1.1 IFAN-PLUS Installation System

The IFAN-PLUS installation system consists of various pipes designed for various fields of application and guarantees a flawless supply of the most precious of all comestibles: drinking water.

Connection Technique using Heated-Tool Socket Welding
When the pipe and the fitting are welded, their plastic materials fuse together to form a homogeneous, firmly bonded whole. Special tools are used to heat up pipe and fitting, which are then just joined together. This connection is reliable and lastingly leakproof.

1.1.1 System Components

1.1.1.1 Fittings

The PP-R-metal connection of the IFAN-PLUS fittings excels by its leakproofness and resistance to torsion. This connection withstands decades of operational loads without any difficulty. Thanks to the specific geometry of their inserts, which are made of high-grade brass, the moulded parts meet the highest safety standards and guarantee safe laying.

The metal threads of the IFANPLUS brass components meet the requirements of the DIN EN 10226 standard and are manufactured from high-quality brass. Moreover, the material complies with the current version of the recommendations (as at 2014) of the Federal Environment Agency on “Materials suitable from a drinking water hygiene point of view”. This guarantees that the limit values of the “Deutsche Trinkwasser-verordnung (TrinkwV 2001)” (German Drinking Water Ordinance) are reliably observed. All IFAN-PLUS fittings are compatible with all IFAN-PLUS pipes (refer to page 8 and following).

1.1.1.2 Pipes and Fittings

All pipes and fittings of the IFAN-PLUS installation system are made of PP-R, with only high-quality raw materials being used. This raw material is equipped with high-grade stabilizers. The stabilizer package protects the polymer from oxidation, which may occur, for example, following long-term exposure to high temperatures > 70 °C and high pressure.

1.1.2 Material-related Guide Values of PP-R

Properties	Measuring method	Unit	Value
Density	ISO 1183	kg/m³	898
Melt Flow Rate 230 °C/2.16 kg	ISO 1133	g/10 min.	0.3
Modulus of Elasticity in Tension (1mm/min)	ISO 527	MPa	900
Tensile Stress at Yield (50 mm/min)	ISO 527	Mpa	28
Charpy Impact Strength, notched (+23 °C)	ISO 179	kJ/m²	25
Coefficient of linear expansion	DIN 53752	mm/mK	0.15
Thermal conductivity	DIN 52612	W/mK	0.24
Pipe surface roughness k		mm	0.007
Specific heat at 20 °C	Calorimeter	KJ/kg K	2.0

1.1.3 Material-related Guide Values of PP-RCT

Properties	Measuring method	Unit	Value
Density	ISO 1183	kg/m³	905
Melt Flow Rate 230 °C/2.16 kg	ISO 1133	g/10 min.	0.3
Modulus of Elasticity in Tension (1mm/min)	ISO 527	MPa	900
Tensile Stress at Yield (50 mm/min)	ISO 527	MPa	25
Charpy Impact Strength, notched (+23 °C)	ISO 179	kJ/m²	40
Coefficient of linear expansion	DIN 53752	mm/mK	0.15
Thermal conductivity	DIN 52612	W/mK	0.24
Pipe surface roughness k		mm	0.007
Specific heat at 20 °C	Calorimeter	KJ/kg K	2.0

1.1.4 Fields of Application

For more than 30 years, polypropylene has been successfully used in supply lines of buildings in many countries worldwide. The combination of such excellent properties as chemical resistance, homogeneous connection, resistance to pressure and easy laying make it a reliable and lasting system suitable for various applications. In many countries it is gradually replacing such traditional materials as copper and galvanized steel.

Properties of IFAN-PLUS

- **Enormous durability** thanks to high-quality materials and processing
- **Homogeneous connection** guarantees high operational reliability.
- **High demands for hygiene** guarantee perfect water quality.
- **Good thermal load capacity,** therefore high operational reliability.
- **High chemical resistance** guarantees high durability.
- **Minor flow noise** makes living highly comfortable.
- **High dimensional accuracy and low weight,** therefore time- and cost-saving pipe laying.

1.1.5 Possible Uses

The IFAN-PLUS installation system fulfils a variety of demands made on supply lines. It is suitable for universal use in:

• New buildings • Refurbishment • Repairs;

in **drinking water installations** for cold and hot water pipes in residential buildings, hospitals, hotels, office buildings, schools, etc., for example:

• Service connections • Boiler connections • Water distributing systems
• Rising lines • Floor-level distribution • Fittings

as well as **piping networks** for:

• Rainwater systems • Outside pipe laying • Compressed air systems • Agriculture and horticulture
• Industries, for example the transportation of aggressive media (acids, alkaline solutions, etc.), taking into account its resistance to chemical agents
• Climate technology • Chilled water technology • Heating installations • Shipbuilding
• Further media and possible applications upon request.

