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*'Engineers  
of proven  
technology.'*

## Introduction to R&V Engineering

Rodenhuis & Verloop, later R&V Engineering was founded in 1923 as an engineering company, providing consultancy and design services to many industries. Rodenhuis & Verloop got involved in combustion technology in the mid thirties, when internal combustion engines were introduced for railway locomotives and small oil fired steam generators were needed for train heating purposes. After the Second World War, Rodenhuis & Verloop started to develop its own burners and has ever since specialized in the design and supply of burners and associated fuel firing equipment, such as fuel supply systems, burner management systems, control systems, etc.

Early 2004 R&V Engineering b.v. (R&V) took over all business activities from Rodenhuis & Verloop together with the proprietary rights regarding burner technology, design software, drawings, data bases etc. Since February 2008 R&V Engineering b.v. (R&V) is part of the A. de Jong Group and is working together with R&V's sister company De Jong Combustion. Nowadays R&V Engineering b.v. is a leading Dutch supplier of gas and oil burners, offering and selling its products and services to utility companies, oil companies, chemical corporations and other major industries all over the world.

In the general burner market, R&V has specialized in:

- **Supplementary burners and firing systems for waste heat recovery boilers in cogeneration plants.**

To date, R&V supplementary burner references include world-wide more than 350 cogeneration plants

- **Retrofit of existing burners and firing systems, e.g. to upgrade efficiencies, to reduce NO<sub>x</sub> emissions, to increase flexibility by adding alternative fuels, to convert conventional boilers to supplementary fired waste heat recovery boilers, to improve safety and reliability, to automate operation and controls, etc.**
- **Special burners for combustion / incineration of non-commercial fuels (waste fuels, contaminated air or water, sludge, slurries, etc.)**
- **Special burners for low calorific value gases, e.g. blast furnace gases.**

## General introduction to R&V burners

The current generation R&V burner is a multiple fuel burner for gaseous and liquid fuels, specifically designed for high performance long-term free-of-maintenance operation. The burner design incorporates a unique low-pressure air system to atomize liquid fuels and to achieve intrinsic (inherent) gas or oil flame stability (virtually irrespective of combustion airflow conditions such as velocity, pressure drop, temperature, etc.). Basic design and performance features of the R&V burner may be summarized as follows:

- **Dual/multiple fuel firing capability (gas/oil/waste fuels)**
- **Parallel air flow design (no registers required)**
- **Low draught loss**
- **Intrinsic flame stability**
- **Low fuel pressures**
- **Liquid fuels atomized by low pressure atomizing air (no atomizing steam required)**
- **High turndown capability (maximum turndown ratios for R&V gas burners are typically 30:1 or better)**



- **Very low excess air firing**
- **Low NO<sub>x</sub> emissions (The R&V burners can be configured to meet the latest emission requirements world-wide)**

Standard R&V burners have been supplied and commissioned in sizes from 2 MW up to 150 MW heat release per burner.

R&V burner references mainly include following applications:

- **Supplementary fired waste heat recovery boilers (cogeneration plants)**
- **Utility boilers (up to 1500 t/h, 500 MWe)**
- **Industrial boilers (5-200 t/h)**
- **Process heaters**
- **District heating systems (hot water boilers)**
- **Incinerators**
- **Air preheaters**

Features of the R&V burner systems:

- **Economy of operation because of atomizing air application and low excess air firing**
- **Low pressure fuel oil supply system**
- **Suitable for gas, oil and combination firing**
- **Atomizer design with large nozzle diameter avoids plugging and hence no gun cleaning and maintenance required**
- **No air registers required which results in maintenance free burner operation**
- **Proven design based on over 50 years of experience in the field of combustion engineering.**
- **Fuel firing systems in operation on conventional steam boilers, combined cycle units (supplementary firing), CO boilers, incinerators, dryers and cement kilns worldwide.**

## Introduction to R&V supplementary burners

The versatility of the R&V burner design is clearly demonstrated by a wide variety of applications as supplementary burner on fired waste heat recovery boilers in cogeneration plants.

