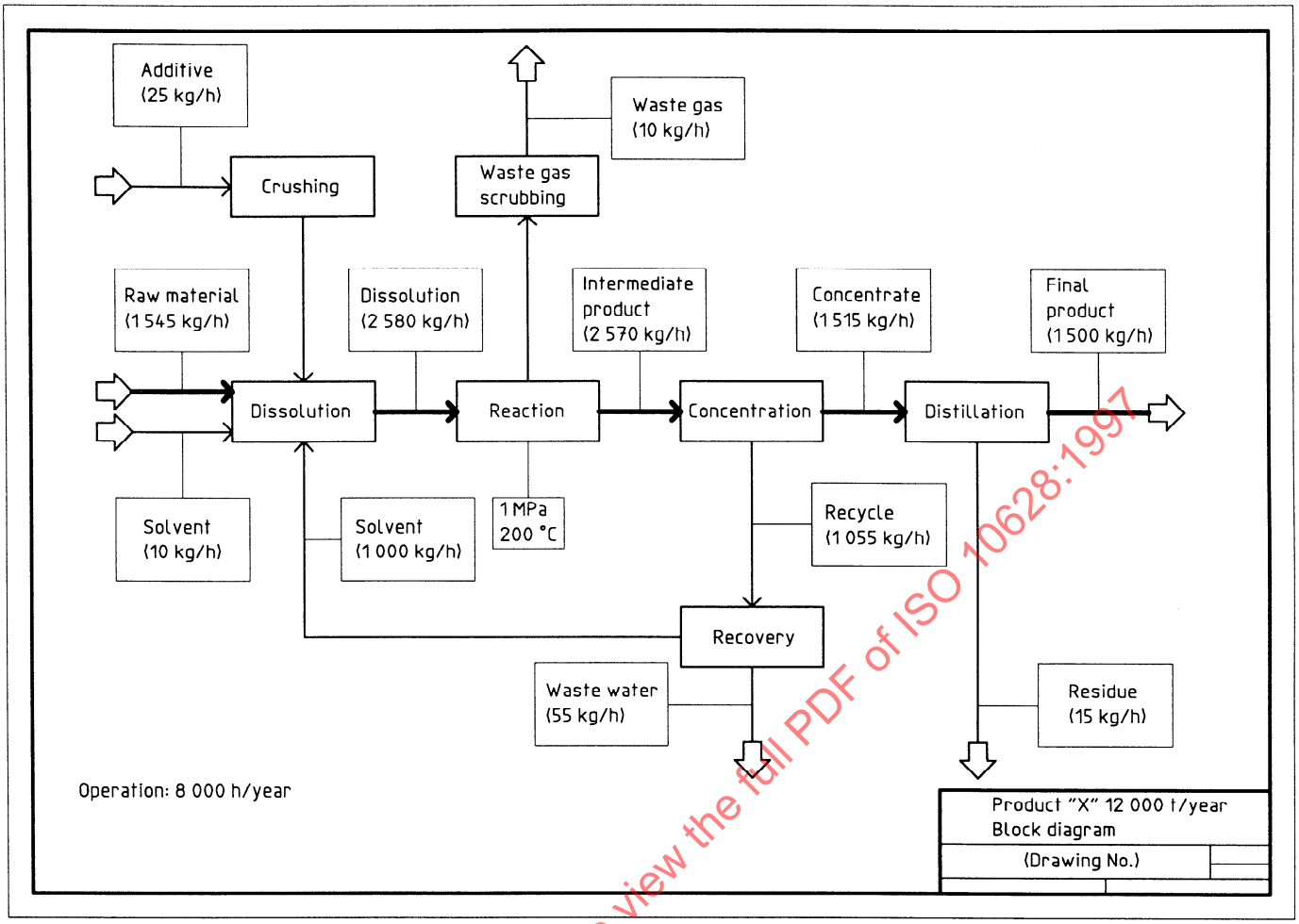


Figure B.2 — Block diagram with basic and additional information

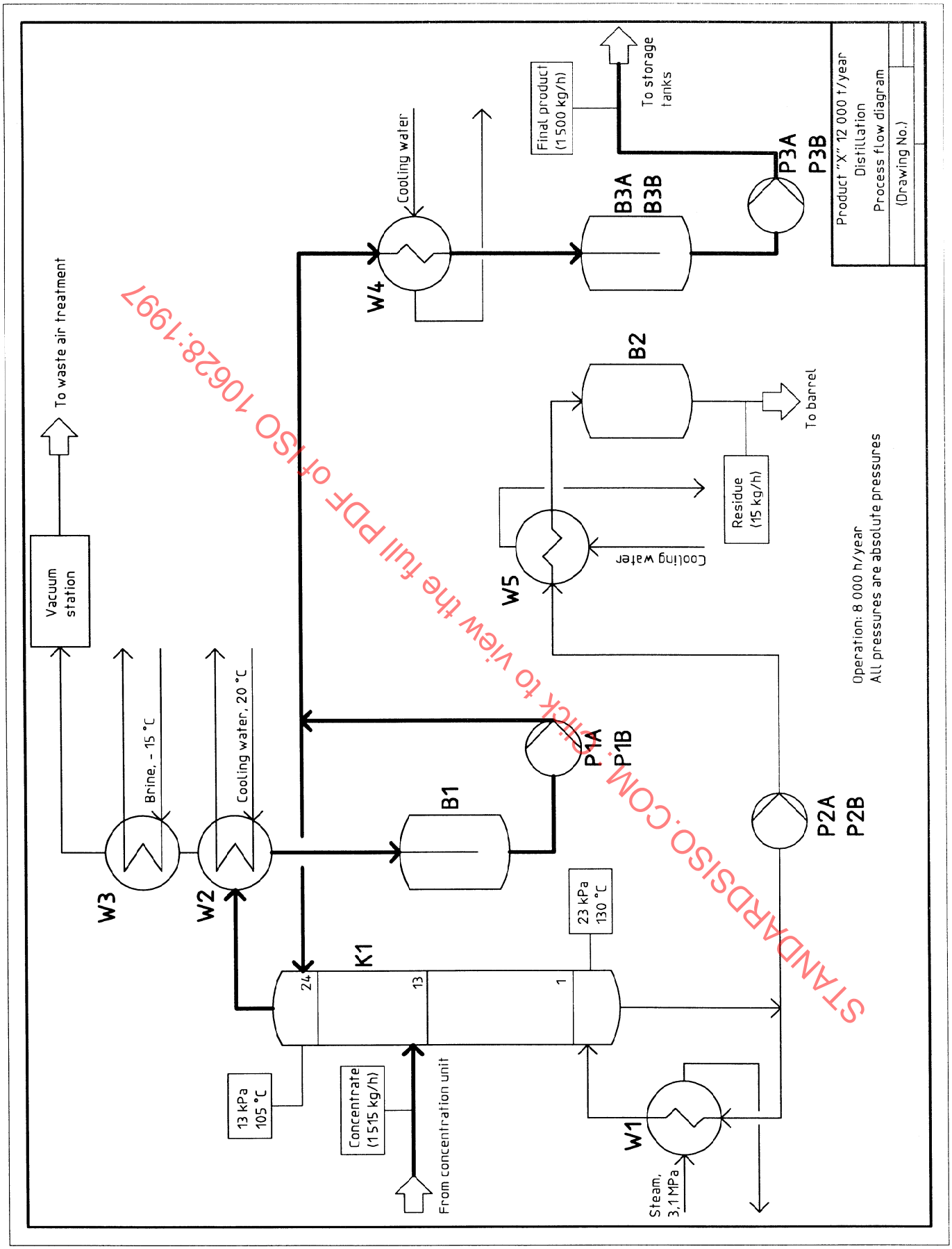
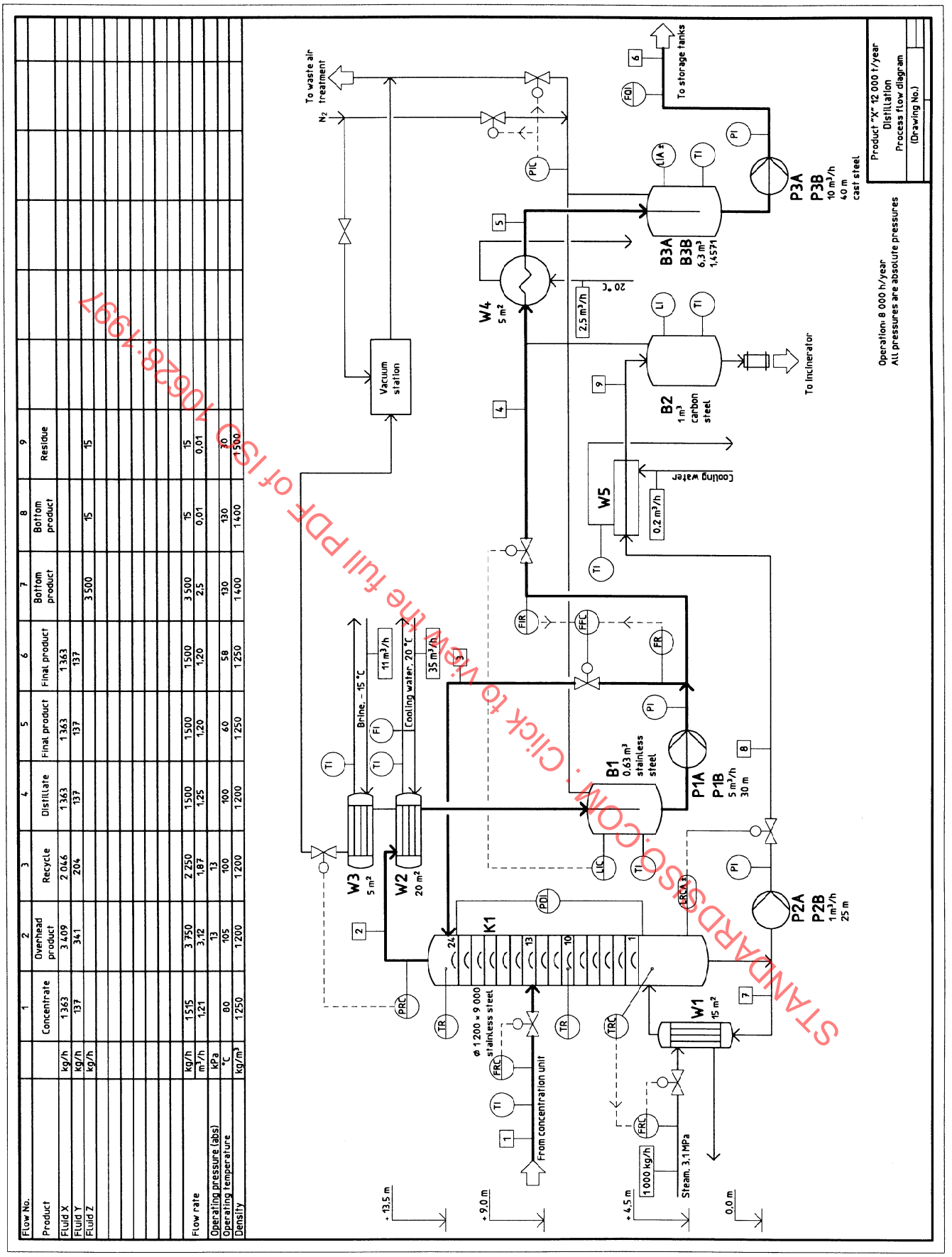
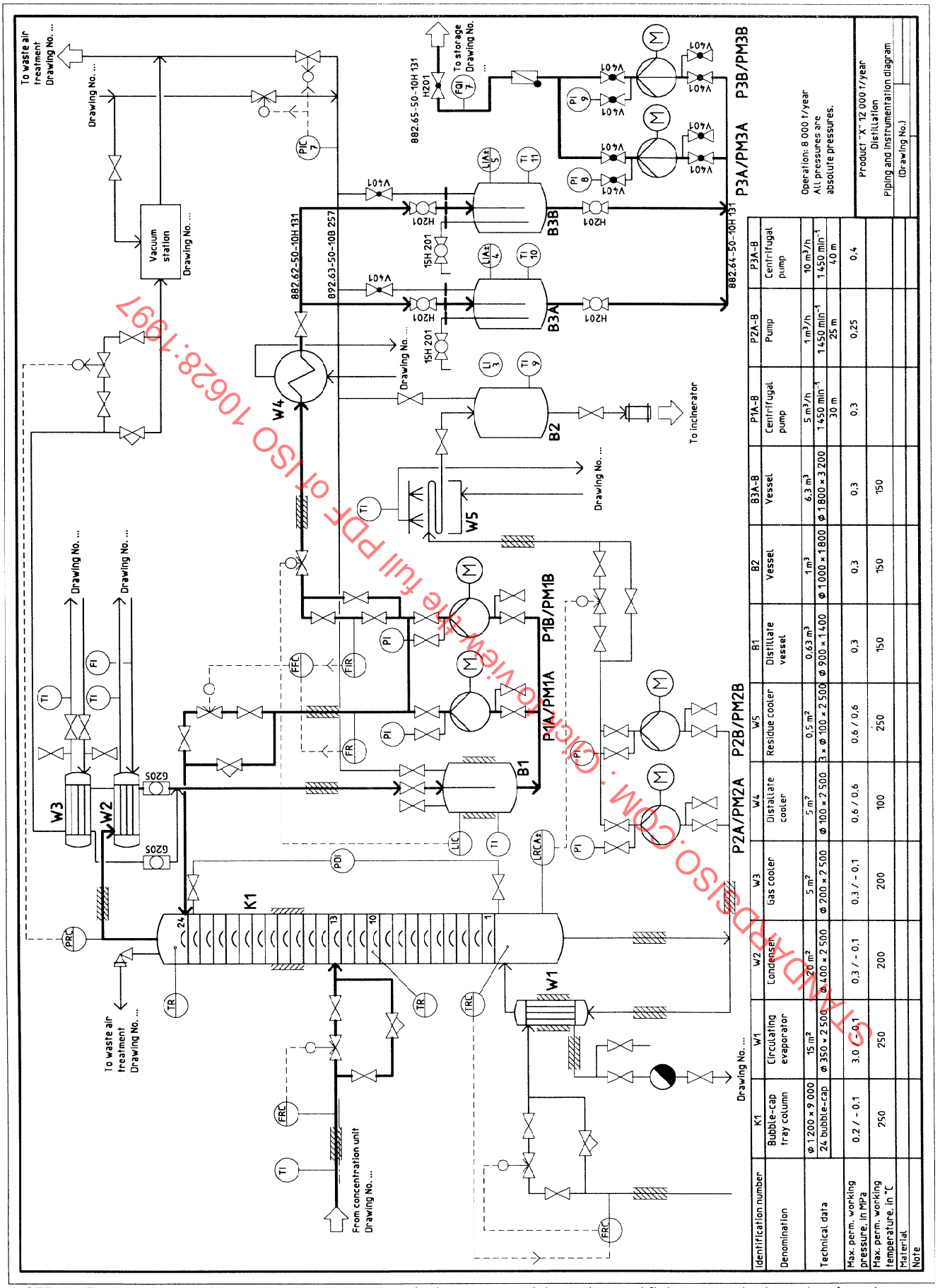


