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Gas turbines — Procurement

AMENDMENT 1: Basic procurement information for combined-cycle plants

Turbines à gaz — Spécifications pour l'acquisition

AMENDEMENT 1: Informations sur les spécifications de base pour l'acquisition d'installations à cycle combiné

Reference number
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Foreword

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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.

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Gas turbines — Procurement

AMENDMENT 1: Basic procurement information for combined-cycle plants

Redesignate existing annexes C to F as annexes D to G. Add a new annex C as shown in the following pages.

Annex C
(normative)

Basic procurement information for combined-cycle plants

C.1 Introduction

This annex provides assistance and technical information to be used in the procurement of combined-cycle plant systems and their auxiliaries employing gas turbines covered by this International Standard.

This annex applies to unfired combined-cycle power plants only and includes new units, the retro-fitting of a new steam cycle to existing gas turbines, or the repowering of existing steam plant boilers with one or more new gas turbines. With suitable adjustments, it may also be used as a general guideline for combined-cycle plants with supplementary firing or other cycle configurations.

C.2 Basis in the standards

There is no general standard yet available covering the entire combined-cycle field. Current standards for the main components are to be applied wherever pertinent.

In some cases, combined-cycle plants may not conform fully to the provisions of this International Standard. Hence, it is the spirit rather than the letter of these provisions that must be applied.

C.3 Definitions of terms

For the purposes of this annex, the following particular definitions shall apply.

C.3.1 combined cycle: Any system comprising one or more gas turbines (topping cycle) with heat recovery steam generators in the exhaust producing steam for additional power and possibly process heat (steam bottoming cycle).

C.3.2 Thermal cycles

C.3.2.1 unfired combined cycle: A combined thermodynamic cycle in which all energy input is supplied to the gas turbine portion of the cycle (see figure C.4).

NOTE — This cycle is selected for new power generation applications primarily due to its high efficiency and simplicity.

C.3.2.2 steam-injected gas turbine cycle: A combined thermodynamic cycle in which the steam generated is admitted totally or in part into the gas turbine in order to produce additional power and/or to reduce No_x emissions (see figure C.5).

C.3.2.3 cogeneration combined cycle: A combined thermodynamic cycle in which steam is provided to a process at some point along the steam expansion. (See figure C.8.)

NOTE — This cycle may also be referred to as "Combined Heat and Power (CHP) Combined Cycles" when heat is used in the downstream process for purposes of heating.

C.3.2.4 process steam: Steam extracted from the steam cycle for purposes other than power generation.

C.3.3 Equipment

C.3.3.1 heat-recovery steam generator (HRSG): A steam generator that uses the heat contained in the gas turbine exhaust to produce steam at one or more pressure levels.

NOTE — The two main design options are (see figure C.1):

— HRSG with forced water/steam circulation in the evaporator, with a mostly vertical structure;

— HRSG with natural water/steam circulation in the evaporator, with a mostly horizontal structure.

Once-through configuration is also applicable, but so far not yet widely used (not shown in figure C.1).

C.3.3.2 bypass damper: One or more exhaust gas valve(s) or damper(s) that divert the gas turbine exhaust gas form the heat-recovery steam generator to the bypass stack, as one way to enable simple-cycle operation of the gas turbine (see figure C.2).

C.3.3.3 bypass stack: An additional exhaust gas stack installed upstream of the HRSG for use during simple-cycle operation of the gas turbine with the steam bottoming cycle inactive (see figure C.2).

C.3.3.4 selective catalytic reduction (SCR): A NO_x reduction system in which the NO_x in the exhaust gases reacts with injected ammonia to form nitrogen and water.

NOTE — SCR NO_x reduction catalytic converters are located in the HRSG according to the temperature requirements and limitations (see figure C.3).

C.3.4 Cycle or equipment options

C.3.4.1 pressure level (of HRSG): Section comprising at least one evaporator with, if applicable, its associated economizer and superheater.

C.3.4.2 single-pressure steam combined cycle: A combined thermodynamic cycle in which the steam is generated at one pressure level only.

NOTE — This is the simplest steam bottoming cycle (see figure C.4).

C.3.4.3 multi-pressure steam combined cycle: A combined thermodynamic cycle in which the steam is generated at more than one pressure level. (See figure C.6.)

NOTE — This is a more complex steam bottoming cycle applied where economically justified in order to achieve higher plant efficiency than with a single-steam-pressure combined cycle.

C.3.4.4 reheat-steam combined cycle: A combined thermodynamic cycle in which the steam is reheated at some lower pressure during the steam expansion.

NOTE — This cycle is applied in conjunction with multi-pressure steam generation where economically justified to increase plant efficiency (see figure C.7).

C.3.4.5 single-shaft arrangement: An arrangement in which the steam and gas turbine drive one generator common to both. (See, e.g., figure C.9.)

C.3.4.6 multi-shaft arrangement: An arrangement of steam and gas turbines in which each gas turbine and each steam turbine drives its own generator.

NOTE — This arrangement allows connection of more than one GT/HRSG to a single steam turbine.

C.4 Site conditions for the combined cycle

In a combined cycle, the steam cycle utilizes the usable heat contained in the exhaust gas of the gas turbine. Efficient and economical utilization of the exhaust gas heat depends not only on the basic thermodynamics involved but also to a large extent on the specific and proprietary characteristics of the various cycle components.

It is therefore recommended that the purchaser specify his evaluation criteria and requirements and leave the choice of the most appropriate steam cycle and its parameters to the suppliers according to their practice and experience. This could include the type of steam turbine, the choice of single-pressure or multi-pressure steam cycle, the configuration of the steam cycle, and the steam turbine exhaust pressure.

If, however, the purchaser should prefer certain parameters or a particular configuration he shall explicitly specify the same.

The data to be specified by the purchaser are to be defined fully with regard to the boundaries of the cycle and the limits of supply.

If, for some reason, the scope of supply is divided among various suppliers, preference should be given to the following division of work:

— the gas turbine, including bypass stack and bypass damper(s);

— the entire steam cycle, including the heat-recovery steam generator, the steam turbine, the condenser and other components in the steam/water cycle and also the control system. (If no air-cooled condenser is used, the cooling water system may or may not be included within the scope of supply for the steam cycle);

— balance of plant;

— civil work;

— station electrical equipment (switchgear, transformers, cabling).

This split provides for a possible phased construction and later expansion of the simple cycle gas turbine into a combined cycle.

In principle, other divisions of work are also possible, for example:

— the condenser may be considered not as part of the steam cycle but rather either as a separate item of supply or as part of the cooling system;

— the steam turbine may also be considered as a separate item of supply independent of the steam/water cycle.

These arrangements, however, imply that the various suppliers are no longer responsible for the optimization of the whole cycle and cannot take proper account of all the component's specific design parameters. Moreover, definition of the interfaces may become difficult and overall guarantees are not possible.

For evaluation of plant performance the purchaser must clearly and fully define any normal design conditions, site conditions or other specific conditions that differ from ISO standard reference conditions. This applies particularly to the cold end of the steam cycle where insistence upon the standard conditions, if these differ from the actual site conditions, may result in an inappropriate turbine design and, consequently, in off-design operation of the steam turbine.

The energy contained in the gas turbine exhaust gas is determined by the mass flow, temperature and

chemical composition of the exhaust gas. These factors depend on the type of gas turbine under consideration, its load, the type of fuel, the presence of steam or water injection, the pressure losses at the inlet and outlet of the gas turbine, and on the ambient conditions, i.e., ambient temperature, barometric pressure and relative humidity.