For supplementary firing purposes, the R&V standard type low pressure air atomized dual / multiple fuel gas / oil burner is applied, originally designed for ambient air operation but equally suitable for supplementary firing in low oxygen exhaust gas from gas turbines or diesel engines. This burner design features “intrinsic” flame stability virtually irrespective of oxygen source flow characteristics.

## Burner rating

To date, standard R&V ambient air / supplementary burners have been supplied in following nominal burner ratings (based on Net Calorific Value):

**As ambient air burner:** 2 - 300 MW

**As supplementary burner:** 2 - 220 MW

## Burner arrangement

For supplementary firing purposes, R&V supplementary burners may be arranged either as side wall mounted duct burners or as traditional boiler front burners. The number of burners for a particular application will normally be determined to provide optimum downstream temperature distribution, related to flows, required heat release and available duct / furnace dimensions.

## Suitable fuels

To date, R&V has supplied supplementary burners for following fuel:

- A. Liquid fuels:**
1. Heavy fuel oil
  2. Light fuel oil
  3. Liquid waste fuel (various types)
- B. Gaseous fuels:**
1. Natural gas (various types)
  2. Coke oven gas
  3. Hydrogen
  4. Chemical waste gas (various types)
  5. Blast furnace gas

## Suitable oxygen sources

To date, R&V has supplied supplementary burners for following oxygen source characteristics:

- Types:**
1. Turbine exhaust gas
  2. Diesel engine exhaust gas

**Oxygen contents:** 10 -16 % (vol.)

**Temp. at burner inlet:** 170 - 650 °C

## Turndown ratio

Typical "max" turndown ratios for R&V supplementary burners:

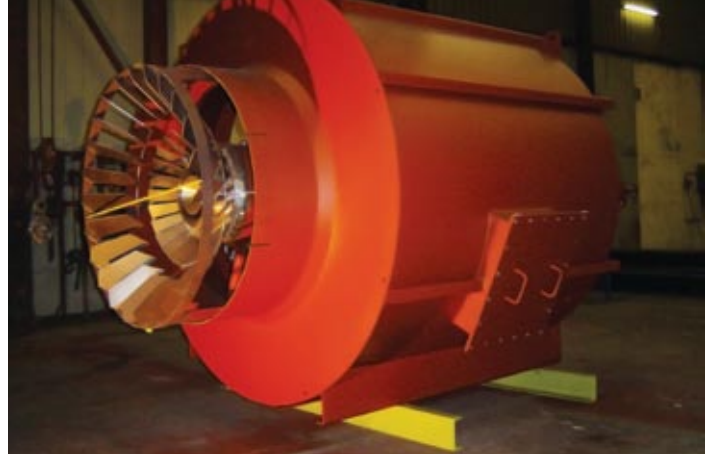
**5:1** for liquid fuels

**15/50:1** for gaseous fuels

The above turndown ratios allow for high waste heat boiler turndown capability without the necessity to shut off individual burners, i.e. without affecting temperature distribution downstream of the burners.

## Draught loss

Draught loss of oxygen source (e.g. exhaust gas) for R&V supplementary burners is typically between 20 and 150 Pa (2-15 mm WG)



at full flow, dependent on system layout and arrangement.

## Supplementary firing rate

R&V supplementary burners do not have any constraint on supplementary firing rate, i.e. these burners are suitable for any downstream temperature level up to temperatures associated with nearly stoichiometric combustion.

## Excess oxygen

R&V supplementary burners in turbine exhaust gas may be operated to rest oxygen levels below 2% (vol. dry) without significant CO emission. Should oxygen contents in turbine exhaust gas be insufficient for boiler heat / fuel demand, additional oxygen may be supplied by a supplementary air system.

## Dual firing mode capability

Due to its design, R&V supplementary burners feature full dual firing mode capability, i.e. either in turbine or diesel exhaust gas or in ambient air (e.g. as back up in case of gas turbine or diesel engine failure). R&V has specialized in dual firing mode systems, featuring automatic changeover while in operation.

## References

To date, R&V supplementary burner references include worldwide more than 350 cogeneration plants.

**A. de Jong Groep**

**A. de Jong Installatietechniek b.v.**

**A. de Jong Installatiebeheer**

**A. de Jong Airconditioning**

**De Jong Thermal Engineering b.v.**

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