Figure B.3 — Process flow diagram with basic information



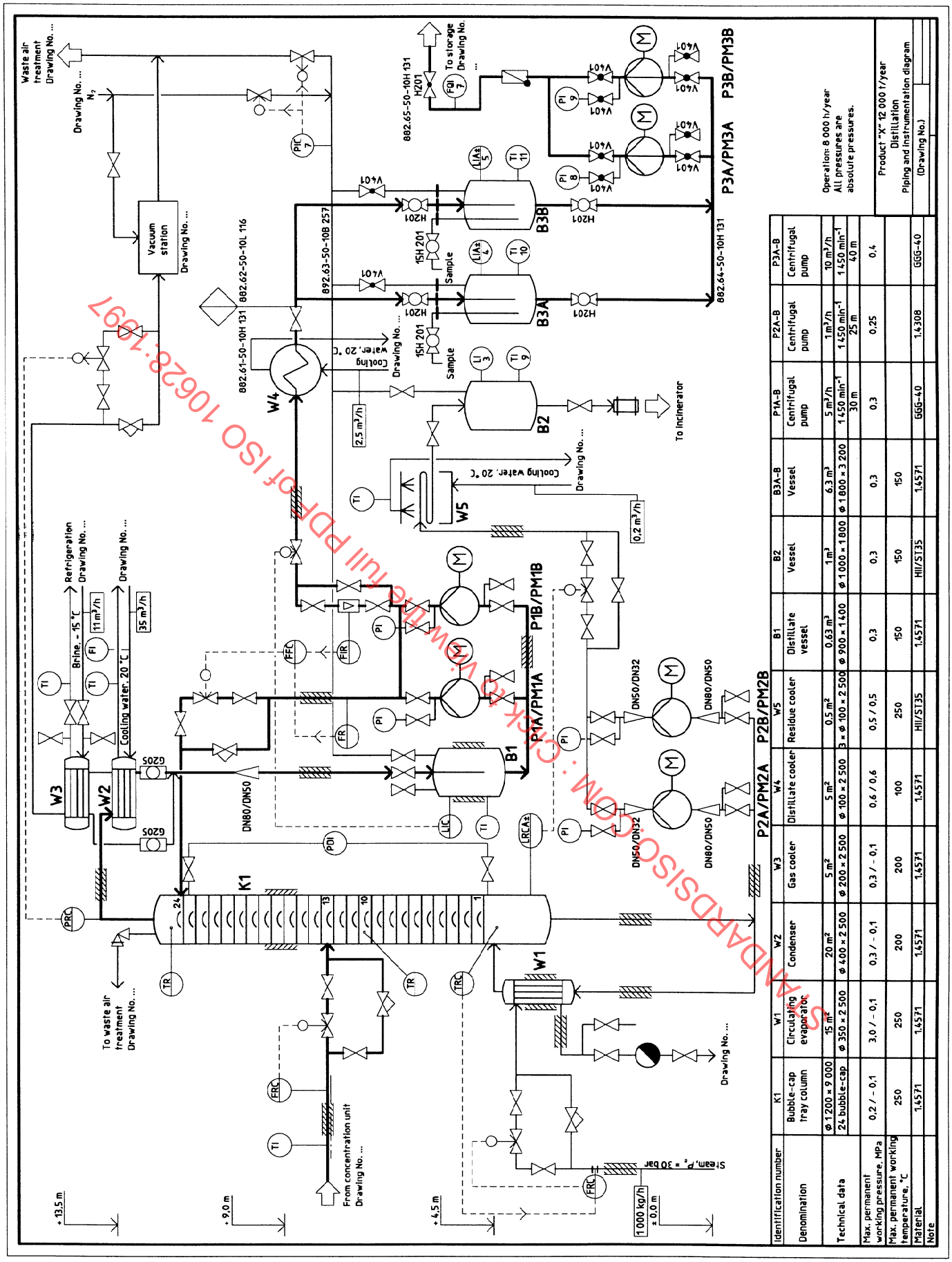
Flow No.		1	2	3	4	5	6	7	8	9
Product		Concentrate	Overhead product	Recycle	Distillate	Final product	Final product	Bottom product	Bottom product	Residue
Fluid X	kg/h	1 363	3 409	2 046	1 363	1 363	1 363			
Fluid Y	kg/h	137	341	204	137	137	137	3 500	15	15
Fluid Z	kg/h									
Flow rate	kg/h	1515	3 750	2 250	1 500	1 500	1 500	3 500	15	15
	m³/h	1,21	3,12	1,87	1,25	1,20	1,20	2,5	0,01	0,01
Operating pressure (abs)	kPa		13	13		60	58	130	130	30
Operating temperature	°C	80	105	100	100					
Density	kg/m³	1250	1200	1200	1200	1250	1250	1400	1400	1500

Figure B.4 — Process flow diagram with basic and additional information



NOTE — For better clarity of representation, designations for instruments, piping, valves and fittings are only shown in a few places.

Figure B.5 — Piping and instrumentation diagram (P & ID) with basic information



NOTE — For better clarity of representation, designations for instruments, piping, valves and fittings are only shown in a few places.

Figure B.6 — Piping and instrumentation diagram (P & ID) with basic and additional information

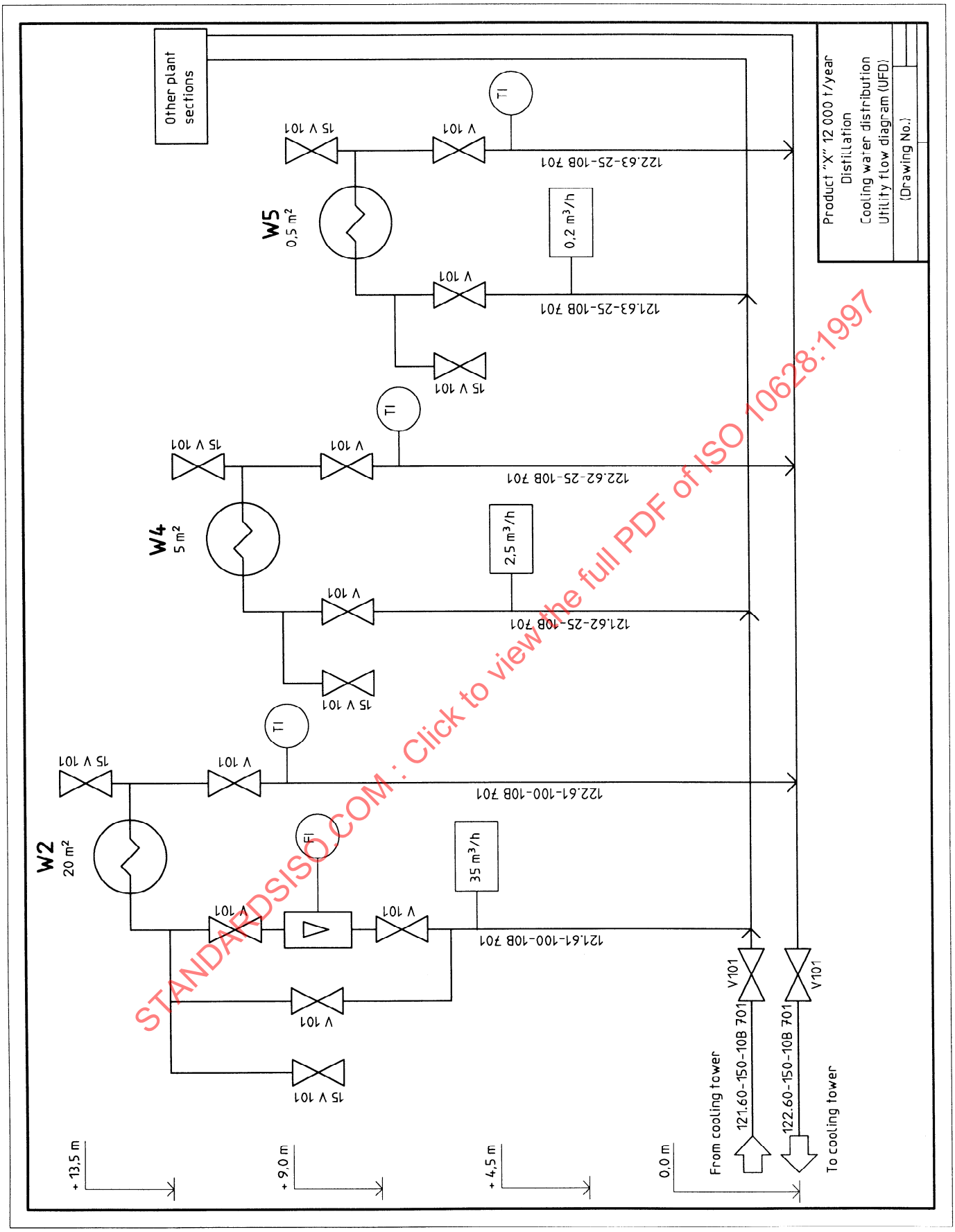


Figure B.7 — Piping and instrumentation diagram as utility flow diagram (UFD)

Annex C
(informative)

Selection of graphical symbols

This annex will be reviewed and revised, if necessary, when the general joint coordination work of ISO/TC 10/SC 10 and IEC/TC 3/SC 3A leads to a new universal library of graphical (tpd) symbols. New standards may then be published as collective symbol standards.

C.1 Principles

In order to harmonize the sizes of graphical symbols with those of other drawing indications, the rules given in ISO 3461-2 shall be applied.

The grid underneath the graphical symbol gives an indication of the proportions of the graphical symbol and facilitates its positioning and reproduction.

Preferred locations of flow line connections to a graphical symbol are indicated by —Ⓐ. This is not a part of the graphical symbol. When flow diagrams are produced by means of a computer aided design (CAD) system, flow lines can only be connected to a graphical symbol at grid points.

C.2 Representation

Graphical symbols may be turned or mirrored, if their meaning does not depend on the orientation. The representation of some graphical symbols (i.e. columns, vessels, etc.) can be adjusted to the actual scale with respect to the process plant.

C.3 Classification

The graphical symbols are grouped together in subject groups according to functional and/or design features. They are arranged in basic series, detailed series and examples of application.

The basic series shall preferably be used at the preliminary design stage (process flow diagram), whereas the detailed series shall be applied at a more advanced or final stage of the engineering work (piping and instrument diagram).

Additionally, it is recommended to use graphical symbols of the basic series in piping and instrument diagrams, since it is often impossible to show every special feature of the equipment in a graphical symbol. The special features are given in the equipment data sheets.

C.4 Summary of graphical symbols

C.4.1 Subject groups

A distinction is made between the following subject groups:

1 Vessels and tanks
2 Vessels with internals, columns with internals, chemical reactors with internals
3 Facilities for heating or cooling
4 Heat exchangers, steam generators, furnaces
5 Filters, liquid filters, gas filters
6 Sifters, screening devices, screening machines, sorting devices, sorting machines
7 Separators
8 Centrifuges
9 Driers
10 Crushing/grinding machines
11 Agitators/stirrers
12 Mixers, kneaders
13 Processing machines, shaping machines
14 Liquid pumps
15 Compressors, vacuum pumps, blowers, fans
16 Lifting, conveying and transport
17 Scales
18 Proportioners, feeders and distribution facilities
19 Motors, engines, drives
20 Miscellaneous items of equipment
21 Shut-off valves
22 Check valves
23 Control valves
24 Valves and fittings with safety function
25 Fittings
26 Other graphical symbols

C.4.2 Graphical symbols for equipment, machinery and piping

See table C.1.

Graphical symbols are shown in the recommended sizes for flow diagrams (module grid M 2,5 mm).