Discharge conditions on the steam side vary widely with the condensing system prescribed or selected and with the temperature of the cooling medium. The purchaser shall provide the supplier with the following information regarding the cooling system employed and site conditions.

a) Direct water-cooling (fresh water, sea water): analysis of the cooling water; maximum permissible cooling water flow; cooling water inlet temperature range and design temperature; maximum permissible cooling water outlet temperature; and/or maximum permissible rise in cooling water temperature.

b) Recirculation cooling with a cooling tower (wet, dry or hybrid): atmospheric conditions and analysis of the make-up water.

c) Air-cooling: atmospheric conditions, minimum, maximum and average design.

NOTE — There are often advantages in establishing a basis for reference. The standard reference (for instance for catalogue) conditions at which ISO-power, ISO-efficiency, ISO-heat rate and ISO-specific fuel consumption of the combined cycle are defined, are indicated in C.5.

C.5 ISO standard reference conditions for the combined cycle

C.5.1 Ambient conditions

The ISO reference atmospheric inlet conditions for a combined cycle are the same as those for the gas turbine itself (see 4.1):

— a pressure of 101,3 kPa;

— a temperature of 15 °C;

— a relative humidity of 60 %.

C.5.2 Compressor inlet conditions

The gas turbine inlet filtration pressure losses are supplier specific according to their standard offering. In the absence of supplier data, a pressure drop of 1 kPa between atmospheric pressure and pressure at compressed intake flange can be considered as normal and therefore as a standard value.

Site air quality or specific customer requirements may dictate other values.

C.5.3 Boiler conditions

In establishing ISO standard combined cycle data the values given in table C.1 may be used.

The standard reference condition for the exhaust gas at the outlet from the stack is the pressure corresponding to a static pressure of 101,3 kPa at ground level.

For the purposes of general comparison, the network gas pressure to the gas turbine is considered as meeting the supplier's requirements.

C.5.4 Discharge conditions of the bottoming cycle

Depending on the cooling system prescribed or selected, the following standard reference discharge conditions may be defined:

a) 4,5 kPa and a cooling water temperature of 15 °C: for direct cooling and wet cooling tower;

b) 16,6 kPa for hybrid cooling towers or direct air cooling at ISO ambient conditions.

C.5.5 Make-up water conditions

The standard reference condition of the make-up water for the steam cycle is 15 °C.

C.5.6 Process steam conditions

When cogeneration is planned, the purchaser must provide the supplier with the following information at the specific interface point:

— required mass flows of steam;

— related steam pressure and steam temperatures of total supply of heat;

— condensate return conditions.

Because these depend upon the process, no standard conditions can be defined.

C.6 Ratings

C.6.1 General

The rating of an unfired combined-cycle plant depends on the gas turbine cycle and on the steam cycle and related parameters.

Whenever the gas turbine can be operated independently of the combined cycle, e.g., via a bypass stack, the ratings of the gas turbine in this operating mode shall be as defined in clause 6.

Table C.1 — Boiler conditions

Condition	Unit	Single pressure	Dual pressure	Triple pressure
Pressure losses (gas-side)	kPa	2,5	3	3,3
Pinch point	K	15	10	10
Superheater terminal temperature difference	K	25	25	25
Economizer approach temperature difference	K	5	5	5
Heat losses (percentage of heat exchanged, uniformly distributed)	%	1	1	1
Mass losses:				
without bypass	%	0	0	0
with bypass	%	0,5	0,5	0,5
Boiler feedwater temperature with:				
gas firing (100 % CH_4)	°C	50	50	50
oil firing (fuel No. 2)	°C	130	130	130

The combined cycle rated output, heat rate and the steam produced depend on specific site conditions. Accordingly, the 100 % base-load output from the gas turbine(s) under site conditions is to be selected as the basis for calculating the total electric output. The rating must therefore not be specified unless particular factors (like grid load, etc.) require that the maximum output be limited or supplementary firing of the HRSG be specified or permitted.

C.6.2 ISO standard ratings

The supplier may, for reference purposes, define standard ratings for the combined cycle based on its net output under the standard reference conditions as indicated in C.5.

The net output is understood as the power delivered on the high-voltage side of the main transformer.

The net utilization rate is given by

$$\frac{P_{el} + Q_{out} - Q_{in}}{Q_{cyc}}$$

where

P_{el} is the net electric power delivered to grid, in watts;

Q_{out} is the total heat flux supplied to process, in watts;

Q_{in} is the total heat flux in process return streams, in watts;

Q_{cyc} is the heat flux to cycle based on net specific energy, in watts.

The following definition based on exergy is recommended

$$E_E = \frac{P_{el} + E_q}{E_f}$$

where

E_E is the exergetic efficiency, in watts;

E_q is the net exergy flux of process heat, in watts;

E_f is the exergy flux content of fuel, in watts.

The standard types of fuel and gas turbine operating modes involved (limited to 100 % of the base load) shall conform to clause 6.

No standard ratings can be defined separately for the steam section of the combined cycle alone because gas turbine exhaust gas conditions are not defined by this International Standard.

C.7 Equipment

C.7.1 Standards

Combined-cycle systems are installations combining several different components.

Specific standards applicable for these individual components cover design and materials, etc. Where applicable, reference should be made to these standards when tendering a combined-cycle plant.

C.7.2 Scope of supply

The scope of supply may vary widely depending on purchaser requirements, site conditions and con-

figurations of the steam cycle and the condensing system. A certain minimum scope of supply, however, is necessary to ensure an integrated system that will function as a unit.

A combined-cycle plant shall include, but not be limited to, the following equipment:

— the gas turbine(s) and associated generator(s);

— the heat-recovery steam generator(s) including catalysts (if specified);

— the steam turbine and associated generator (if generator is not common with gas turbine generator);

— the condensing system, including air removal equipment;

— the condensate forwarding system;

— the feedwater storage system, including the feedwater de-aerator (if not combined with the condensing system) and the forwarding system for it;

— the control and protection equipment;

— the piping and valves;

— all equipment needed for adequate combined-cycle start-up and shut-down;

— electrical equipment (transformers, distribution boards, cabling, switch gear, etc.);

— equipment fire protection system.

C.8 Operating conditions of combined-cycle plants

Attention must be paid to operating conditions such as the following specific to combined-cycle plants.

Requirements to be specified by the purchaser shall include but not be limited to the following:

a) black start capability;

b) loading rate under cold and hot conditions;

c) minimum operating load;

d) presence of a bypass stack and damper;

e) dry operation of the boiler (perhaps partially);

f) self-contained operation (spinning reserve with generator breaker open or isolated in "island" mode);

g) local grid requirements (frequency control/range, voltage range, reactive power range);

h) range of temperatures prevailing at the condensing system;

i) range of ambient temperatures prevailing for base-load operation of the combined cycle;

j) any standards that shall be followed;

k) operation mode (base load, two shifts, daily start and stop);

l) equipment cyclic life criteria;

m) special or abnormal modes (load rejection, transient conditions, emergency shut-down);

n) environmental requirements.

Requirements to be indicated by the manufacturer:

a) possible loading rate under cold and hot conditions;

b) restrictions on restarting the plant after a shut-down;

c) minimum operating load;

d) limitations on possible dry operation of the boiler (perhaps partially);

e) limitations, if any, of possible self-contained operation;

f) limitations, if any, of frequency control;

g) limitation, if any, on operation at high condensing system temperatures;

h) any standards that are applicable.

C.9 Control and protection equipment

The control equipment shall include all equipment needed to operate the combined-cycle plant in accordance with the automation criteria defined by the purchaser as given in clause 7.

Appropriate control devices for limiting pressure and pressure changes shall be provided for safe control of system pressure throughout the entire range of combined-cycle operation from start-up to shut-down.

Overpressure safety devices such as pressure-relief valves shall be supplied to protect the system in case of emergencies, e.g., a malfunction of the control devices.

