

## Working Underground



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ProKASRO robots  
open up inaccessible areas

PROKASRO



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### (Our purpose) Working underground

The name of ProKASRO is synonymous with progressive sewer rehabilitation robotic systems. These systems enable the user to safeguard the entire underground supply whilst maintaining ecological, hygienic and technical standards. ProKASRO robots provide entry to inaccessible locations in the sewer network. They enable damage diagnoses and repairs to be carried out without excavation work, traffic obstructions or noise. The short completion times which normally ensue mean that it is usually not necessary to block off the sewer during rehabilitation work.

On acquisition of the company in the year 2000 sewer rehabilitation robots were already being developed and manufactured. The range of products was extended to cater to the continual changes of the market and customer requirements and at present now includes CCTV inspection systems, jetting systems and UV liner systems. New products are developed by ProKASRO while existing systems are subjected to continual further development and comprehensive testing. Each component is manufactured and assembled in the ProKASRO factory thus ensuring that mature systems are subsequently launched onto the market. Short administrative channels and interactive production processes guarantee maximum reliability for our products. We are a medium sized company presently enjoying a healthy expansion which has a worldwide customer base.

### (Our products) Exactly what you need

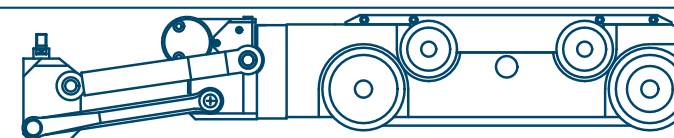
ProKASRO robotic systems consist of individual components which can be combined to enable specific rehabilitation jobs to be carried out. According to model they are suitable for use in the nominal widths of DN100 to DN800 in circular or ovoid profiles. Various tool attachments permit the sewer robots to perform milling, grinding, filling, moulding and injection operations. They can also be used for positioning balloons and installation of top hat profiles and liners for house connections. Rehabilitation work is managed and monitored at the control units installed in the vehicles whereby transportable mobile control units are available on an optional basis.

The extended range of products including items such as UV liner systems and camera inspection systems enable ProKASRO to offer all the products needed for inspection and cleaning, milling, liner installation and rehabilitation, from the begin right up to final acceptance.