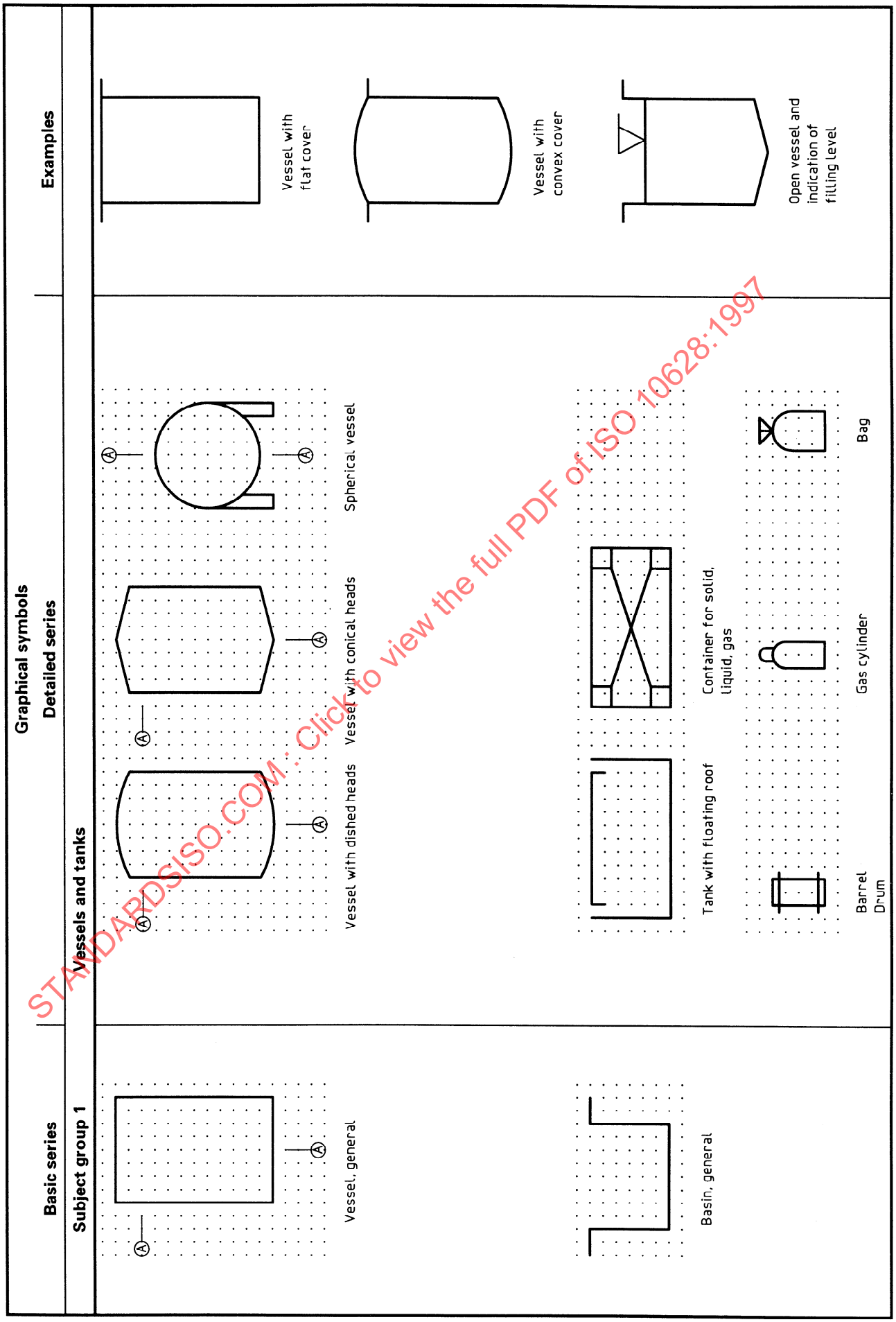
C.4.3 Explanatory notes

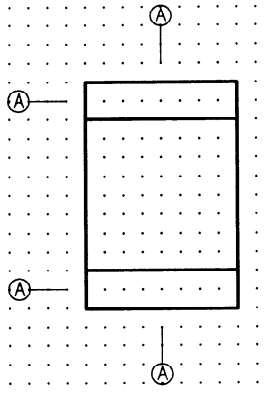
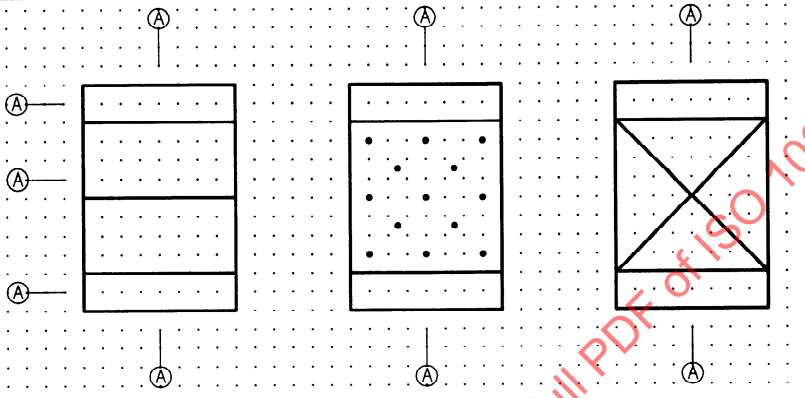
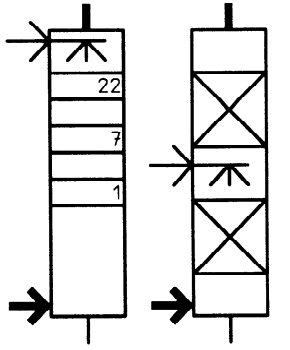
The graphical symbols shown in this annex are primarily used in process flow diagrams. Therefore, details were deliberately not shown and only typical features of the design have been included.

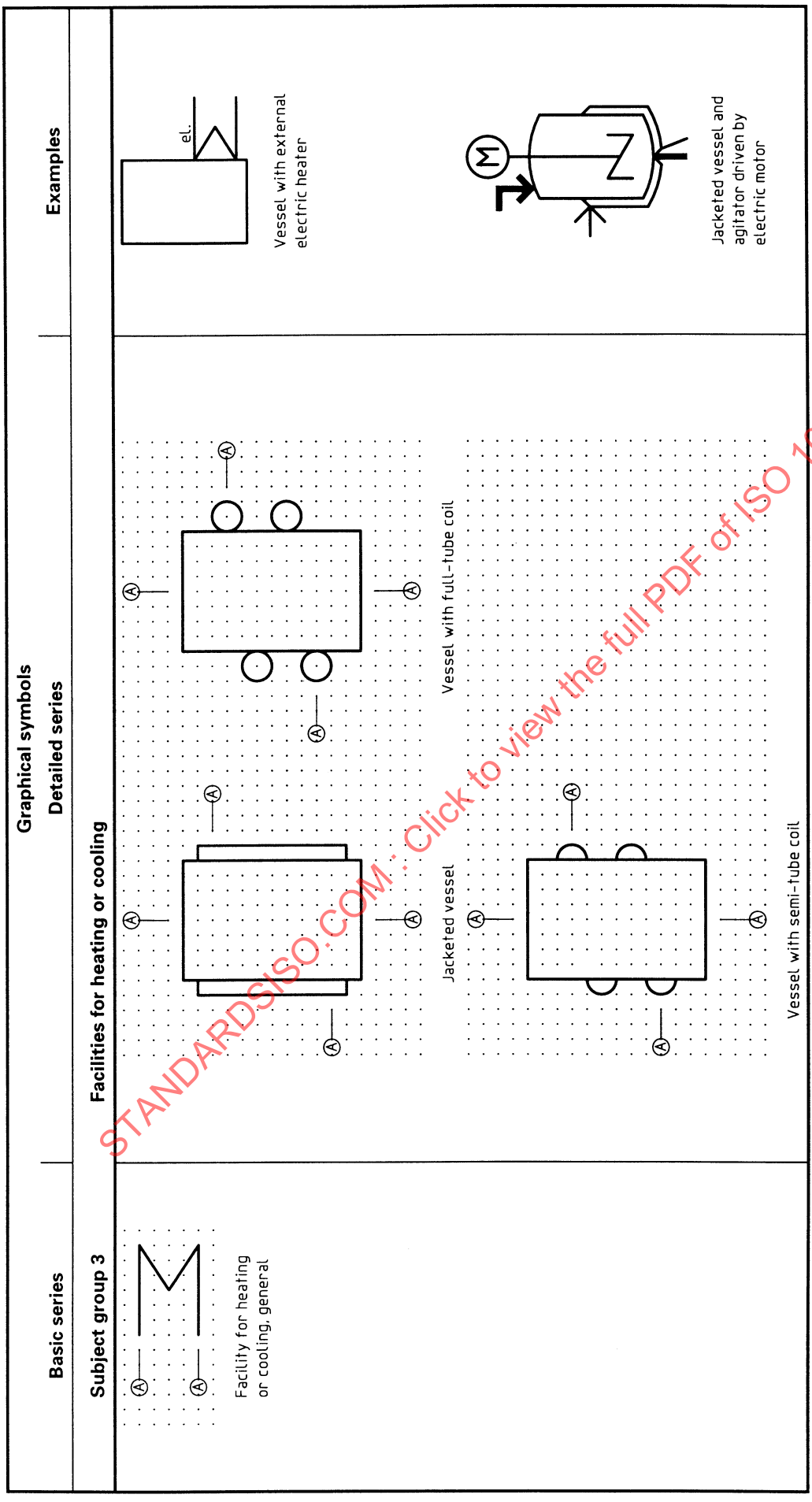
If the user considers the clarity of a graphical symbol insufficient, he may

a) supplement a general graphical symbol by an explanatory note, or
b) supplement a graphical symbol by showing additional design details.

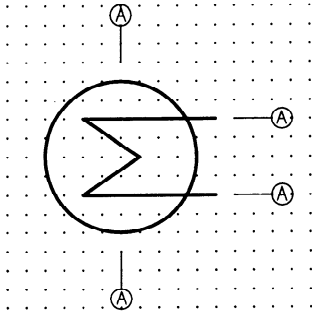
Table C.1



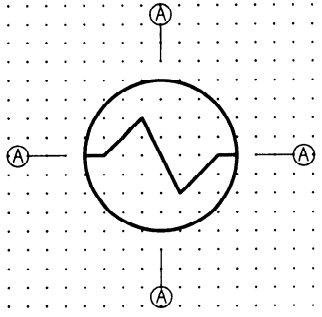
Graphical symbols		
Basic series	**Detailed series**	**Examples**
Subject group 2	**Vessels with internals (B)** **Columns with internals (K)** **Chemical reactors with internals (C)**	
 Column, general Vessel with internals, general	 Vessel with trays, general Column with trays, general Vessel with fluidized bed Vessel with fixed bed Column with fixed bed	 Column with specified number of trays Packed column with two packing zones



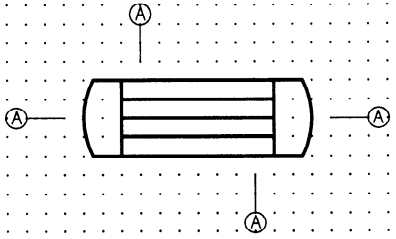
Graphical symbols		
Basic series	**Detailed series**	**Examples**
Subject group 4	**Heat exchangers (W)** **Steam generators (D)** **Furnaces (D)**	



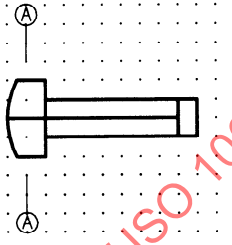
or



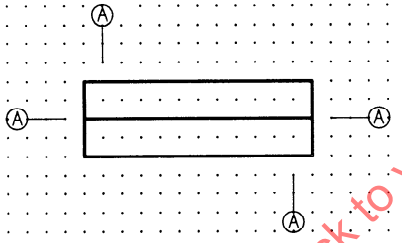
Heat exchanger, general



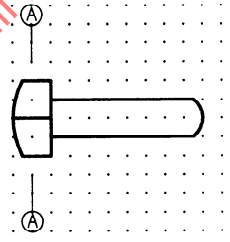
Tube-bundle heat exchanger
shell and tube type heat exchanger
with fixed tube sheets