Appropriate control devices for limiting temperature and temperature changes shall be provided for safe control of the system temperature throughout the entire range of combined-cycle operation from start-up to shut-down.

Specific control and protection devices for equipment such as gas turbines, steam turbines, pumps, etc. are

defined in the pertinent standards and are part of the supply.

C.10 Environmental impact

C.10.1 General

The provisions of clause 9, regarding acoustic, thermal and chemical pollution of the atmosphere from the gas turbine and of the site itself shall apply.

In addition, the environmental impact of all other plant equipment shall be treated in a similar manner.

C.10.2 Thermal effects on water

Local laws and regulations may limit the maximum cooling water outlet temperature, the maximum temperature rise caused by the water discharged and the heat load rejected into the river, lake or any other body of water, etc.

They shall be considered when choosing the cooling cycle and its design parameters.

C.10.3 Visible emissions

Local laws and regulations may define stack and/or cooling tower visible emissions.

C.11 Technical information to be supplied in the enquiry by the purchaser

Clause 10 covers the main information to be supplied by the purchaser.

Table C.2 gives information concerning the type of plant the purchaser intends to build, e.g., new combined-cycle units, the retro-fitting of a new steam cycle to existing gas turbines or the repowering of existing steam plant boilers with one or more new gas turbines/HRSG(s).

The provisions below deal with details particular to a combined-cycle plant.

C.11.1 Driven equipment

Unless otherwise stated, the driven machine in a combined cycle is an electrical generator.

C.11.2 Applications

Possible applications of combined cycles include straight condensing operation (generating electrical power only) and cogeneration (with process or district heat).

C.11.3 Scope of supply

The purchaser shall clearly define the scope and limits of supply for the auxiliary systems and/or civil construction. Even when ordering a turnkey power plant in which case most limits of supply and the interfaces between the various systems are within the total scope of supply, external interfaces with other suppliers remain and shall be clearly specified.

C.11.4 Environmental impact

In addition to the provisions of 10.4 c) any special requirements regarding the cooling system, e.g., restrictions on the mass flow of cooling water, the temperature of the water returned, the cooling tower plume, etc. shall be stated. The same provisions also apply to the requirements regarding the make-up water supply and the waste water discharge.

Information shall also be provided with regard to the quality and chemical analysis of the cooling water (particularly, any variations therein with time of day or season, covering as long a period as possible), and with regard to possible use of the water for purposes other than cooling which could affect its quality.

C.11.5 Site details

In addition to the provisions in 10.5 h), the purchaser shall also indicate the cooling system preferred.

C.11.6 Expected duty cycle

C.11.6.1 The site rating of the combined cycle depends on the design ambient conditions, the cooling system prescribed or selected, the off-design operation (based partly on economic factors), process steam requirements (flow, pressure, temperature) and the interaction of all these factors.

The variation of the following site design parameters shall be stated:

— ambient conditions (minimum, normal and maximum);

— economic factors;

— process steam requirements (mass flow, pressure, temperature);

— extreme process steam requirements in relation, where necessary, to ambient conditions or loads;

— requirements of the condensate return system under design and extreme conditions;

Table C.2 — Technical information to be supplied in the enquiry by the purchaser

Information	New unit	Retro-fit	Repower
Site conditions — Temperature/pressure range — Altitude — Plot plan — Water quality availability — Seismic/soil loadings — Space available	X	X	X
Environmental requirements — Exhaust — Noise — Heat rejection restriction — Waste water	X	X	X
Cooling system — Water temperature/temperature range — Water temperature vs. ambient temperature — Water quality	X	X	X
Guarantees required — Performance — Noise — Emissions — Starting/loading — Availability	X	X	X
Control and instrumentation requirements	X	X	X
Fuel specification	X		X
Electrical requirements — Speed/frequency variations, voltage levels — Grid connections	X	X	X
Schedule	X	X	X
Evaluation/optimization — Criteria — Operating profile	X	X	X
Process interface requirements — Steam conditions/profile — Process return conditions: quantity, temperature, quality	X	X	X
Performance of existing equipment			
— Gas turbine exhaust flow, temperature, analysis, energy exhaust flow, temperature, profile exhaust press correction curves		X	
— Steam turbine heat balance machine limitations at inlet and exhaust of each casing (F, P, T)			X
— Generator performance curves capability			X
— Auxiliary equipment			X
Scope of supply	X	X	X
Cycle/equipment preference and requirements	X	X	X
Plant drawings of existing equipment — Plant elevation arrangement — Electrical single-line diagram		X	X

— whether supplementary firing is acceptable and if so, to what degree;

— fuel availability (primary and alternative).

C.11.6.2 Information shall also be provided on grid connections and any operation required to support grid frequency, etc.

C.11.6.3 In cases where the gas turbine is not a part of the scope of supply, the gas turbine exhaust, i.e. chemical composition, mass flow, admissible back-pressure, temperature and temperature distribution shall be specified.

The influence of backpressure changes on the gas turbine performance and the exhaust gas conditions shall be supplied.

C.11.6.4 Details of the interconnection to the process steam load and/or to the district heating system shall also be provided.

C.11.7 Make-up water

Detailed information on the make-up water if different from the cooling water shall be provided.

C.11.8 Auxiliary power supply

The purchaser may define the desired or required features of the auxiliary power supply system.

C.11.9 Standards

The purchaser may specify particular standards (national or international) or other regulations applicable.

C.12 Technical information to be provided by the supplier when tendering

The main aspects are covered in clause 11, where the term "gas turbine" is to be interpreted as referring to the entire combined-cycle plant and the equipment specific to it.

Table C.3 summarizes the main information to be provided by the supplier along with his tender.

Only aspects specific to the combined-cycle plant are dealt with below.

C.12.1 General

Combined-cycle plant gas turbines are not likely to be operated at low loads, yet the expected performance of the combined-cycle plant at the design load of the gas turbines over the specified range of ambient conditions shall be provided by the manufacturer.

The performance of combined-cycle plant at the rating point is to be presented in the form of heat balance.

Changes in ambient air and cooling conditions and variations in the performance of associated equipment affect the output and the thermal efficiency of the plant cycle selected. The tender shall include correction curves to qualitatively show the influence of these changes on the plant performances. Typical curves may be included where available.

The performance of the gas turbine in simple-cycle operation shall be provided according to clause 11 where plant configuration allows for simple-cycle operation (for example single shaft without clutches).

C.12.2 Drawings

Outline drawings of the proposed station layout and principal components together with preliminary foundation loads for the heavy parts shall be supplied.

Cross-sectional drawings of the main components and a process flow diagram shall be supplied.

C.12.3 Environmental protection

At the request of the purchaser, the tender shall include sufficient information on expected or guaranteed emissions from the equipment he is supplying, including emissions of gas or solids from the boiler stacks, emissions associated with the condensing plant (cooling tower, cooling water), noise, vibrations, drain systems (contamination and other problems), etc.

C.12.4 Auxiliary equipment

The power demand and the electrical requirements of the combined-cycle auxiliaries shall be indicated.

The auxiliary consumption is understood as the parasitic losses of the supplier scope of supply.