IFAN-PLUS is not suitable for:

• Industrial gases • Flammable liquids and gases • Coolants/Refrigerants

1.2 IFAN-PLUS Pipes

1.2.1 Overview

IFAN-PLUS, the high-grade installation pipe made of polypropylene, **IFAN-PLUS ML5, IFAN-PLUS ML3 and IFAN-UV ML5,** the multilayer fibre-reinforced composite pipes, guarantee reliable, durable and flawless supply in installation systems.

Wall thickness, pipe material and temperature range are the factors that decide the level of the resistance of a plastic pipe system to pressure.

IFANPLUS pipes are available in various wall thicknesses:

	Product range overview IFAN-PLUS pipes												
Diameter in mm	20	25	32	40	50	63	75	90	110	125	160	200	250
IFAN-PLUS SDR 6													
IFAN-PLUS SDR 11													
IFAN-PLUS ML5 SDR 7.4													
IFAN-PLUS ML3 SDR 11													
IFAN-UV ML5 SDR 7.4													

Pipes 20 - 125 mm = socket welding

Pipes 160 - 250 mm = butt welding

IFAN-PLUS

IFAN-PLUS ML5

IFAN-PLUS ML3

IFAN-UV ML5

CALCULATED LIFETIME OF MORE THAN 50 YEARS

IFANPLUS pipes made of PP-R and PP-RCT are manufactured according to DIN EN ISO 15874, EN ISO 21003 and DIN 8077/78 and fulfil their quality requirements.

1.2.2 IFAN-PLUS

The traditional IFAN-PLUS mono-pipe is made of PP-R.

1.2.2.1 Properties of the material

The physical and chemical properties have been chosen to meet the specific demands of drinking water systems. Regular testing by in-house and external monitoring guarantee its suitability for various kinds of application.

1.2.2.2 Specification

Material: PP-R (Polypropylene-Random)

Pipe series: SDR 6 / S 2.5 colour: green with a red stripe SDR 11 / S 5.0 colour: green with a blue stripe

Classification of operational conditions: application class according to EN ISO 15874

- SDR 6: class 1/10 bar, class 2/8 bar
- SDR 11: class 1/6 bar, class 2/4 bar

Info: Explanation on SDR and operational conditions see page 39/40.

Coefficient of linear expansion: α 0.15 mm/mK

1.2.2.3 Advantages

- Homogeneous connection
- Quick and easy assembly
- Resistance to corrosion
- Neutral in taste and odour
- Smooth pipe inner surface
- Good heat and sound insulation properties

1.2.3 IFAN-PLUS ML5

The IFAN-PLUS ML5 pipe represents a milestone in PP-R development. A 5-layer fibre pipe made of PP-R with glass fibre and the PP-RCT material.

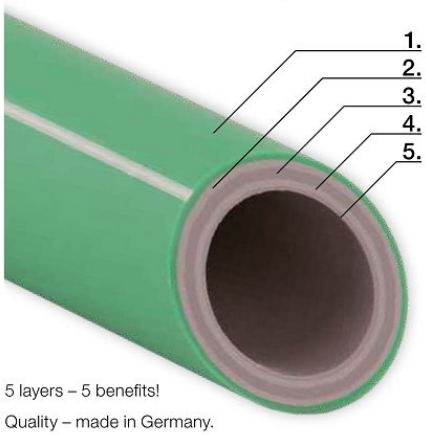
1.2.3.1 Properties of the material

PP-RCT: Polypropylene random copolymer with modified crystalline structure and increased resistance at elevated temperature. This material represents a new generation of the tried and tested PP-R material. Especially with higher temperatures, the increased crystallinity of PP-RCT provides an improved creep-depending-on-time behaviour under internal compression.
PP = polypropylene
R = random
C = crystallinity
T = temperature

This is why pipes made from this material can have thinner walls and consequently larger inner diameters. Designers and plumbers are offered convincing advantages from this circumstance. Thanks to the larger inner diameter, the hydraulic capacity of the pipes increases, which is specifically advantageous in systems that need to transport large amounts of water, for example in high-rise buildings.

Pipes made of PP-RCT are accepted according to the EN ISO 15874 standard and the EN ISO 21003 standard on multilayer pipes, and represent the state of the art. The same well-tried connection technique is used for pipes and fittings made of PP-RCT as for PP-R pipes.

1.2.3.2 Distribution of layers



5 layers – 5 benefits!
Quality – made in Germany.

1. Exterior PP-R layer
The exterior layer made of high-grade PP-R provides the colour code and guarantees flawless and reliable welding of pipe and fitting.

2. Second exterior layer made of HPCE, a special IFANPLUS compound material
This PP-R glass fibre compound material has been specially developed by IFANPLUS Polymer Engineering and repre-sents the result of many years of research in this field. The perfect connection of glass fibre and PP-R provides excellent linear expansion, deformation properties, as well as good resistance to impact loads at low temperatures.