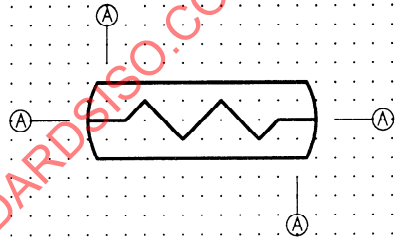
Tube-bundle with
floating head



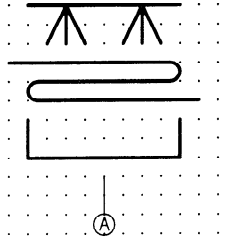
Double-pipe heat exchanger



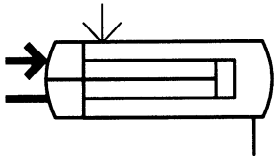
Tube-bundle with U-tubes



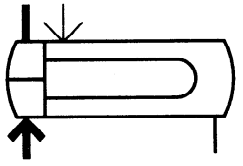
Heat exchanger with tube coil



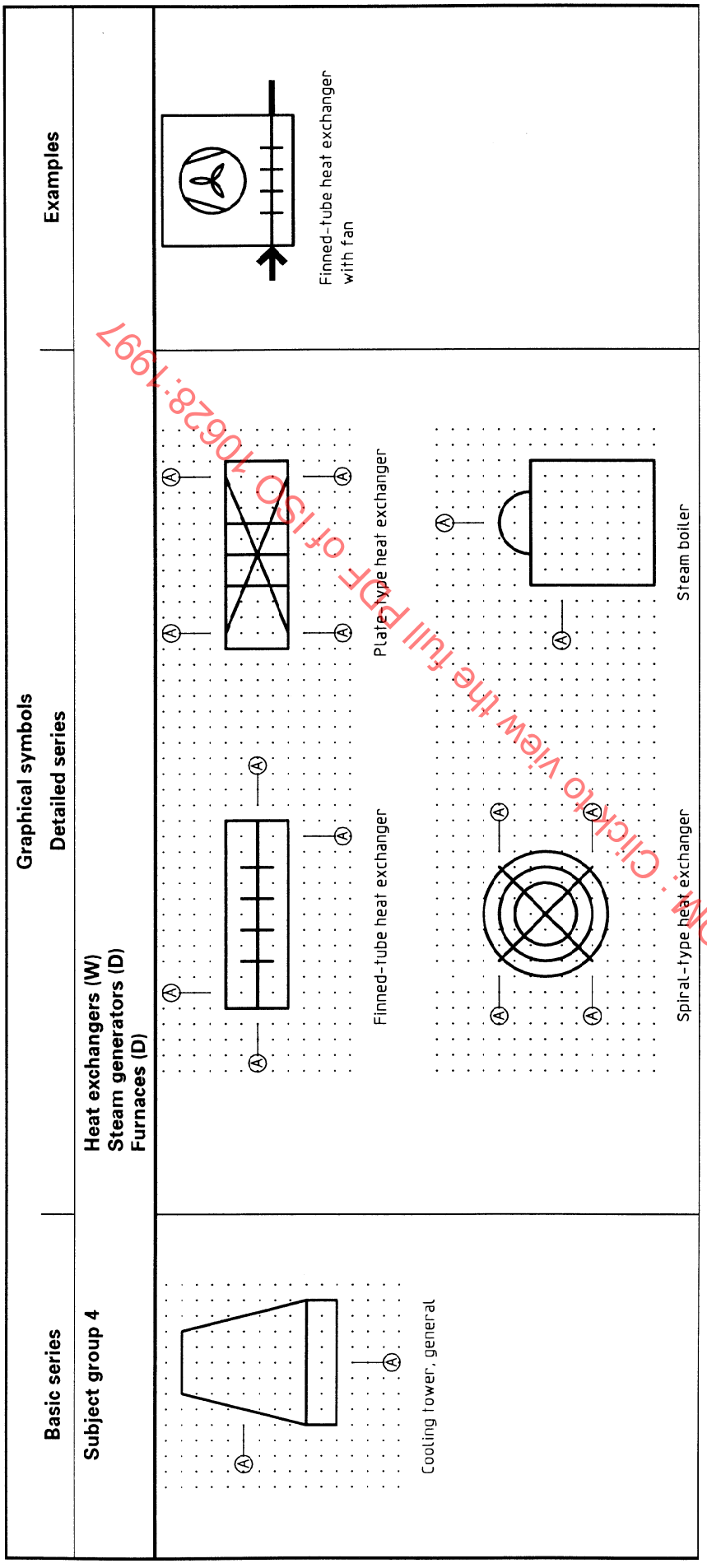
Spray cooler

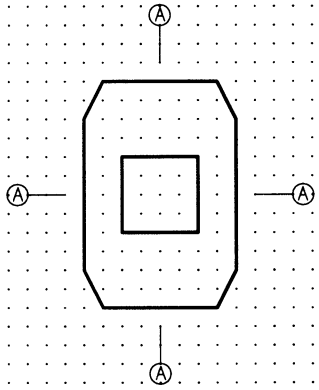
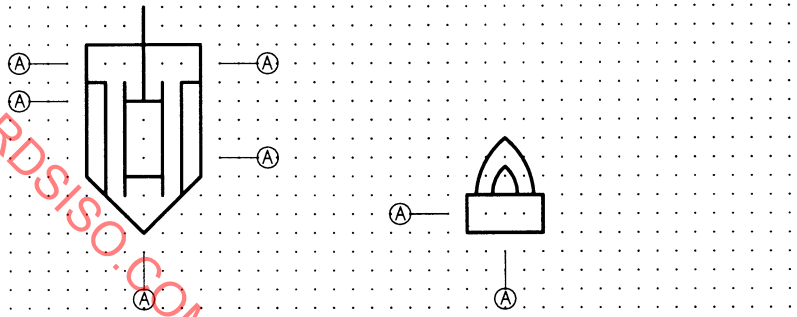
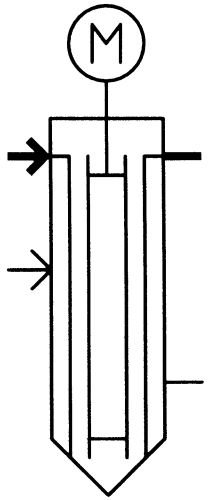
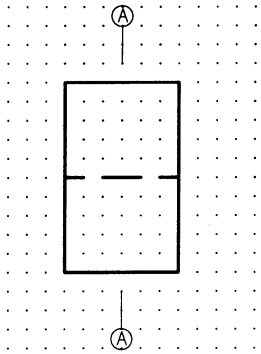
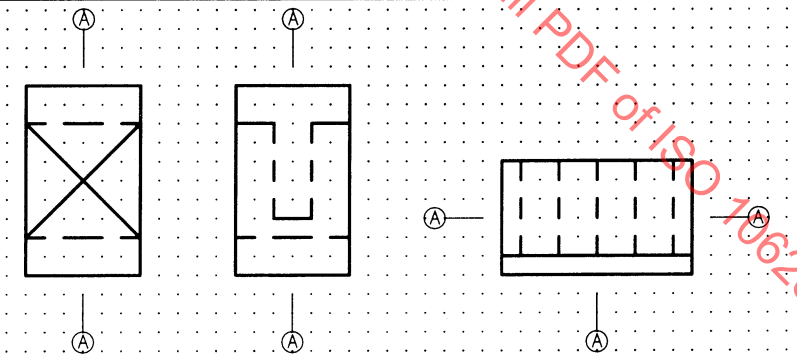


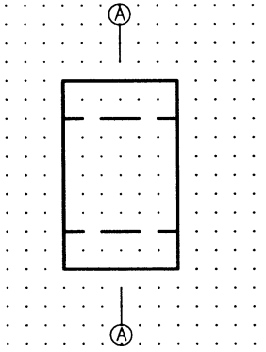
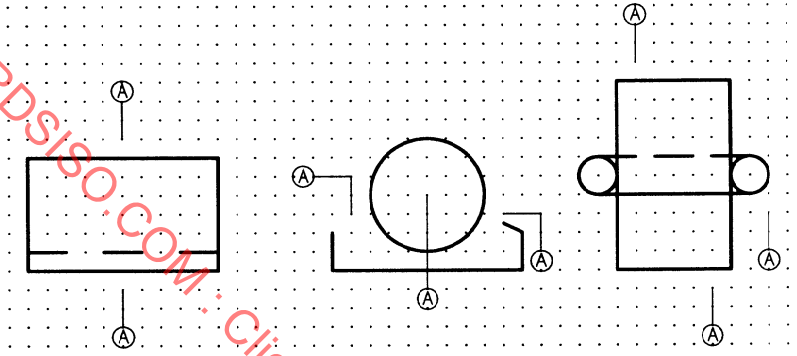
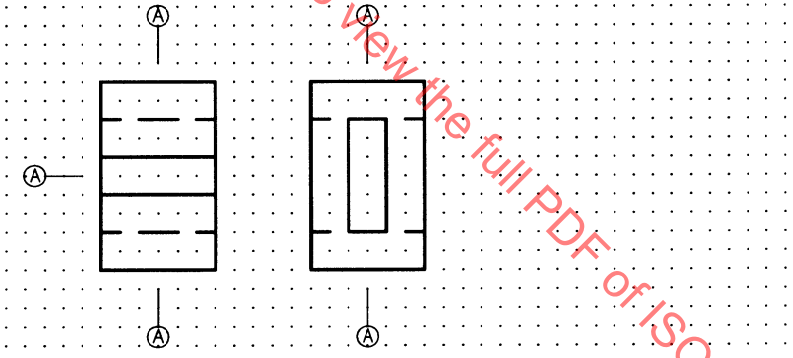
Floating-head tube-bundle
heat exchanger

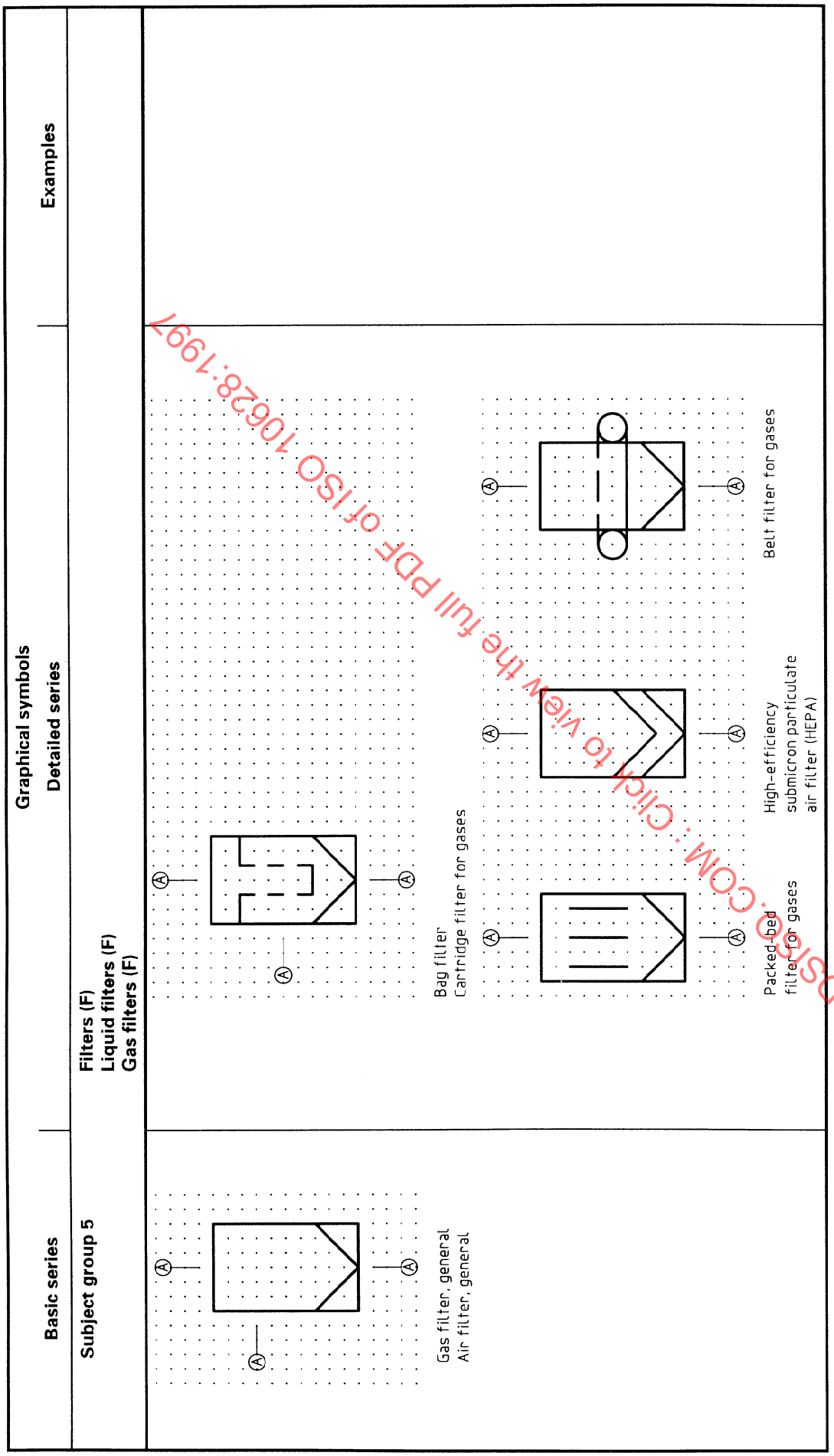


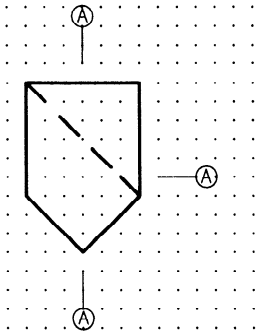
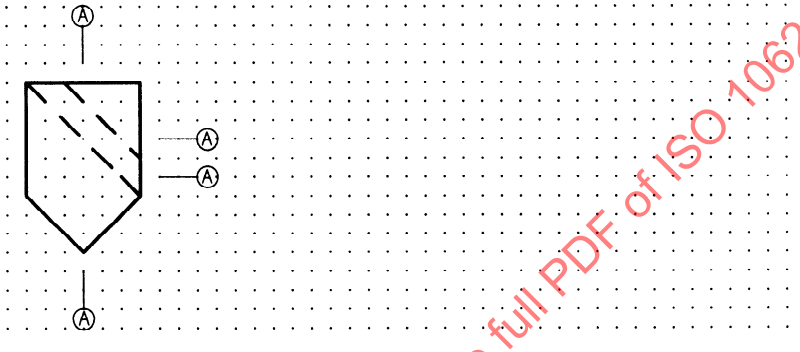
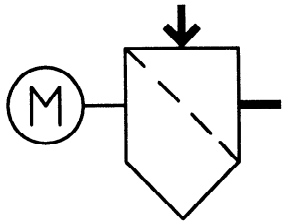
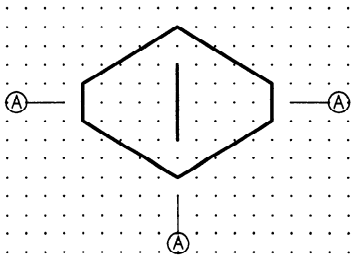
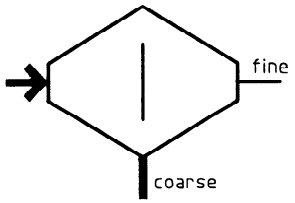
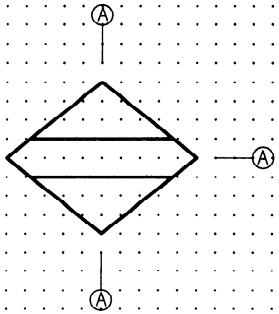
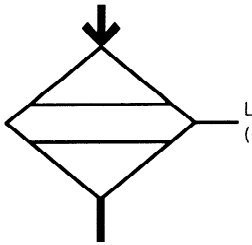
Tube-bundle heat
exchanger with U-tube