Table C.3 — Technical information to be supplied by the supplier when tendering

Information	New unit	Retro-fit	Repower
General information	X	X	X
— Description of thermal process			
— Electrical concept			
— Control and instrumentation concept			
— Layout concept			
— Operating concept			
Scope of work	X	X	X
— Scope of supply			
— Limits of supply			
— Exclusions from scope of supply			
— Options			
Performances			
— Acceptance test procedures	X	X	X
— Combined cycle	X	X	X
heat balances			
— Gas turbine			X
exhaust flow, temperature, energy			
exhaust flow, temperature profile			
exhaust pressure correction curve			
— Steam turbine/HRSG		X	X[1]
heat balances			
— Auxiliaries	X	X	X
— Interface data	X	X	X
— Design criteria	X	X	X
lifetime of major components			
performance degradation			
interchangeability of plant components			
maintenance recommendations			
Guarantees			
— Performances			
combined cycle	X		
gas turbine			X
steam turbine/HRSG		X	X[1]
— Emissions	X		X
— Availability of supplied equipment	X	X	X
— Others	X	X	X
Schedule	X	X	X
— Overall project schedule			
Standards	X	X	X
— Standard applied			
— Specifications			
— Comments/exceptions related to customer's enquiry specification and allied standards			
Quality assurance	X	X	X
— Shop inspections and tests			
— Site inspections and tests			
Equipment description	X	X	X
— Description of main system			
— Description of main components			
— Technical data of main components			
— Description of electrical equipment			
— Description of instrumentation and controls			
Civil and building	X	X	X
— Description of building and structures			
— Description of facilities			

1) Only applicable to heat recovery steam regenerators.