3. Central layer made of PP-RCT
PP-RCT is a polypropylene random copolymer with a modified crystalline structure. This material improves the long-term behaviour during longer operational periods, particularly, at increased temperatures.

4. Second inner layer made of HPCE, the special IFANPLUS compound material
This layer also provides excellent properties, such as linear expansion, deformation and good resistance to impact load at low temperatures.

5. Inner layer made of PP-RCT
In the same way as the central layer, this layer guarantees improved long-term behaviour during longer operational periods at increased temperatures. Smooth pipe inner surfaces prevent sediments and incrustations.

1.2.3.3 Specification

Material: PP-R / PP-GF / PP-RCT / PP-GF / PP-RCT

Pipe series: SDR 7.4 / S 3.2 colour: green with silver stripe

Classification of operational conditions: application class according to EN ISO 15874
- SDR 7.4: class 1/8 bar, class 2/8 bar

Info: Explanation on SDR and operational conditions see page 39/40.

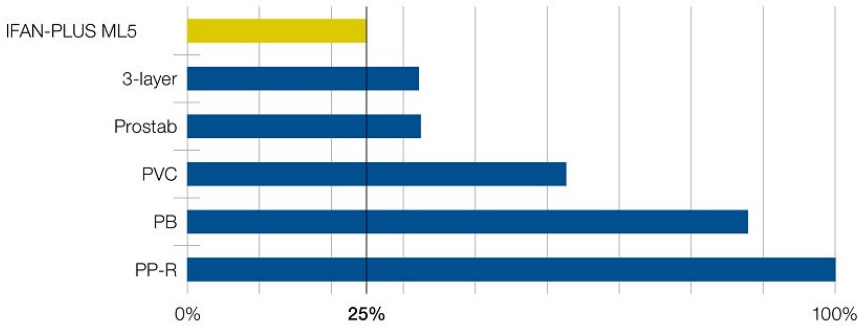
Coefficient of linear expansion: α 0.038 mm/mK; tested and approved by a third party: OFI Institute, Vienna

1.2.3.4 Advantages

- **Lower linear expansion** reduced by 75% as compared to a PP-R standard pipe
- **Improved resistance to internal pressure** at increased temperatures as compared to a PP-R standard pipe, thanks to the PP-RCT material
- **Increased stability** allows longer distances between the fastening points
- **Increased flow rate** increased by approximately 16% thanks to thinner walls at unchanged dimension and pressure strain
- **Higher resistance to impact loads** – special compound materials increase the resistance to impact loads
- **Good chemical resistance** thanks to the PP-RCT material

1.2.3.5 Comparison of Linear Expansion

This comparison distinctly shows the linear expansion caused by temperature changes of a standard PP-R pipe and the IFAN-PLUS ML5 pipe.
Linear expansion reduces by 75%.



Comparison of linear expansion values

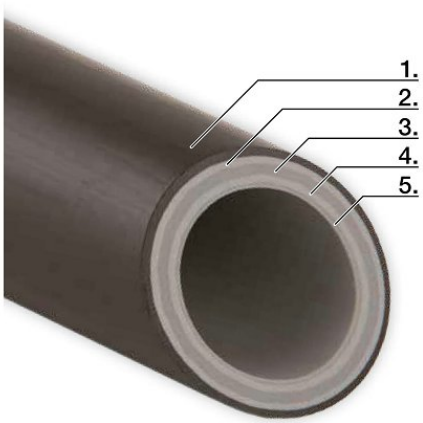
1.2.4 IFAN-UV ML5

The IFAN-UV ML5 pipe is a further development of the IFAN-PLUS ML5 pipe.

1.2.4.1 Properties of the material

The pipe structure has been adopted from the IFAN-PLUS ML5 pipe, only the exterior layer has been modified. Thanks to this UV resistant layer, this pipe is particularly suitable for laying of supply lines in outdoor areas, for example, in drinking water systems, irrigation systems, heating and cooling water systems.

1.2.4.2 Distribution of layers



1. Exterior PP-R UV layer
The first layer provides UV protection and is made of specially stabilised PP-R to make the pipe highly reliable and resistant to ageing caused by UV radiation.

2. Second exterior layer made of HPCE, the special IFANPLUS compound material
This PP-R glass fibre compound material has been specially developed by IFANPLUS Polymer Engineering and represents the result of many years of research in this field. The perfect connection of glass fibre and PP-R provides excellent linear expansion, deformation properties, as well as good resistance to impact loads at low temperatures.

3. Central layer made of PP-RCT
PP-RCT is a polypropylene random copolymer with a modified crystalline structure. This new material improves the long-term behaviour during longer operational periods, particularly, at increased temperatures.

4. Second inner layer made of HPCE, a special IFANPLUS compound material
This layer also provides excellent properties, such as linear expansion, deformation and good resistance to impact load at low temperatures.