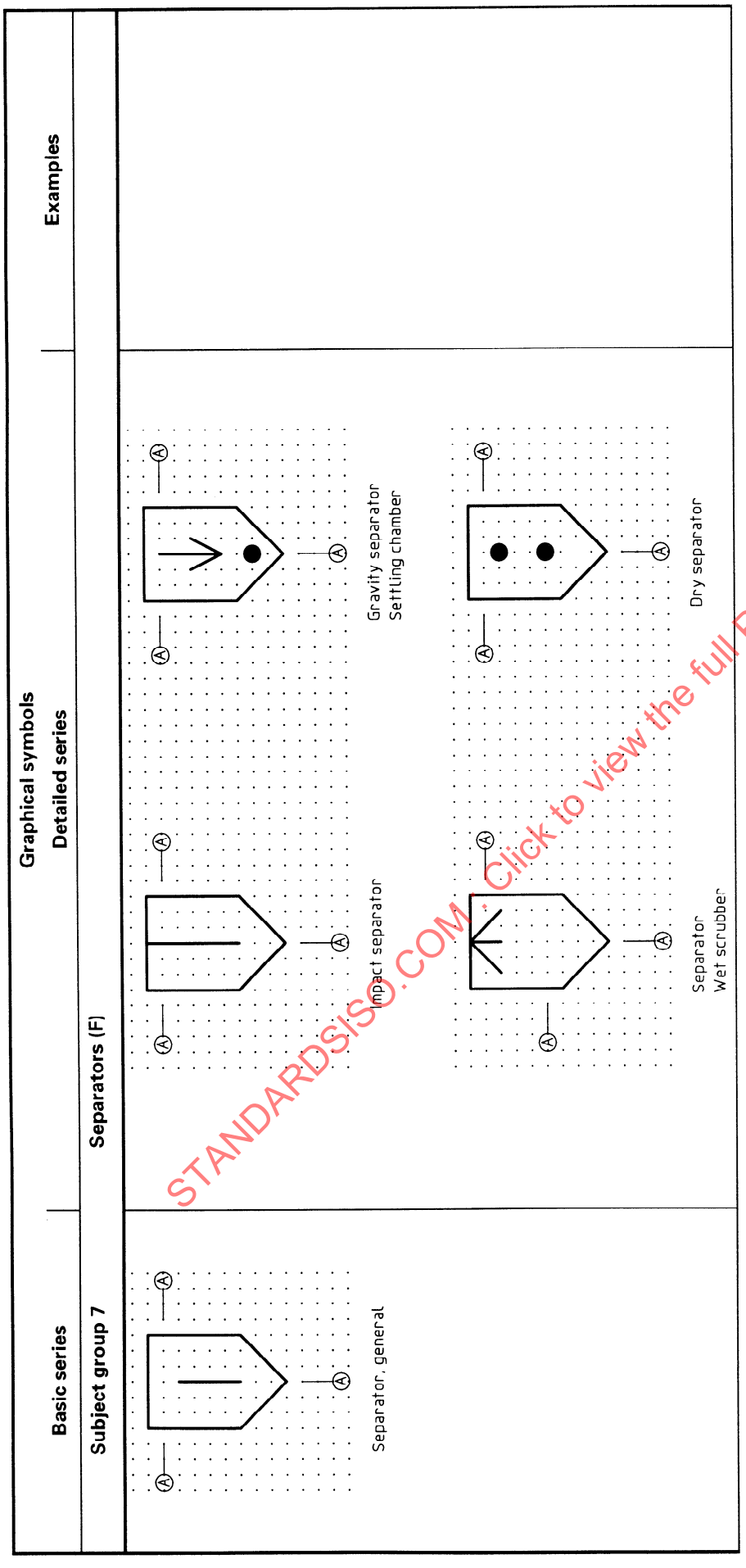


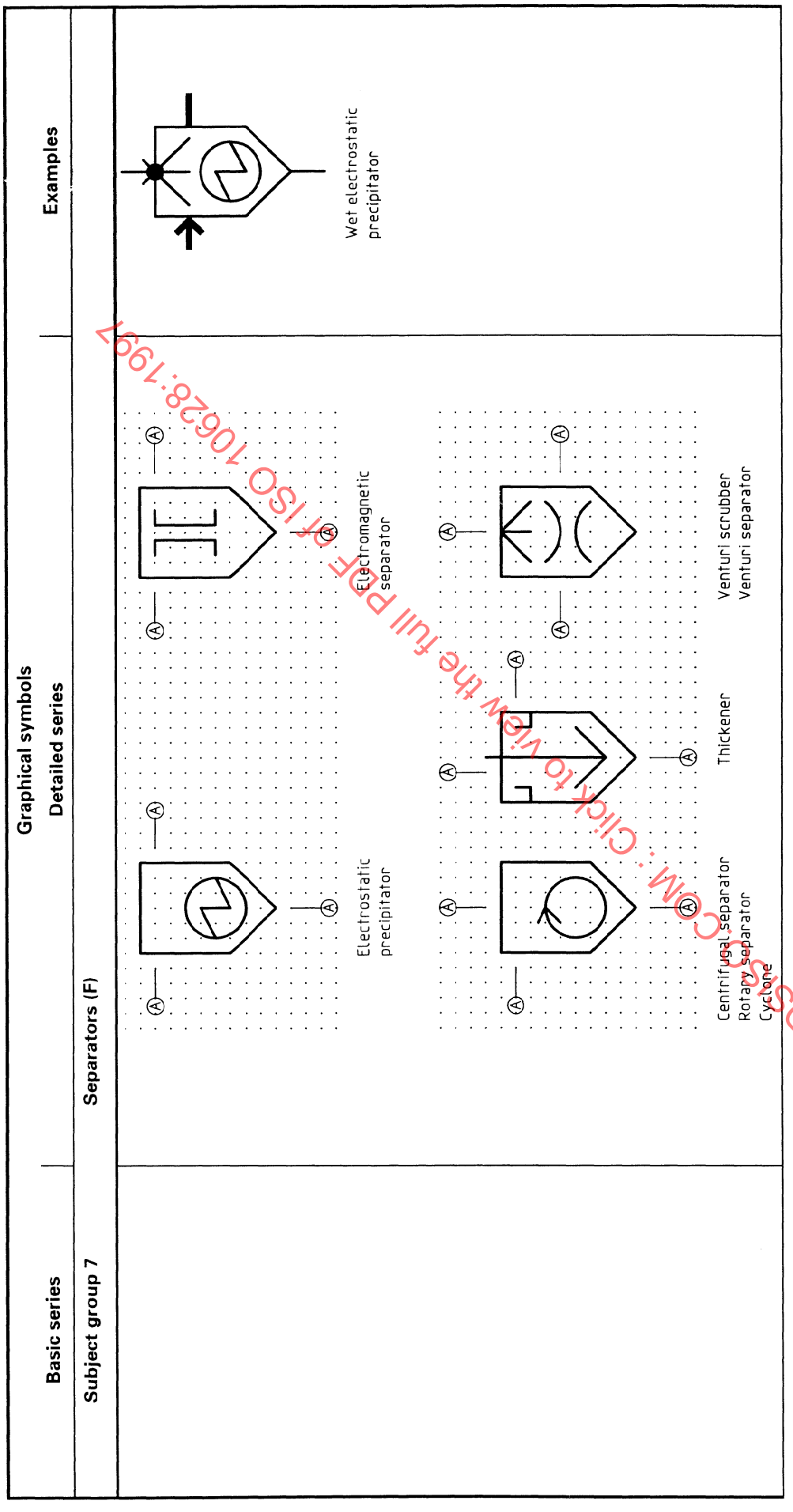
Graphical symbols		
Basic series	**Detailed series**	**Examples**
Subject group 4	**Heat exchangers (W)** **Steam generators (D)** **Furnaces (D)**	
 Industrial furnace, general	 Film evaporator Firing system, burner	 Film evaporator with electric motor
Subject group 5	**Filters (F)** **Liquid filters (F)** **Gas filters (F)**	
 Filter, general Filter equipment, general	 Fixed-bed filter Cartridge filter Filter press	

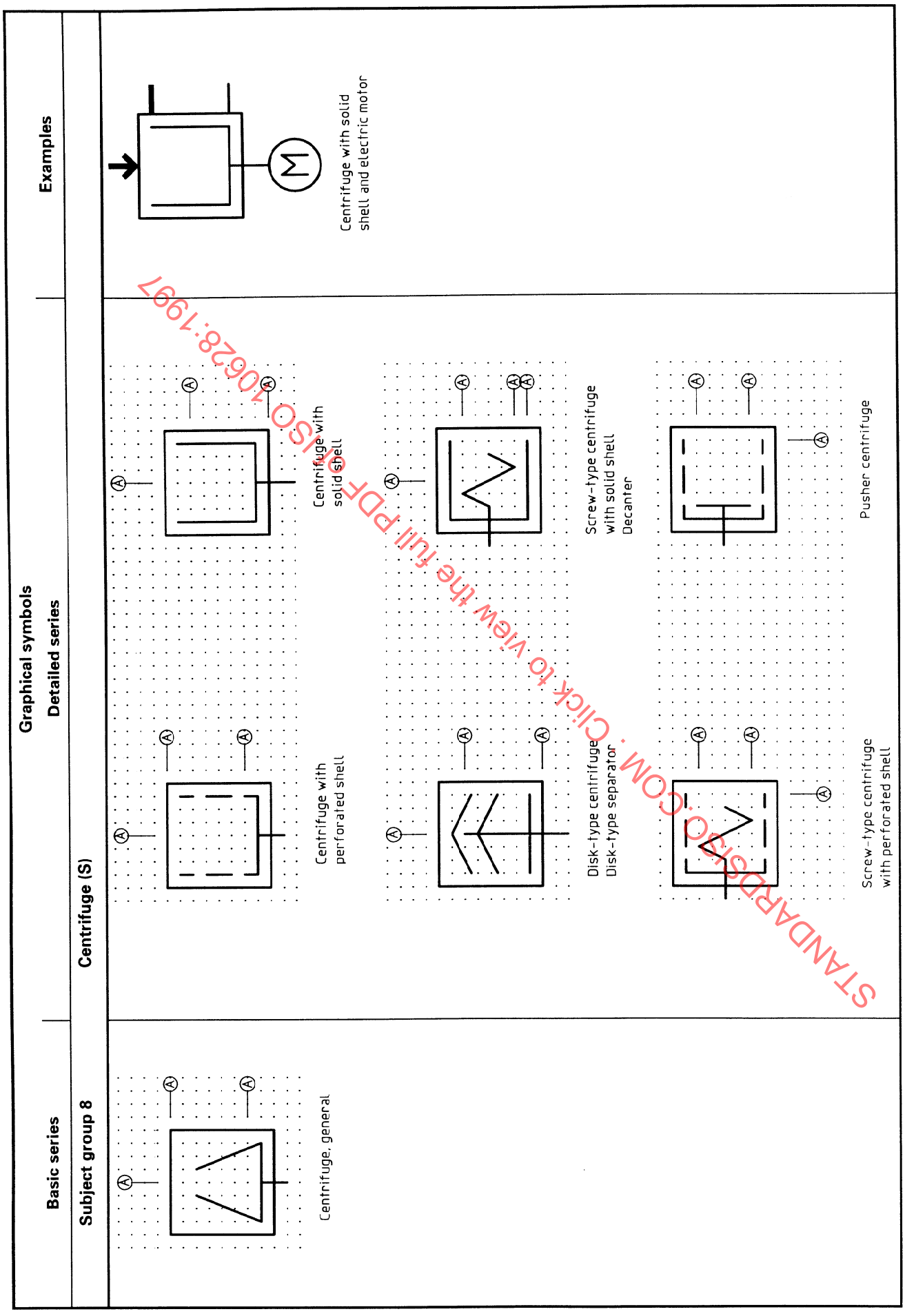
Graphical symbols		
Basic series	**Detailed series**	**Examples**
Subject group 5	**Filters (F)** **Liquid filters (F)** **Gas filters (F)**	
 Liquid filter, general	 Suction filter Rotary drum filter Rotary disk filter Belt filter for fluids  Ion exchange filter Activated carbon filter	