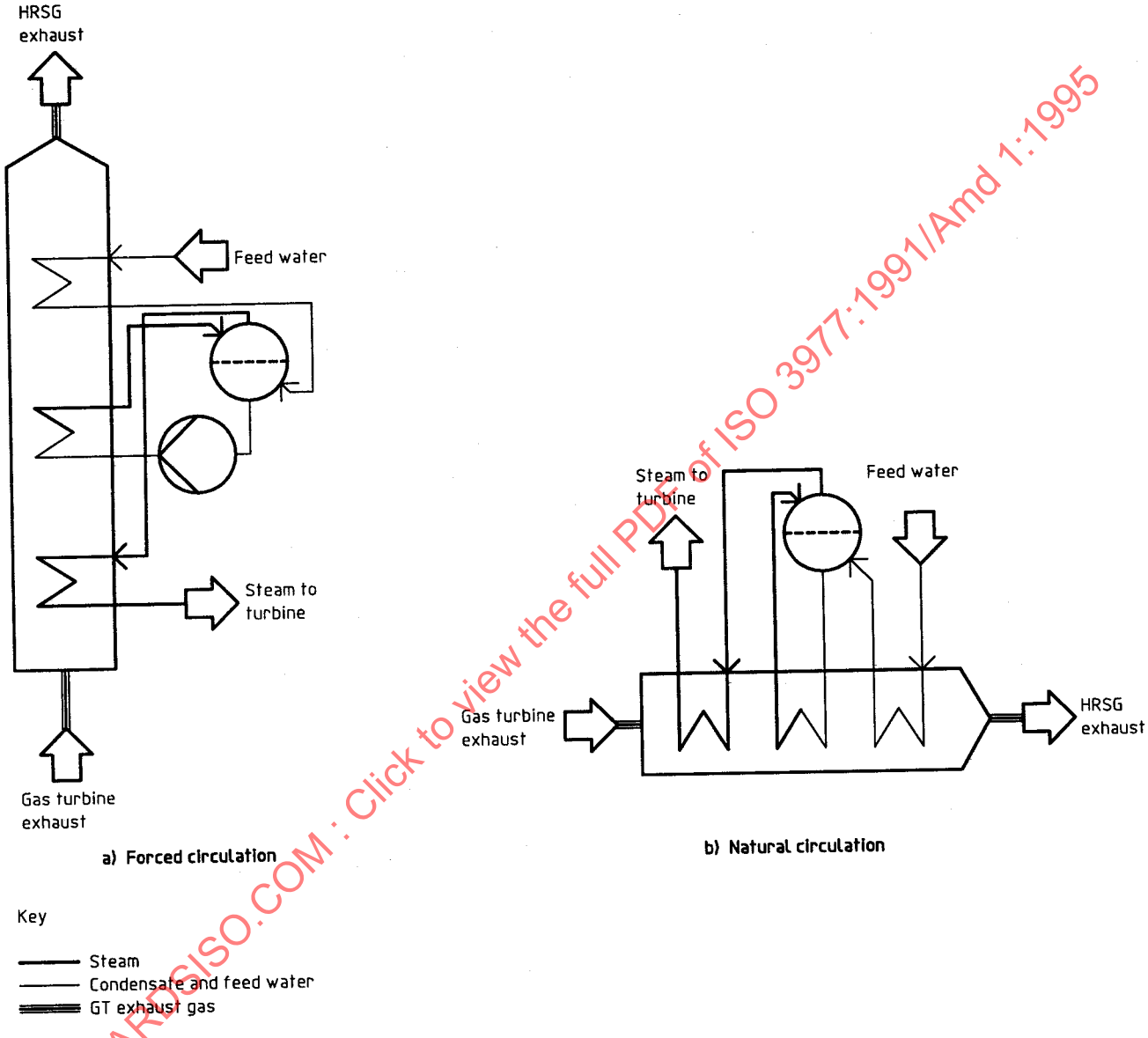


Figure C.1 — Combined-cycle equipment: heat recovery steam generator — Options

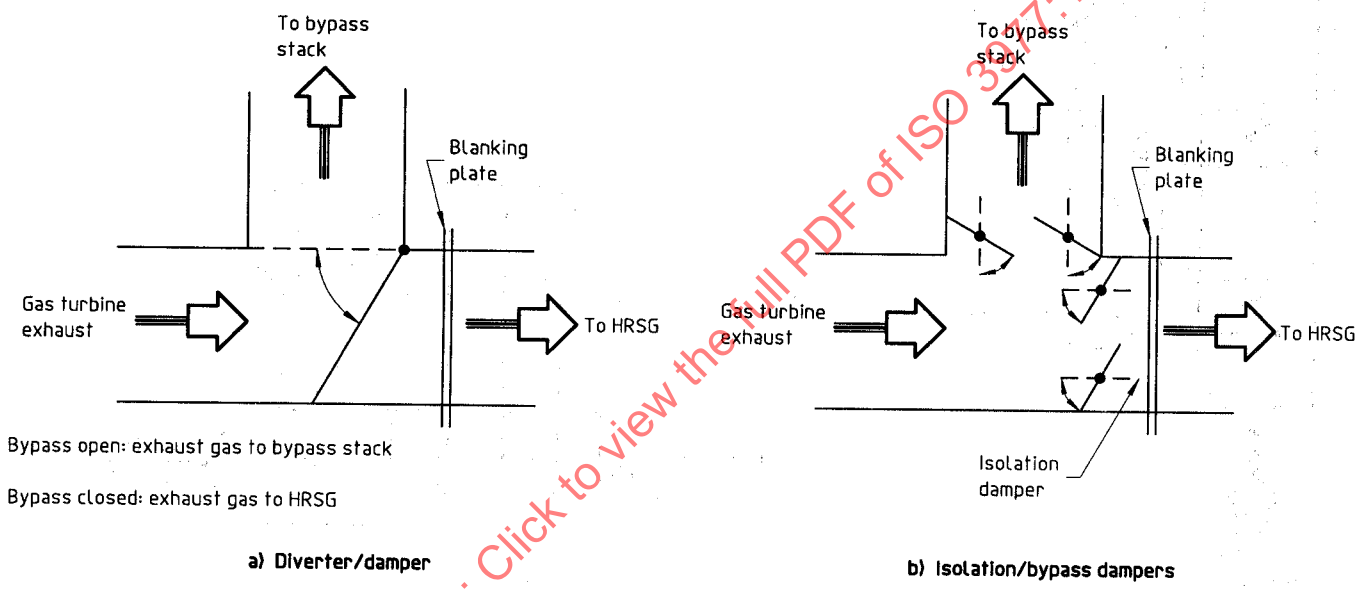