5. Inner layer made of PP-RCT
In the same way as for the central layer, we guarantee improved long-term behaviour of this layer during longer operational periods at increased temperatures. Smooth pipe inner surfaces prevent sediments and incrustations.

1.2.4.3 Processing

The pipes are installed using the existing fittings programme, without any additional operations.
The IFAN-UV ML5 pipe can be welded directly, with no need of peeling off the outer layer.
Thus, pipes and fittings can be installed in the usual simple and safe way.

The fittings of the IFAN-PLUS product line using the green colour are not long-term resistant to UV light. Suitable measures need to be taken separately to protect them.

1.2.4.4 Specification

Material: PP-R UV / PP-GF / PP-RCT / PP-GF / PP-RCT

Pipe series: SDR 7.4 / S 3.2 colour: black

Classification of operational conditions: application class according to EN ISO 15874
- SDR 7.4: class 1/8 bar, class 2/6 bar

Info: Explanation on SDR and operational conditions see page 39/40.

Coefficient of linear expansion: α 0.038 mm/mK;
tested and approved by the external OFI Institute, Vienna

UV-RESISTANT

1.2.4.5 Advantages

- **10 years of warranty** on resistance to UV radiation has been tested by a third party
- **No additional operations required** – usual and safe homogeneous welding of pipe and moulded part
- **Low linear expansion** – reduced by 75% as compared to a PP-R standard pipe
- **Increased stability** allows longer distances between the fastening points
- **Increased flow rate** – increased by approximately 16% thanks to thinner walls at unchanged dimension and pressure strain
- **Higher resistance to impact loads** – special compound materials increase the resistance to impact loads

1.2.4.6 Examined Resistance to UV Radiation

The resistance of the IFAN-UV ML5 pipe to UV radiation has been tested by an acknowledged testing laboratory. During the entire test period samples were taken at certain intervals, which were then subjected to strength tests to examine them for possible changes of the material's mechanical properties. At the same time, material stability tests were carried out on a regular basis. The radiation intensity used for these tests was the same as in Aswan / Egypt over a period of more than 10 years.

1.2.5 IFAN-PLUS ML3

The IFAN-PLUS fibre compound pipe represents an addition to the comprehensive product line with larger dimensions starting from 125 mm and using the tried and tested 3-layer technology.

1.2.5.1 Distribution of layers

1. External layer made of PP-R-CT
The outer layer made of high-grade polypropylene granulate protects the pipe from surface damage resulting from mechanical external forces.

2. Intermediate layer made of PP-RCT-glass fibre compound
The fibre reinforcement in the intermediate layer increases the stability and, in combination with the other two layers, provides low deflection, reduced linear expansion, a high load carrying capacity, increased robustness and resistance to pressure.

3. Internal layer made of PP-RCT
Used as material for the internal layer, high-grade polypropylene granulate not only provides for high temperature resistance, but also ensures the pipe's resistance to corrosion, pitting, leaching and mechanical abrasion.

1.2.5.2 Specification

Material: PP-RCT / PP-RCT GF / PP-RCT

Pipe series: SDR 11 / S 5 colour: green

Classification of Operational Conditions: application class according to EN ISO 15874
- SDR 11: class 1/6 bar, class 2/6 bar

Info: Explanation on SDR and operational conditions see page 39/40.

Coefficient of linear expansion: α 0.05 mm/mK

1.2.5.3 Advantages

- Low linear expansion
- Optimal stability
- Minor sagging
- Good chemical resistance thanks to the PP-RCT material
- Improved resistance to internal pressure at increased temperatures as compared to a PP-R standard pipe, thanks to the PP-RCT material

1.2.6 Pipe Labelling

The pipes must be durably labelled in the following way:
Example:

Outer diameter x wall thickness	25 x 4.2
Product name	IFAN-PLUS
Designation of material	PP-R
SDR wall thickness ratio	SDR 6
Pipe series S	S 2.5
Dimensional class according to EN ISO 15874	A
Class of application and admissible operational pressure according to EN ISO 15874	Class 1/10 bar, Class 2/8 bar
Range of use	20 bar/20C, 10 bar/70C
Suitability for drinking water	TW
Impermeability to light	opaque
Product standards	DIN 8077/8078, EN ISO 15874
Certificates, approvals	SKZ A 553
Material labelling	Material
Machine number	Machine
Date of manufacture	DAY MONTH YEAR HOUR:MINUTE
Manufacturer	IFANPLUS

Imprint and order:
25 x 4.2 **IFAN-PLUS**
PP-R SDR 6/S 2.5 A Class 1/10 bar Class 2/8 bar 20 bar/20C 10 bar/70C TW opaque
DIN 8077/78 EN ISO 15874 SKZ A 553 Material Machine Day Month Year Hour:Minute