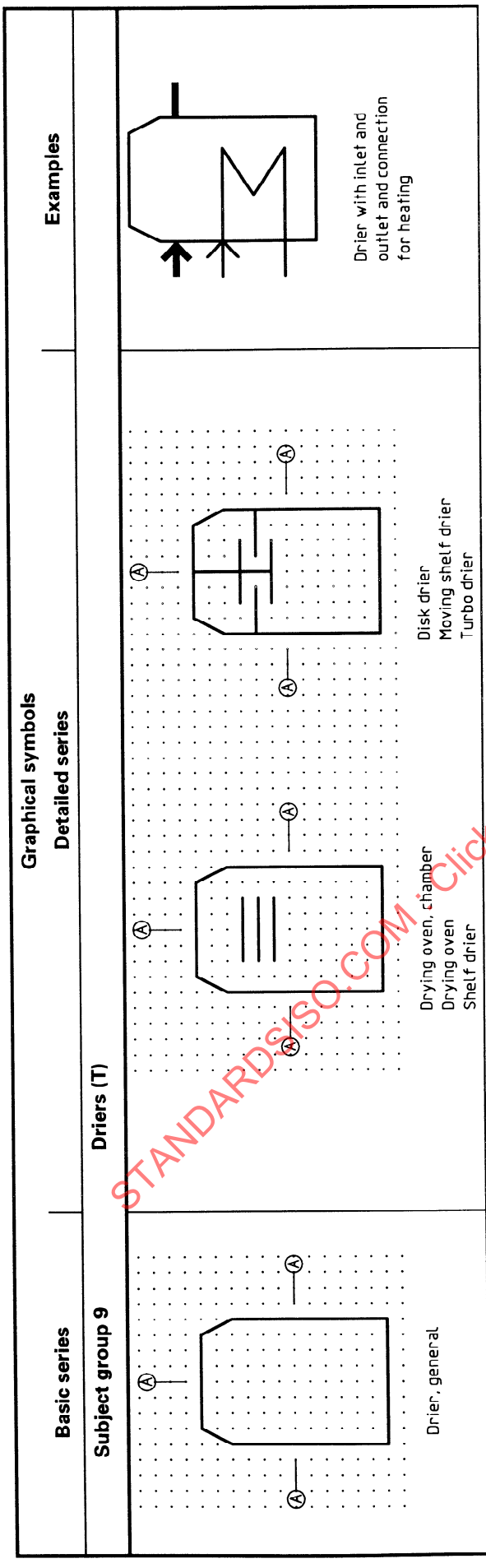


Graphical symbols		
Basic series	**Detailed series**	**Examples**
Subject group 6	**Sifters (F)** **Screening devices (F)** **Screening machines (F)** **Sorting devices (F)** **Sorting machines (F)**	
 Screening device, general Rakes, general	 Screening device with two screens	 Screening device with electric motor
 Sifter, general		 Sifter
 Sorting device, general		 Heavyweight (large grain size)



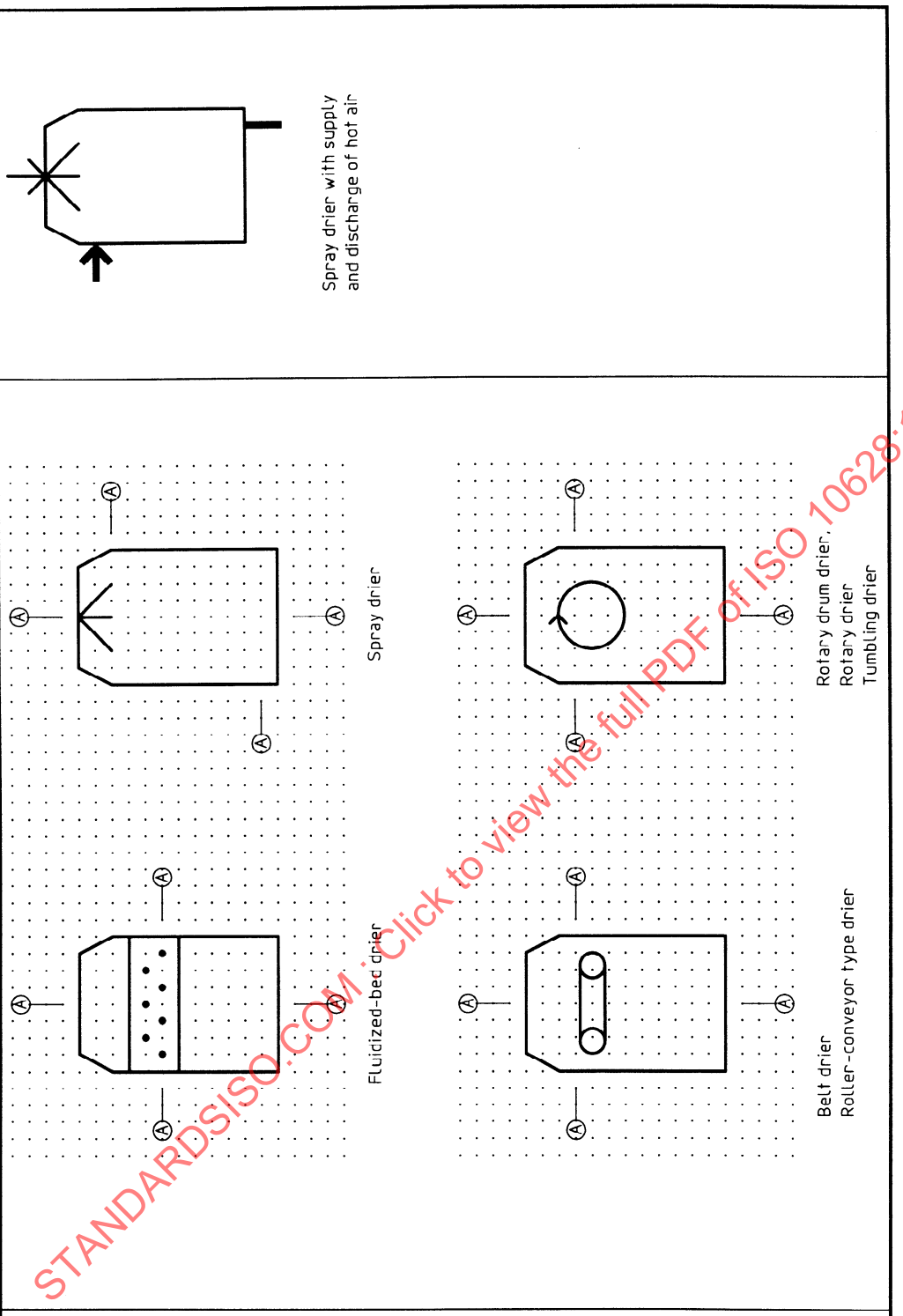


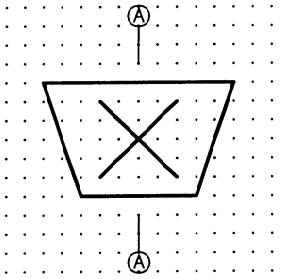
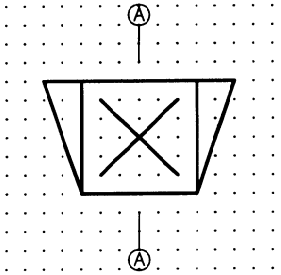
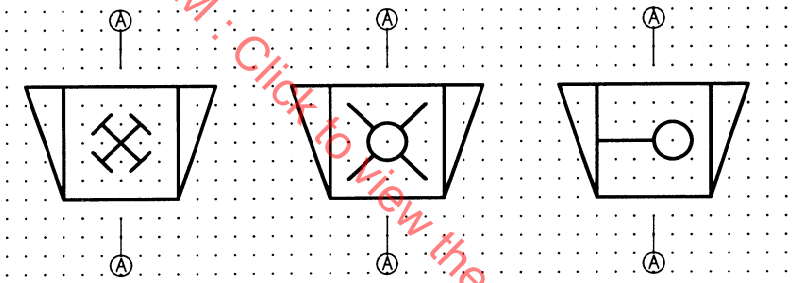
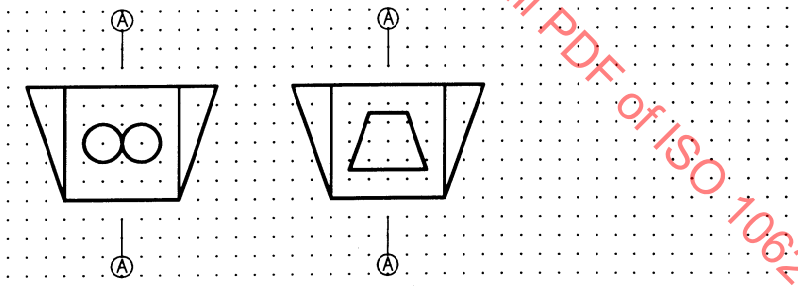
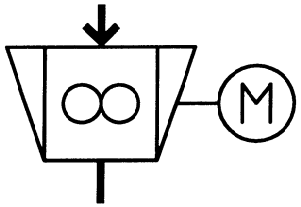


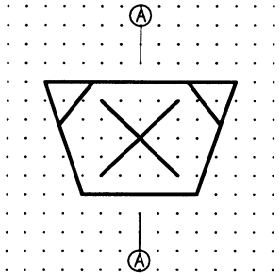
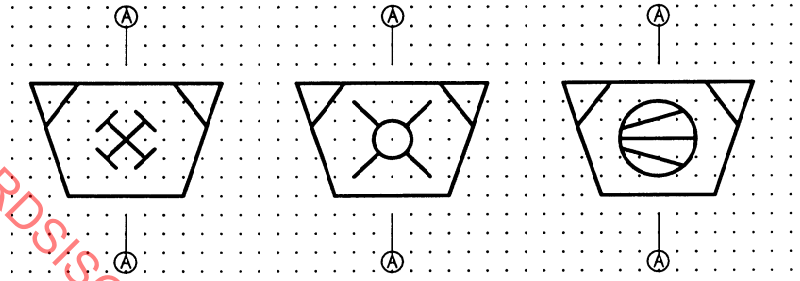
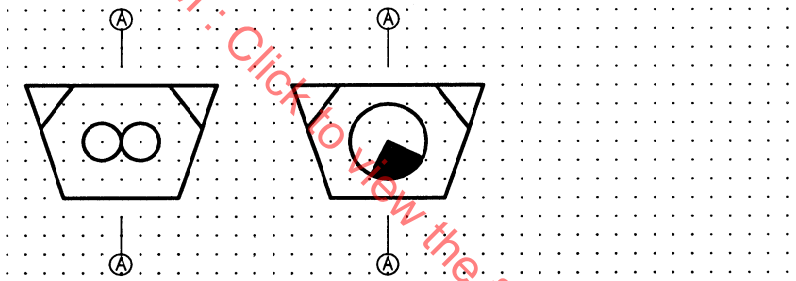
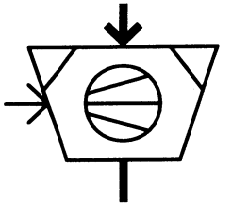


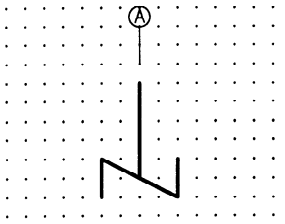
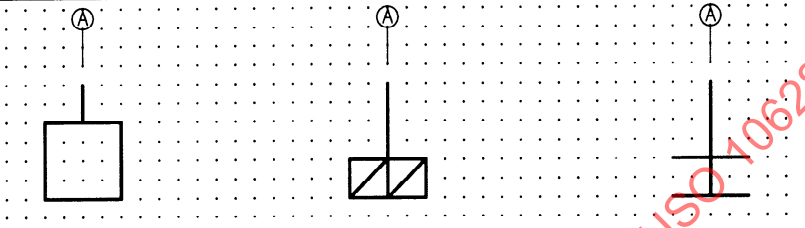
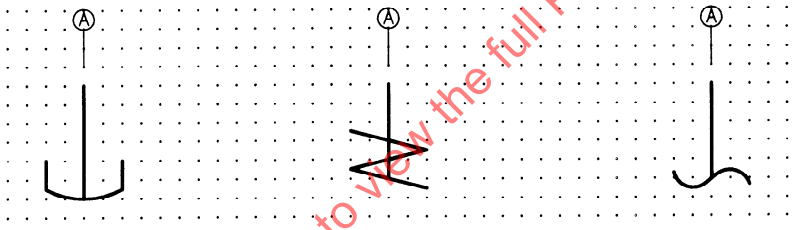
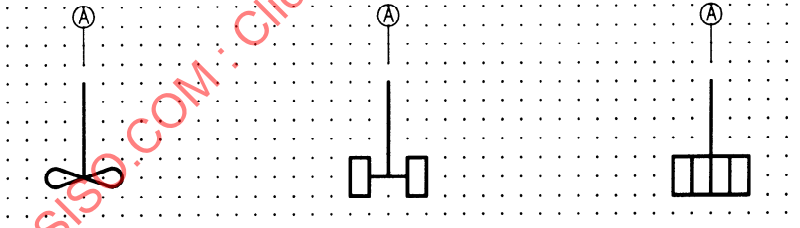
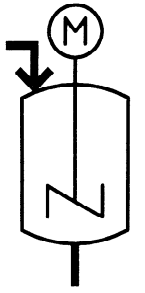
Graphical symbols