Figure C.2 — Combined-cycle equipment: bypass damper — Options

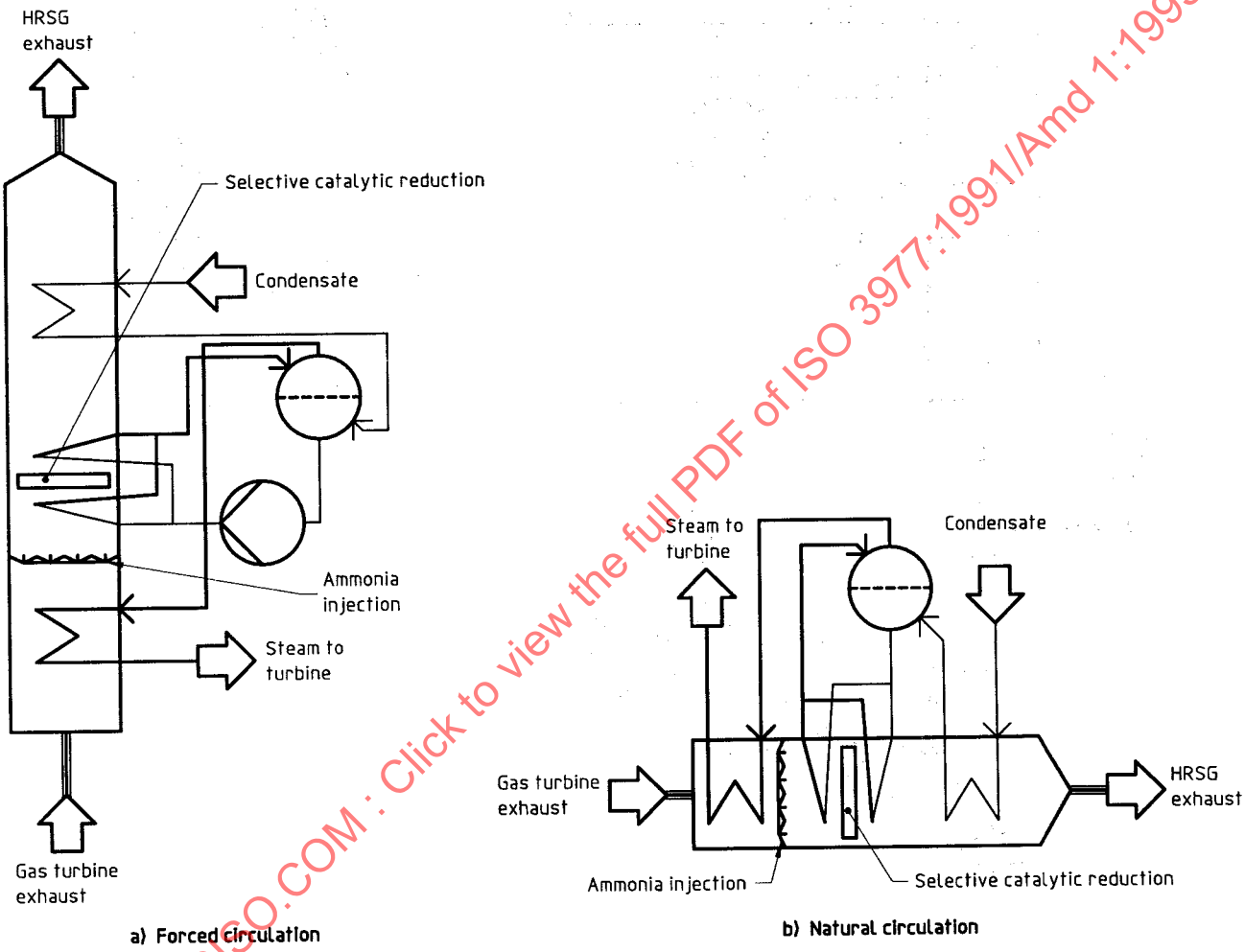
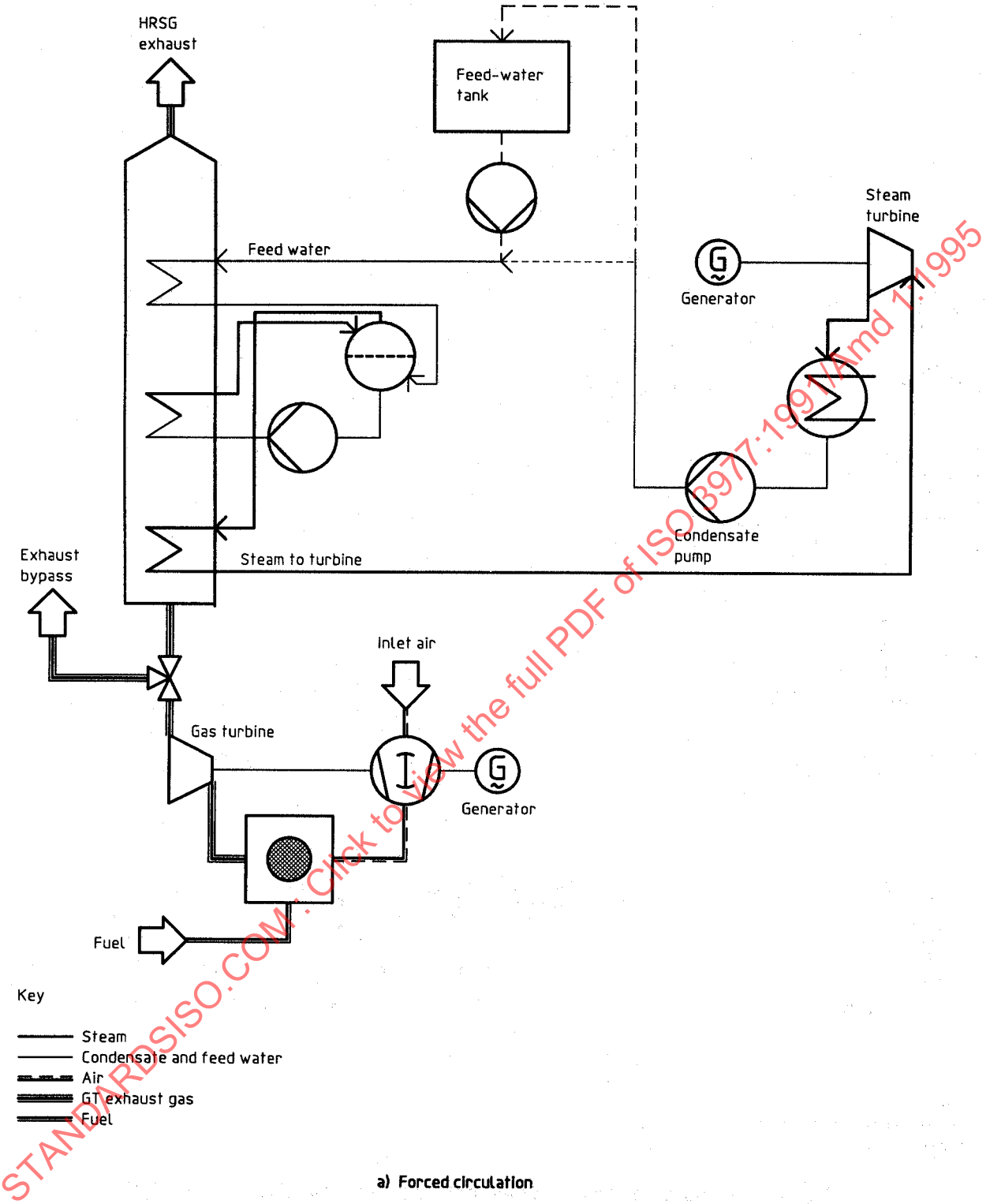
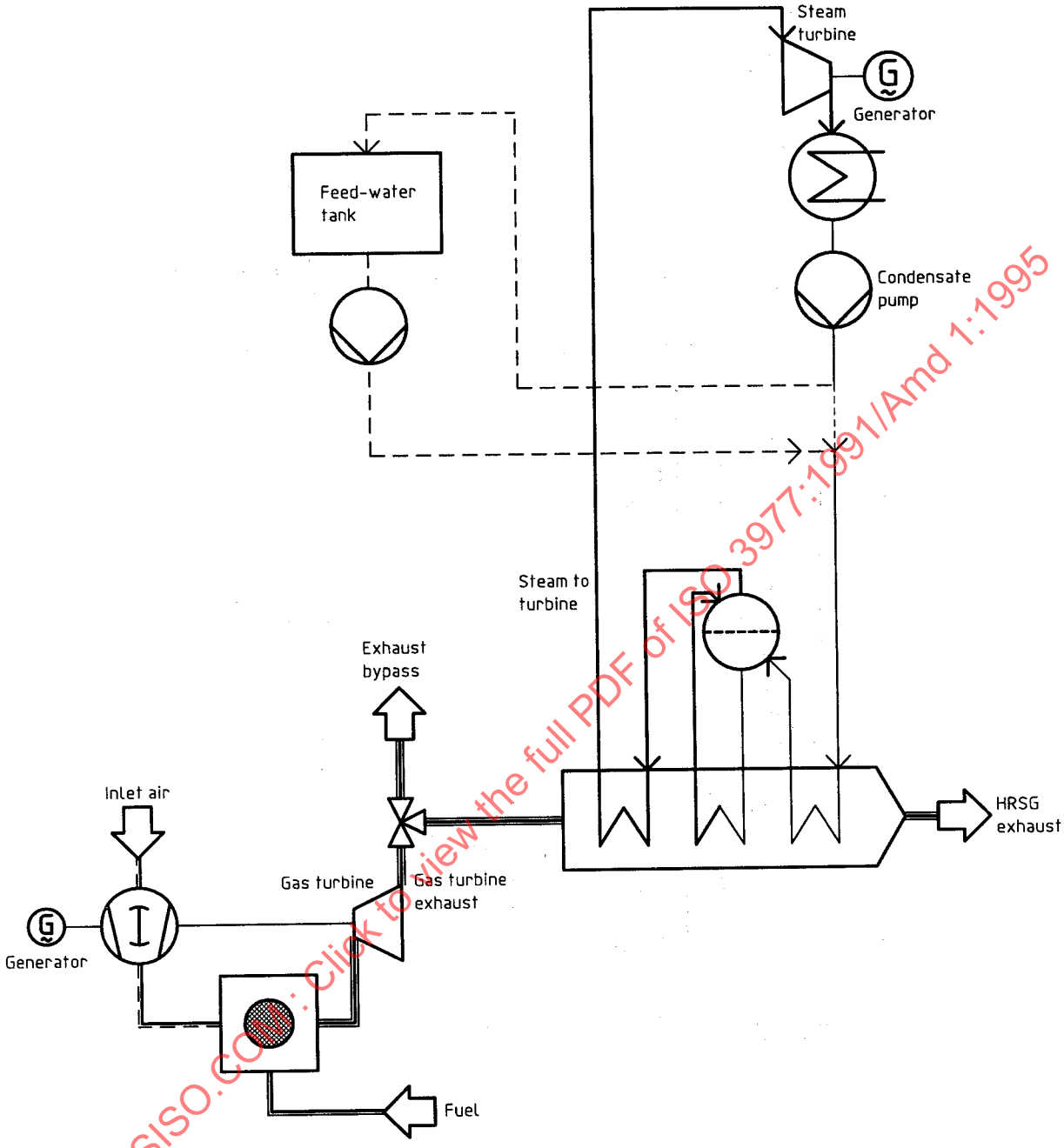


