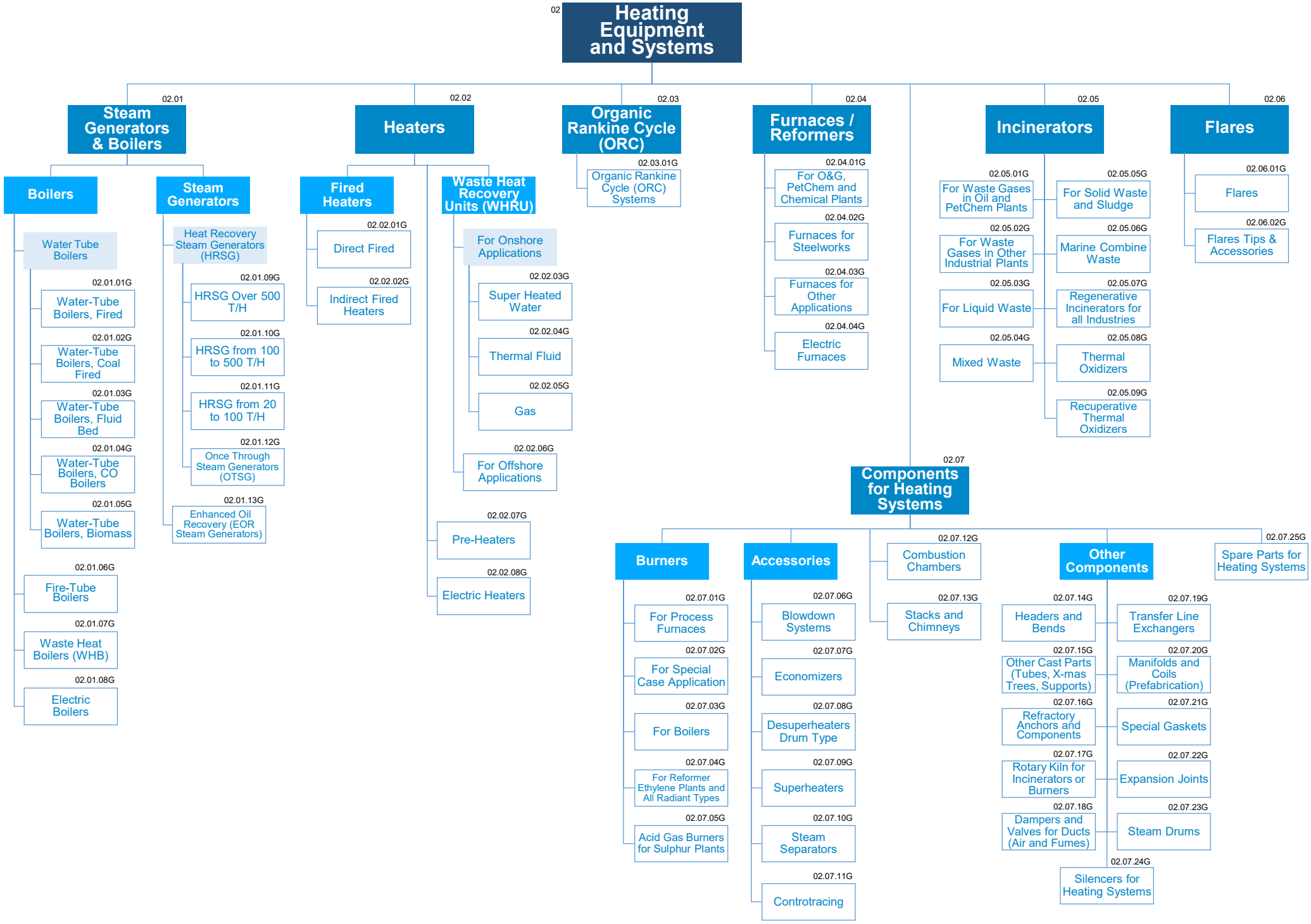

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Heating Equipment and Systems

This category focuses on equipment used for industrial heating purposes. The main industries served by this equipment are the Oil&Gas and Power Generation ones.

The most widespread heating systems are boilers, steam generators (the market is expected to reach an estimated $36.8 B by 2018) and heaters. Their respective heat recovery units (WHB, HRSG and WHRU) are becoming more common too due to the increased efficiency they provide.

Whilst Flares and Incinerators are more for treatment (of flue gas or VOCs) the other categories are all focused on providing heat to (Boilers, Heaters, Furnaces) or recovering heat from (ORC plants) a process.

Main rationales behind the Standard Categorization

On a family level the priority has been given to the different type of equipment, whilst on a category level to the characteristics of the single systems (use, heating/recovery medium and type).

Steam Generators & Boilers

- The most important division to define is that of Steam Generators & Boilers VS Heaters. Steam Generators and Boilers both produce water vapor, whilst Heaters increase the temperature of a thermal fluid (or super-heated water, which due to the high pressure does not vaporize) without actually creating any vapor.
- Fire Tube Boilers: have hot gases inside the tubes and water outside the tubes. It is usually internally fired, and operates under lower pressure. It is not suitable for large power plants.
- Water Tube Boilers: have water inside the tube and hot gases outside the tubes. It is externally fired, and operates under high pressure. It is suitable for large power plants.