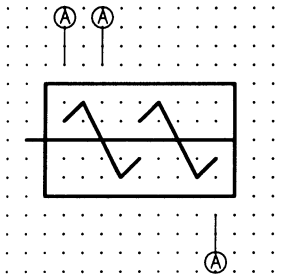
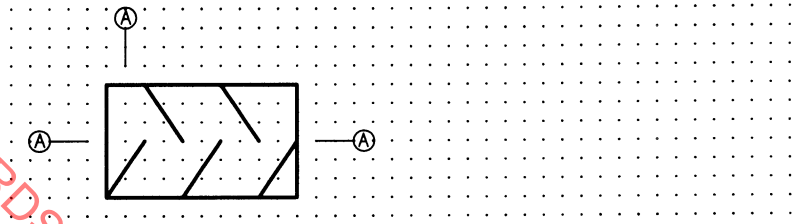
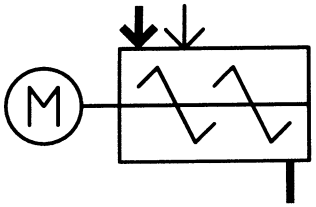
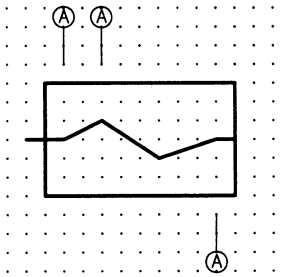
Basic series	Detailed series	Examples
Subject group 9	Driers (T)	

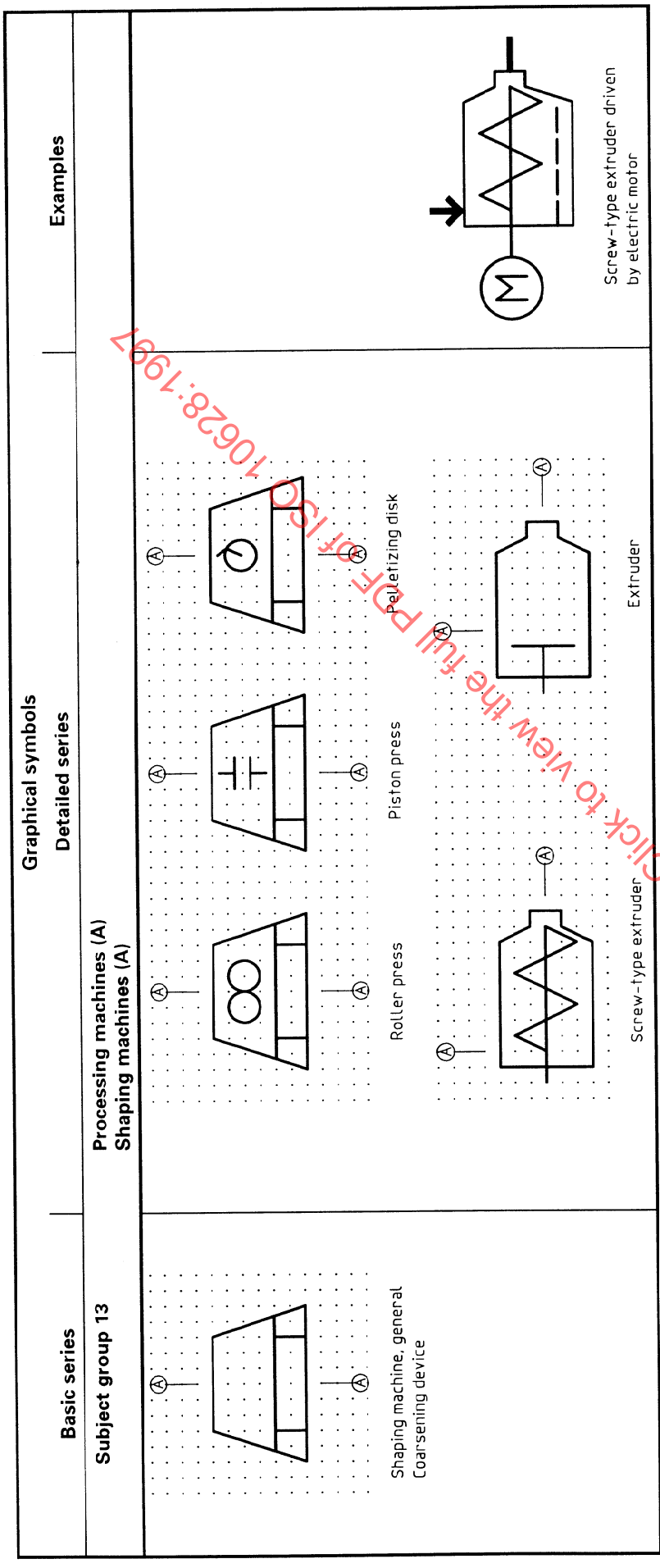


Basic series	Graphical symbols Detailed series	Examples
Subject group 10	**Crushing machines, grinding machines (Z)**	
 Crushing machine, general		
 Crusher, general	 Hammer crusher Impact crusher Jaw crusher  Roller crusher Cone crusher	 Roller crusher with electric motor

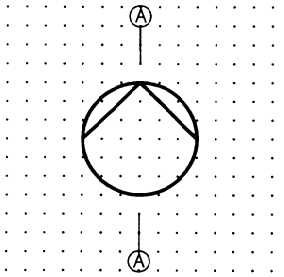
Graphical symbols		
Basic series	**Detailed series**	**Examples**
Subject group 10	**Crushing machines, grinding machines (Z)**	
 Mill, general	 Hammer mill Impact mill Jet mill  Roller mill Vibration mill	 Jet mill with solid and gas flow connection

Graphical symbols		
Basic series	**Detailed series**	**Examples**
Subject group 11	**Agitators, stirrers (R)**	
 Agitator, general Stirrer, general	 Flat-blade paddle agitator Gate paddle agitator Cross-beam agitator  Anchor agitator Helical agitator Impeller agitator  Propeller agitator Disk agitator Turbine agitator	 Vessel with agitator driven by electric motor

Graphical symbols		
Basic series	**Detailed series**	**Examples**
Subject group 12	**Mixers (R)** **Kneaders (R)**	
 Mixer, general	 Static mixer	 Mixer driven by electric motor
 Kneader, general		

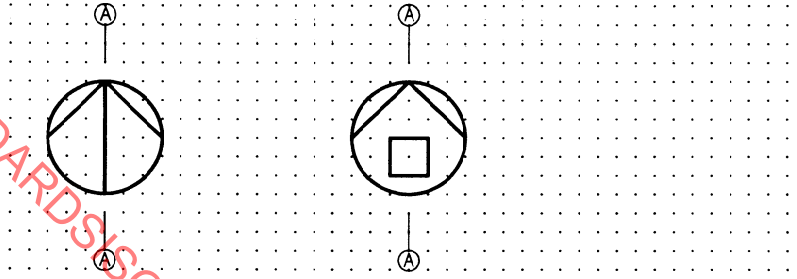


Graphical symbols		
Basic series	**Detailed series**	**Examples**
Subject group 14	**Liquid pumps (P)**	



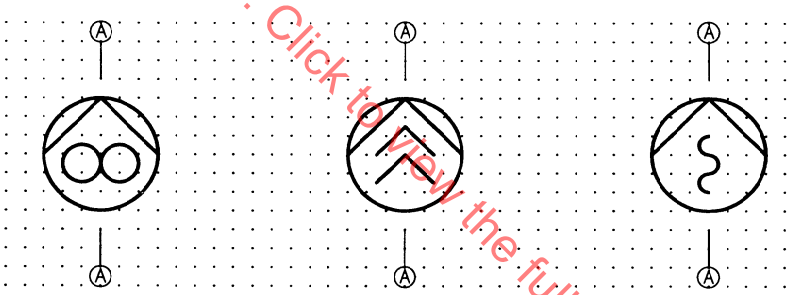
Pump, general

The arrow indicates the direction of flow



Centrifugal pump

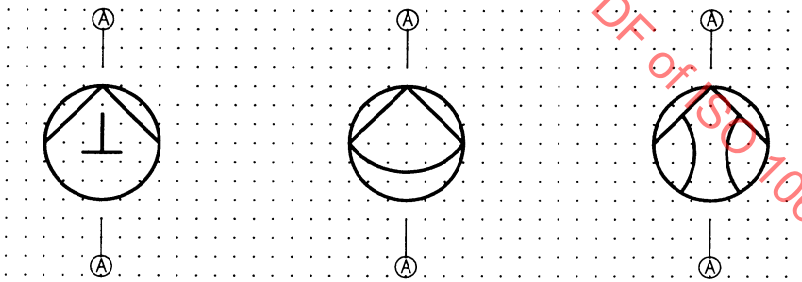
Positive-displacement pump



Gear pump

Screw pump

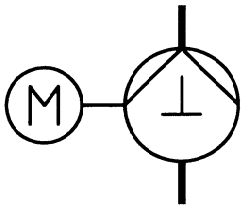
Helical rotor pump



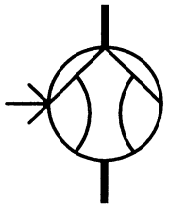
Reciprocating pump

Diaphragm pump

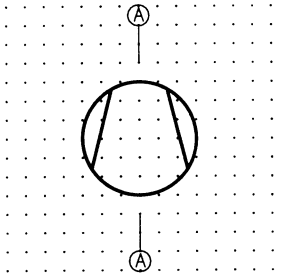
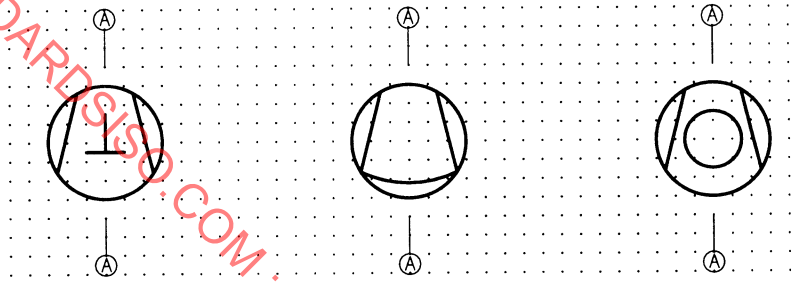
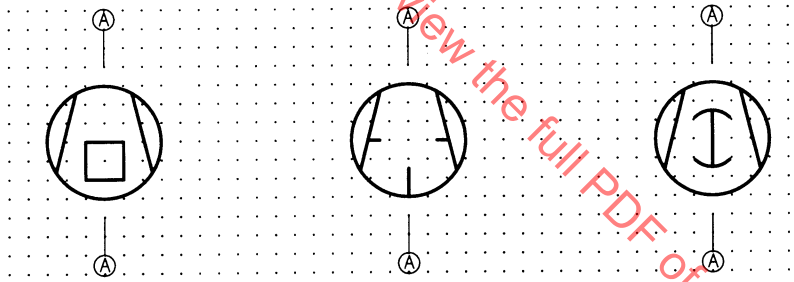
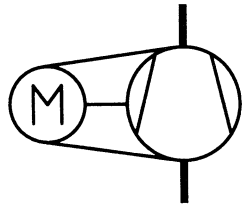
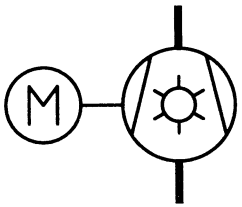
Liquid jet pump

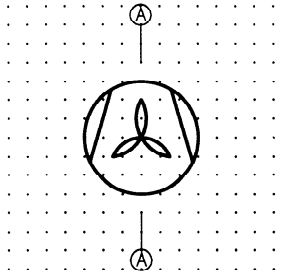
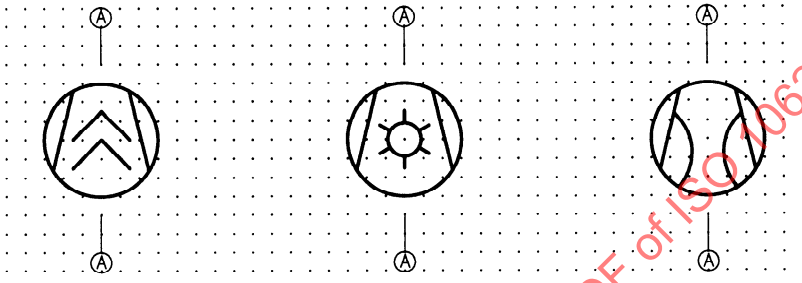
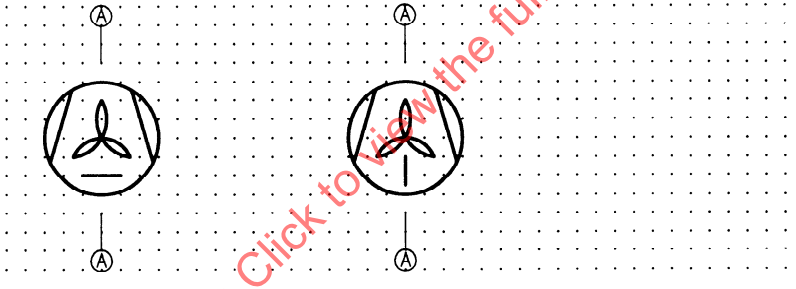
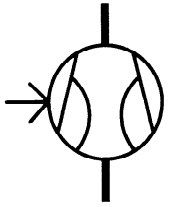