Figure C.3 — Combined-cycle equipment: selective catalytic reactor — Options



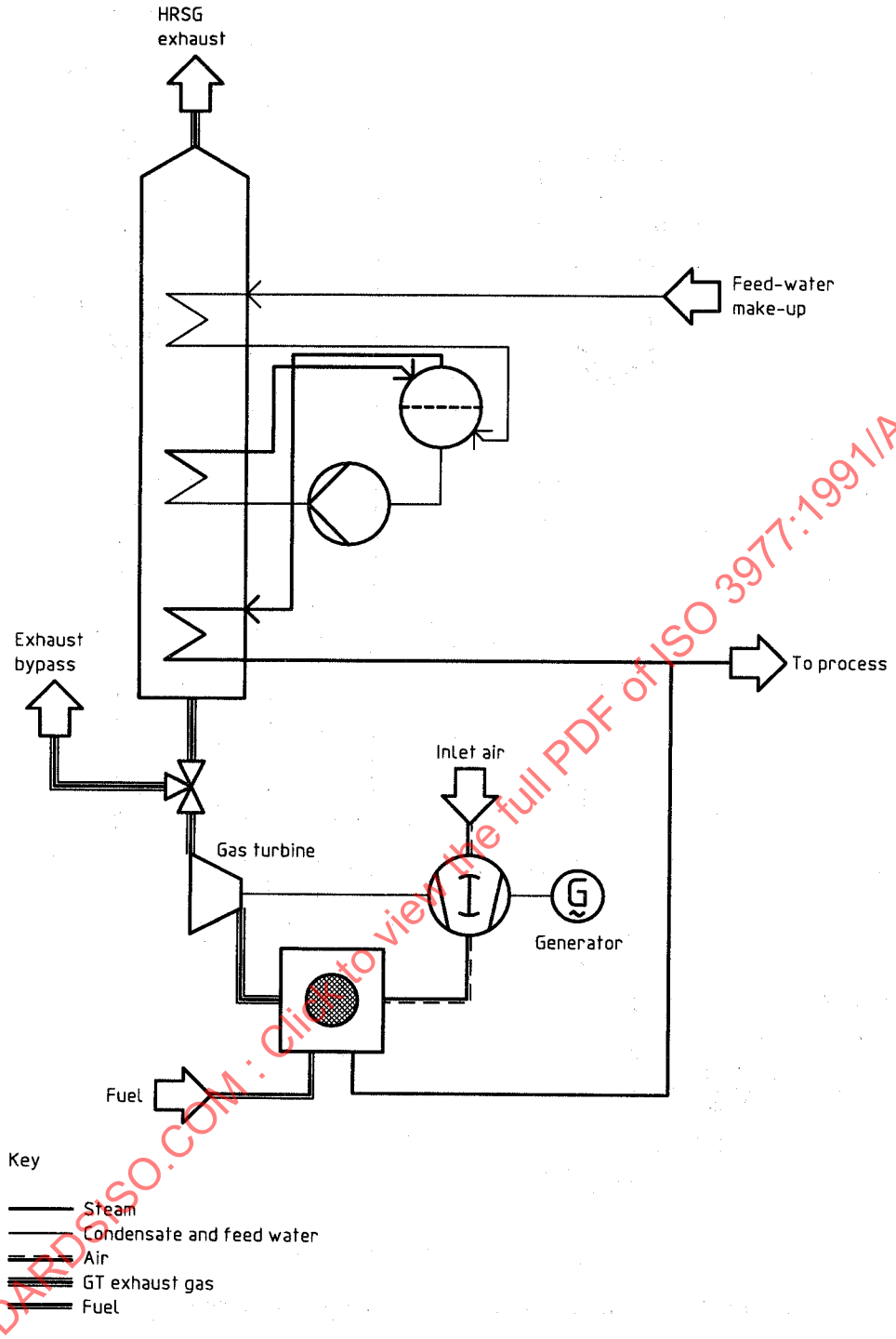
a) Forced circulation

Figure C.4 — Thermal cycles: unfired combined cycle — Options



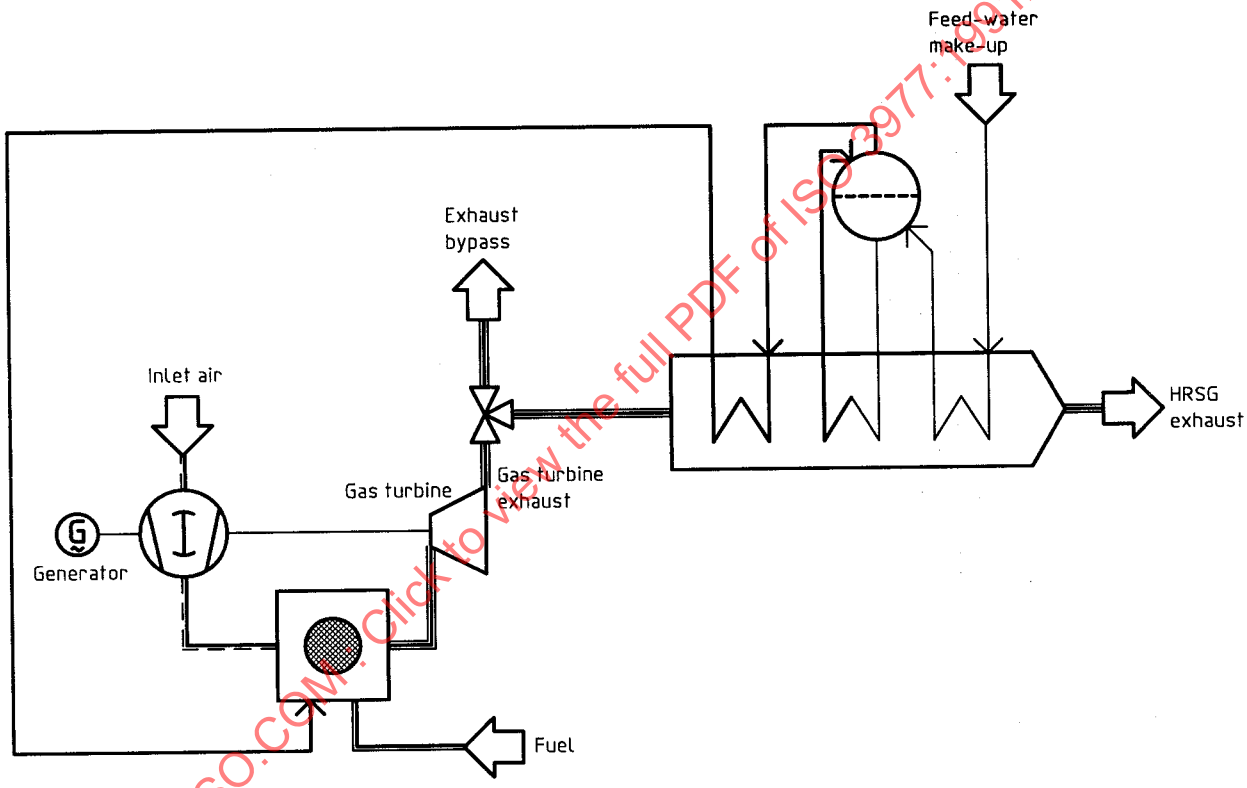
b) Natural circulation

Figure C.4 — Thermal cycles: unfired combined cycle — Options



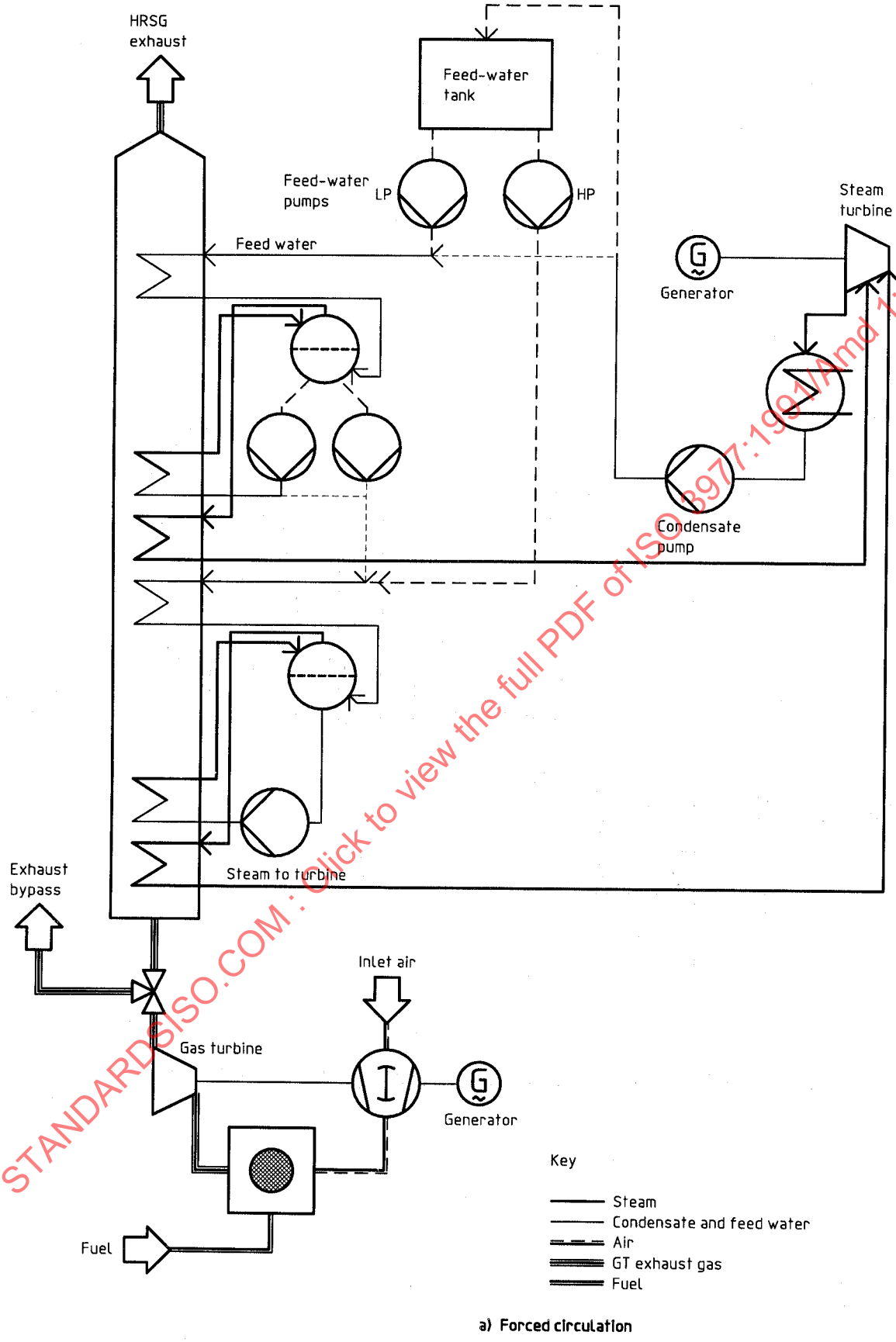
a) Forced circulation

Figure C.5 — Thermal cycles: steam injected gas turbine cycle — Options