Notes:

- While Boilers can be seen as operating at sub-critical pressures, as water actually does reach boiling point, Steam Generators more often operate at super-critical pressures, thus vaporizing water instantly (water changes state without boiling). This will be the distinction followed to differentiate the two systems from each other.
  a. Steam generators = no boiling, water changes straight to vapor
  b. Boilers = boiling is allowed to occur due to sub-critical pressures
- Fire and water tube boilers include all kinds of fuels, whether they are gaseous, liquid or solid. The only separate fuel is biomass as it is quite different from the usual coal, oil or gas fueled types.
- The division among heaters and boilers is based on what has been heated (a direct fired heater will heat either water, thermal fluid or air). In the case of WHBs, HRSGs and WHRUs categorization is based on the source from which we are recovering heat (a WHRU might be recovering heat from super-heated water coming from a turbine process).

Heaters

- The distinction between direct and indirect fired heaters is currently the main differentiating characteristic in the market.
- In the case of Fired Heaters we usually refer to ones built following the API standards.

Notes:

- Direct fired heaters include a various range of products used for different processes including: Hydrotreating, Thermal Cracking, Naphtha Reforming, Dehydrogenation, etc.)
- The Direct and Indirect Fired Heaters categories include the split depending on medium heated: (superheated)water, thermal fluid, air/gas.
- WHR Heaters are considered as a subset of WHR Units.
- 02.02.07G Pre-Heaters includes pre-heaters for (feed)water, thermal fluid and air/gas.

Organic Rankine Cycle Plants

- The Organic Rankine Cycle is a thermodynamic process where heat is transferred to a fluid at a constant pressure. The fluid allows Rankine cycle heat recovery from lower temperature sources such as biomass combustion, industrial waste heat, geothermal heat, solar ponds etc. It is in it's own separate category as it is a specific technology.

Furnaces

- An industrial furnace is a piece of equipment used either to provide heat for a process or to serve a reactor by providing heats of reaction. Design varies as to its function, heating duty, type of fuel and method of introducing combustion air.
- Separating by application of the furnace, is more effective than separating by fuel type. This is because there are larger differences to be noted between furnaces in this categorization.

Notes:

- Furnaces are not to be confused with fired heaters. Furnaces include apparatuses such as Electric arc furnaces, which are used to melt steel. Direct fired heaters are generally not made to reach the heats furnaces can reach and are used for different purposes.

Components for Heating Systems

- This category lists the most used and demanded components for all the previously listed heating systems.

Notes:

- The main add-ons for boilers and steam generators are listed under the 'accessories' family.
- Burners play a major role in furnaces, heaters, boilers and incinerators, which is why they have their own column in the categorization. The use-based distinction was once again chosen to be buyer friendly.
- Combustion Chambers were included due to their use in gas turbines, a major piece of equipment in the Oil&Gas and power generation industries. It is common for them to need replacement, but they are more complex than a simple spare part, therefore they have their own category. They include the various types of build such as can, cannular and annular.
- The 'other components' listed are some of the common forged replacement parts used for heaters, furnaces, incinerators and flares
- 02.07.13G is not limited to the parts listed in brackets; it includes all cast parts that are not mentioned in the neighbouring categories.
- 02.07.19G Special Gaskets and 02.07.20G Expansion Joints refer mainly (but not exclusively) to Desox and Denox plants.
- Spare parts include anything from a replacement part (flange, gasket, door seal, controller, gauge etc.) to insulation coatings.
- 02.07.23G Includes, among others: Exhaust, Vent and Stack Silencers.

Incinerators

- The division by type of waste is based on the fact that the categorization aims to be both vendor and buyer friendly. In this case the choice of categories is buyer oriented. Knowing what kind of waste they need to incinerate, they can find the right incinerators directly.

Notes:

- The difference between regenerative and recuperative in this case refers to the presence of a catalyst. In brief, Regenerative incinerators (02.05.07G) refer to what is commonly known as RTOs and Recuperative thermal oxidizers (02.05.09G) refer to RCOs (catalytic oxidizers).
- This categorization was chosen also because regardless of the type of classification of incinerators the vendor has chosen, it can always be translated to the proposed one. For instance, organic and animal waste (carcasses) would most likely fall under the solid waste.

Flares

- We have chosen not to identify the various types of flares by category as it has emerged that market competition is quite homogeneous, in that each vendor can offer most if not all types of flares (Self-supported, Derrick, Guyed, Ground and Sonic flares).

Notes:

- Also sub-types of the abovementioned flares are included in the single category (e.g Ground flares includes all types of such flares open, enclosed, smokeless, steam assisted, controlled combustion, invisible flaring system, etc.).
- 02.06.02G Flare tips and accessories includes, but is not limited to: Sonic tips, Pilots, Seals, Ignition control systems, Knock-out drums.