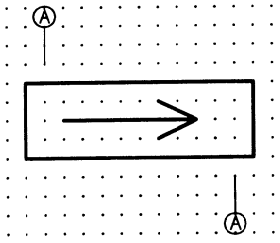
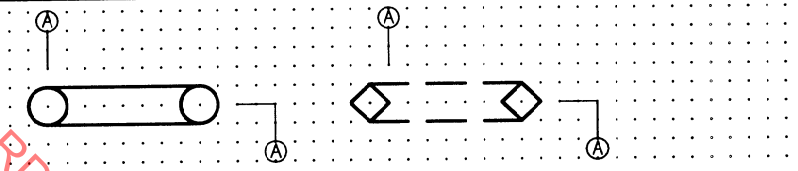
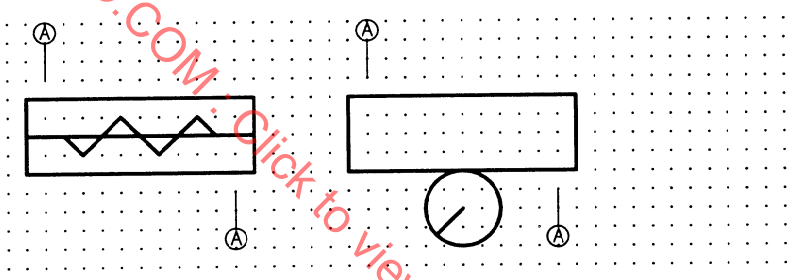
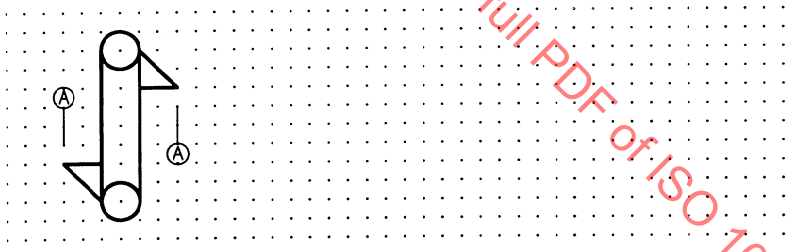
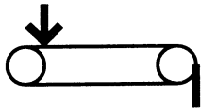
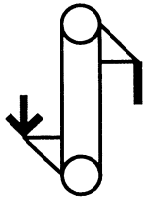
Reciprocating pump with electric motor

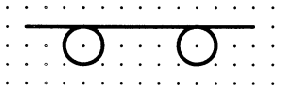
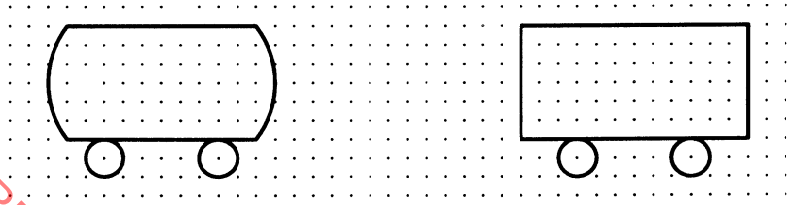
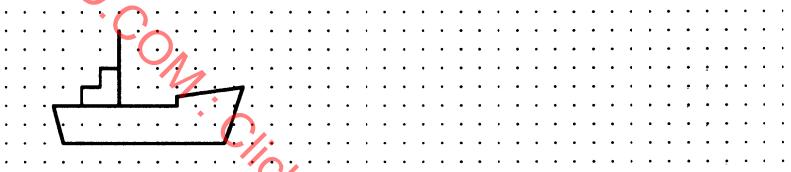
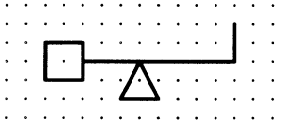
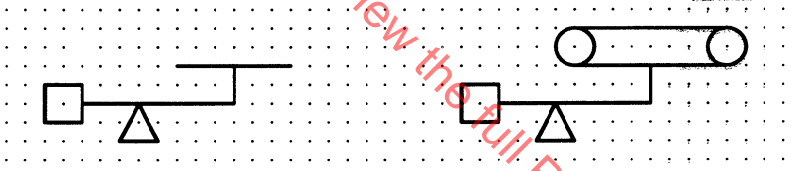


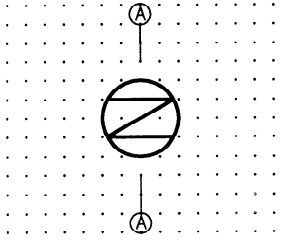
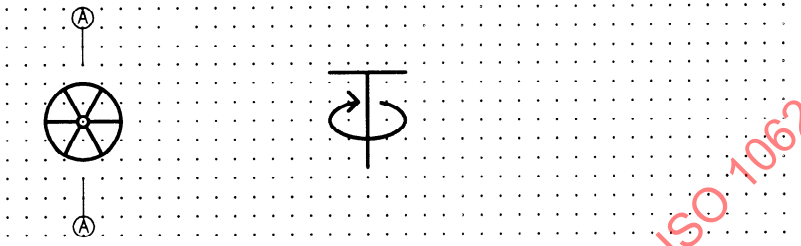
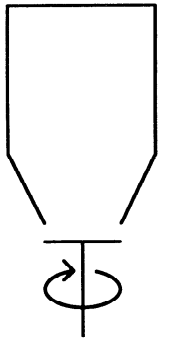
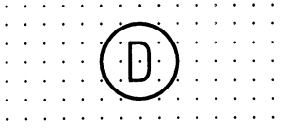
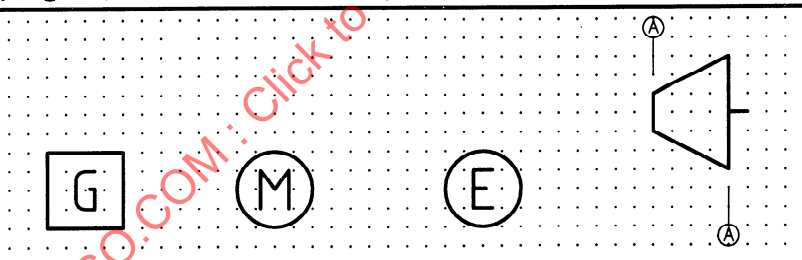
Liquid jet pump with operating fluid supply

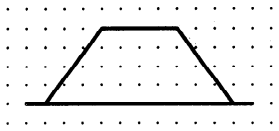
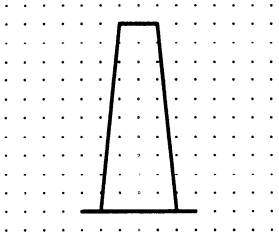
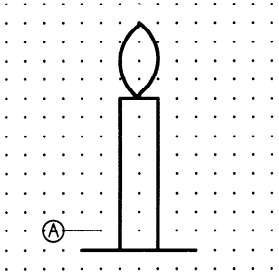
Basic series	Graphical symbols Detailed series	Examples
Subject group 15	**Compressors (V)** **Vacuum pumps (V)** **Blowers (V)** **Fans (V)**	
 Compressor, general Vacuum pump, general The narrowing end indicates the direction of flow	 Reciprocating compressor Reciprocating vacuum pump Reciprocating diaphragm compressor Diaphragm vacuum pump Turbo compressor Turbo-vacuum pump  Positive-displacement compressor Positive-displacement vacuum pump Roller vane compressor Rotary compressor Roller vane vacuum pump Rotary compressor Rotary piston vacuum pump	 Hermetic motor compressor  Liquid ring compressor with electric motor

Graphical symbols		
Basic series	**Detailed series**	**Examples**
Subject group 15	**Compressors (V)** **Vacuum pumps (V)** **Blowers (V)** **Fans (V)**	
 Blower, general Fan, general	 Screw compressor Liquid ring compressor Liquid ring vacuum pump Ejector compressor Jet vacuum pump  Radial blower Fan blower Axial blower Fan blower	 Ejector compressor with operating fluid supply

Graphical symbols		
Basic series	**Detailed series**	**Examples**
Subject group 16	**Lifting, conveying and transport (H)**	
 Conveyor, general	 Belt conveyor, general Chain conveyor, general  Screw conveyor, general Vibrating conveyor Tubular vibrating conveyor Open-pan vibrating conveyor  Bucket elevator	 Belt conveyor with feed and discharge  Bucket elevator with feed and discharge

Graphical symbols		
Basic series	**Detailed series**	**Examples**
Subject group 16	**Lifting, conveying and transport (H)**	
 Industrial truck, general	 Tank car Tank wagon Box truck  Ship	
Subject group 17	**Scales (A)**	
 Scale, general	 Weighing platform Floor scale Weighbridge Belt scale	

Graphical symbols		
Basic series	**Detailed series**	**Examples**
Subject group 18	**Proportioners, feeders and distribution facilities (X)**	
 Proportioner for solids, general	 Rotary valve feeder; Rotary table	 Vessel with rotary table discharge
 Distribution device for fluids Spray nozzle		
Subject group 19	**Motors, engines, drives (M, Y)**	
 Drive, general	 Gear; Electric motor, general; Combustion engine; Drive with expansion of operating fluid Turbine	

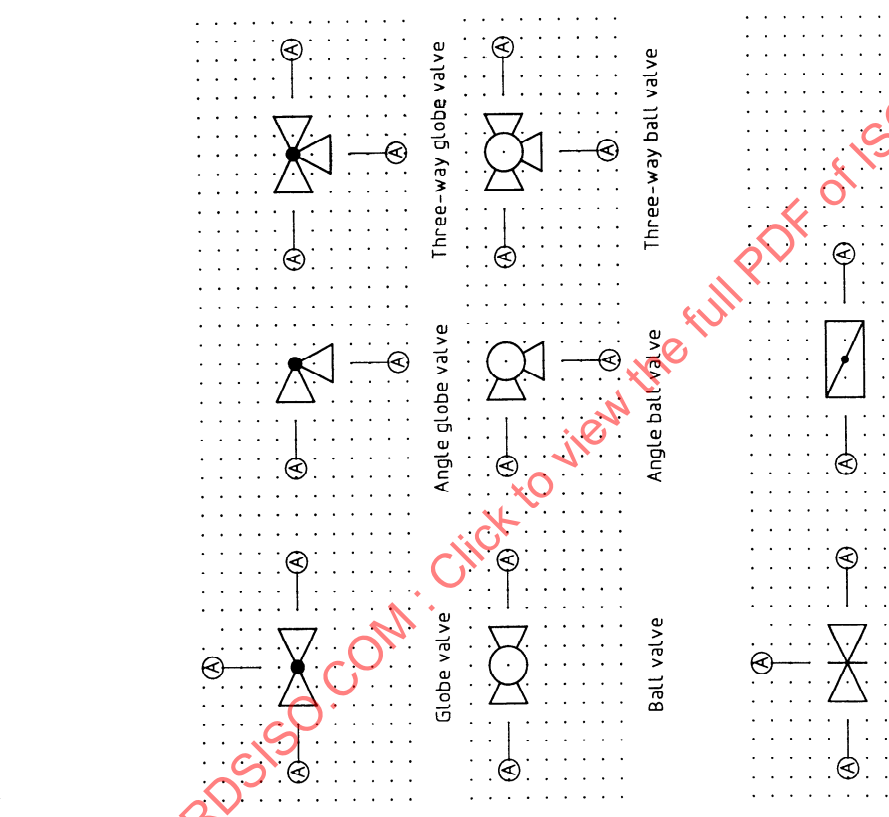
Graphical symbols		
Basic series	**Detailed series**	**Examples**
Subject group 20	**Miscellaneous items of equipment (A)**	
 Bulk storage		
 Stack, chimney		
 Gas flare		

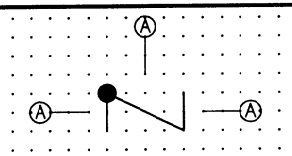
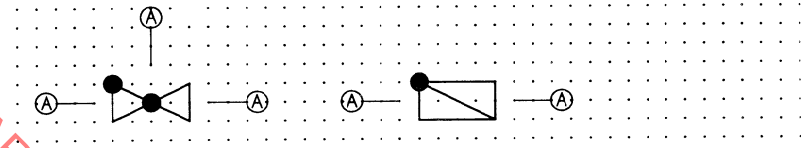
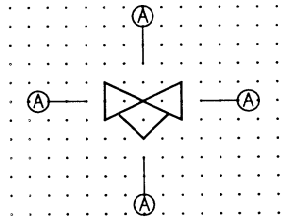
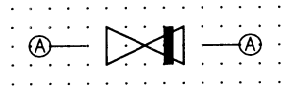
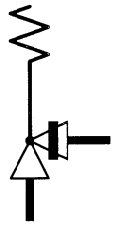
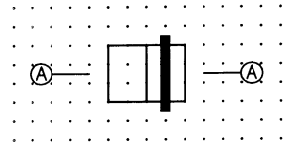
Graphical symbols

Basic series	Detailed series	Examples
Subject group 20	Miscellaneous items of equipment (A)	

Graphical symbols
Detailed series

Basic series	Shut-off valves	Examples
Subject group 21		



Graphical symbols		
Basic series	**Detailed series**	**Examples**
Subject group 22	**Check valve**	
 Check valve, general	 Lift check valve Swing check valve	
Subject group 23	**Control valves**	
 Control valve, continuously operated		
Subject group 24	**Valves and fittings with safety function**	
 Safety valve The heavy line indicates the outlet side		 Angle safety valve, spring loaded
 Rupture disk, general The heavy line indicates the outlet side		