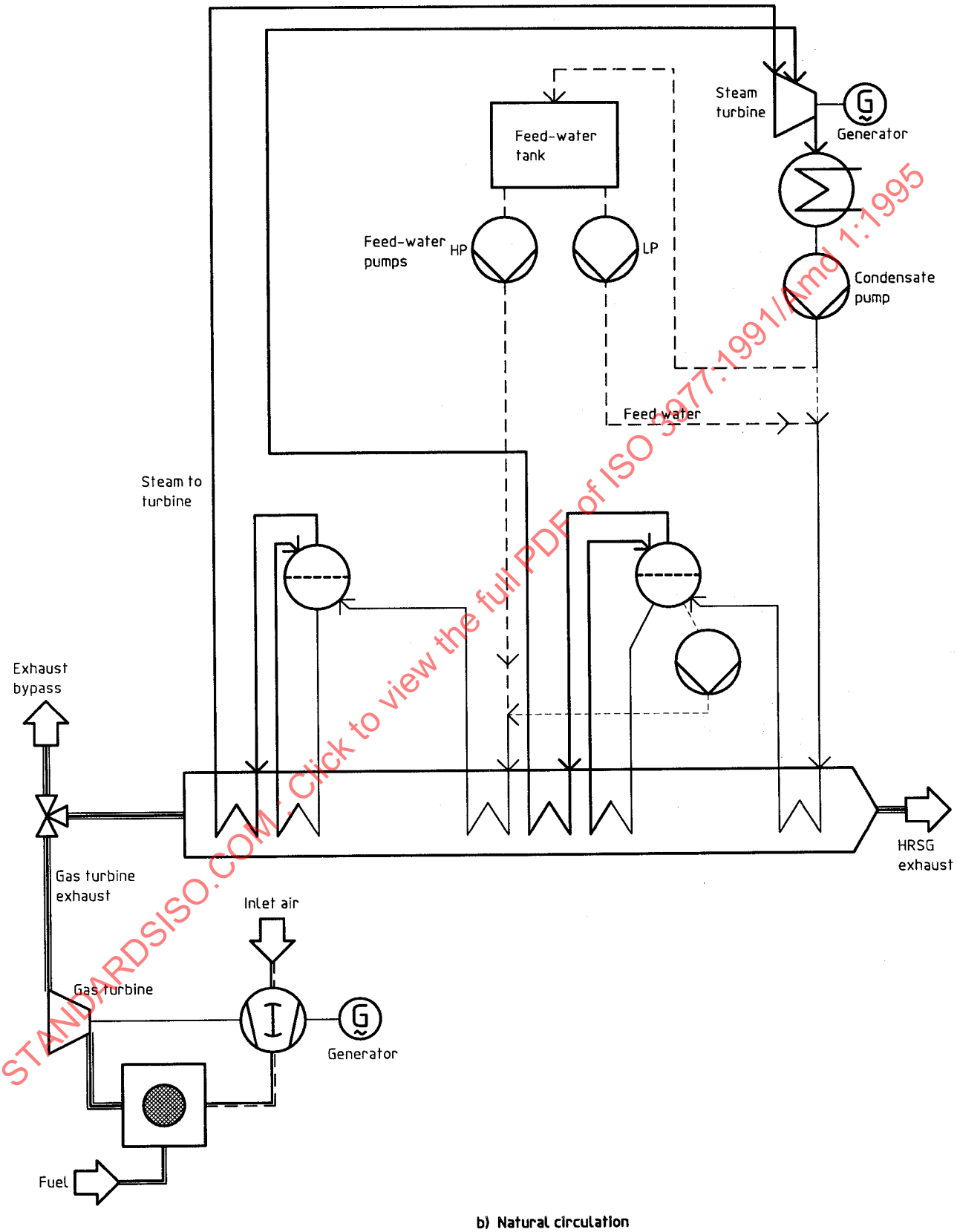
b) Natural circulation

Figure C.5 — Thermal cycles: steam injected gas turbine cycle — Options



a) Forced circulation

Figure C.6 — Equipment/cycle options: multi-pressure combined cycle — Two-pressure HRSG



b) Natural circulation

Figure C.6 — Equipment/cycle options: multi-pressure combined cycle — Two-pressure HRSG

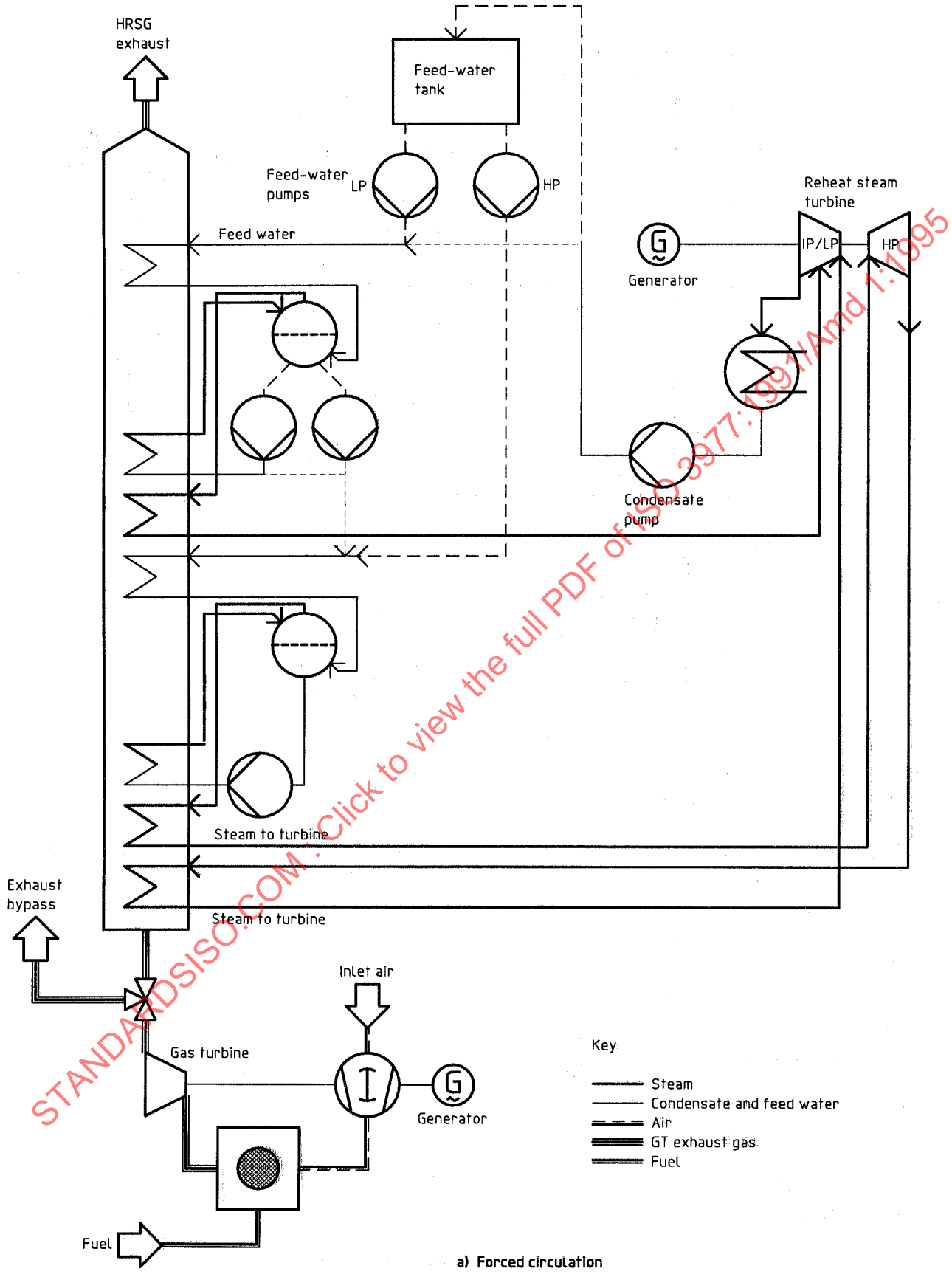


Figure C.7 — Equipment/cycle options: multi-pressure reheat combined cycle — Two-pressure reheat HRSG