### (Our service) ProKASRO is accessible

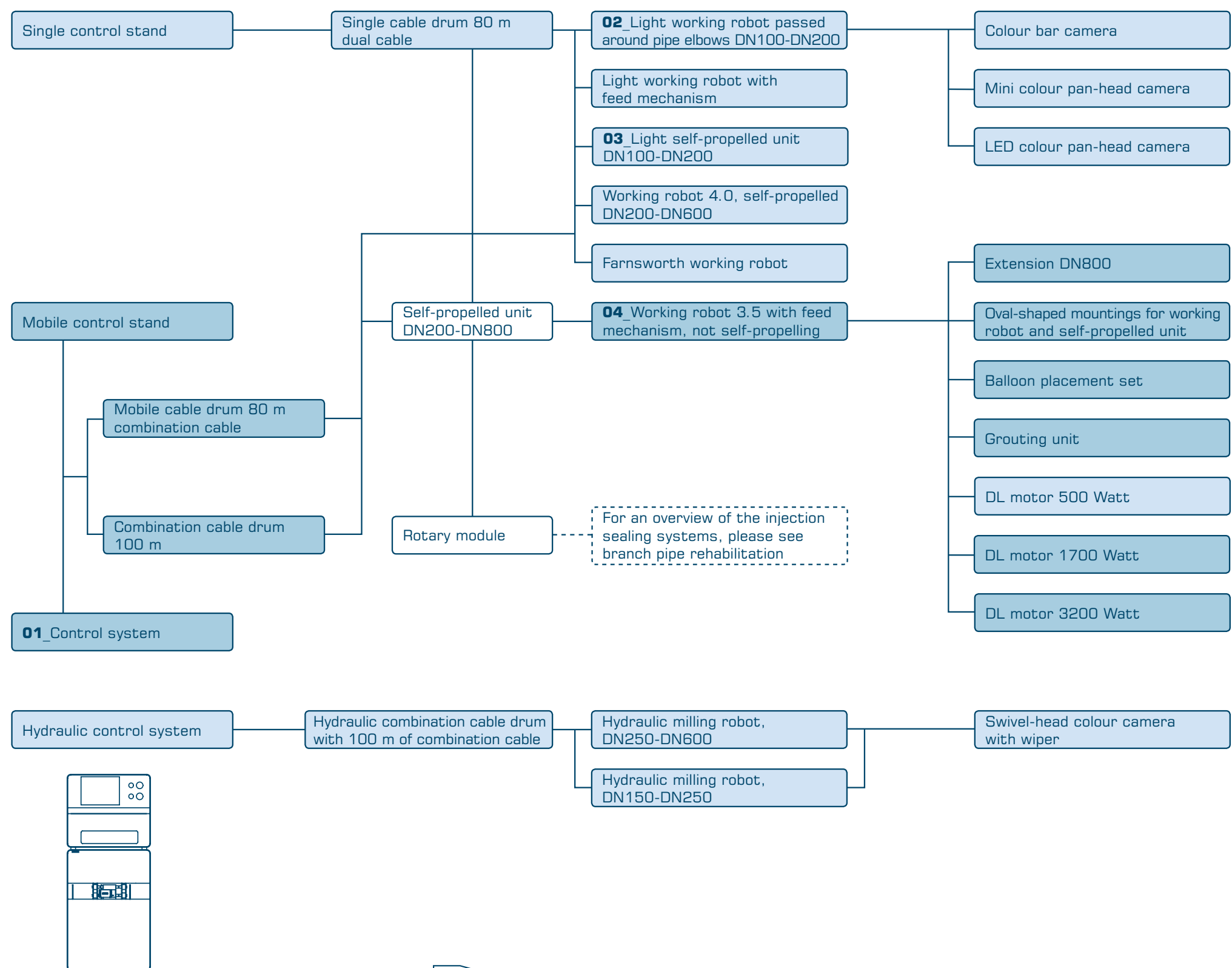
ProKASRO is prepared to visit your construction site to demonstrate the performance capability of our products right where it's needed. Training can be provided for your staff either on site or in the ProKASRO facility in Germany.

A ProKASRO sewer rehabilitation robot is an investment with long lasting benefits. ProKASRO can offer diverse financial models. Please do not hesitate to enquire should assistance be required. In the case of short periods of necessity ProKASRO systems can also be acquired on a leasing or rental contract.





# Robots



### 01\_Control system

In the complete robot assembly, the control system is capable of continuously recording all working parameters of the drive, the working robot and the attached special tools (placement system, injection sealing system, etc.) and displaying them visually on the screen. The operator controls all robot functions and movements manually via the screen image. Important parameters, such as bracing and injection sealing pressures, are displayed and controlled at the pressure gauges. Data such as length of entry, heating power and heating time are displayed visually. Both data and images may be documented and archived as a log on a computer. They may also be printed out for handing over to the customer.

### 02\_Light working robot, bend-capable, DN100-DN200

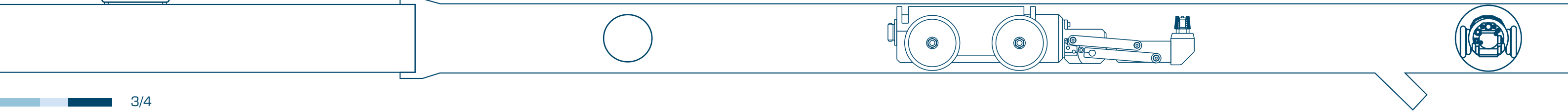
The light, bend-capable KASRO working robot is capable of working in three degrees of freedom: Rotation, forward/reverse and raising/lowering the tool head. All three types of movement may be performed simultaneously at controlled speeds, allowing the robot to work in three dimensions. The self-propelled unit brings the light bend-capable working robot into position. It is mounted as the last component of the working robot and braced with a pneumatic buffer. The tractive force of the drive module can be varied using the pressure of the tension buffer. One active and two passive joints allow the working robot to travel along certain types of bends. When the robot is working, the two passive joints are locked pneumatically. This provides for a centred and stable positioning of the working robot in the pipe.

### 03\_Light self-propelled unit DN100-DN200

The KASRO self-propelled unit is equipped with a cross-bar pressure system. The bars of this system hold the wheels and prevent them from slipping in damaged locations such as pipe fractures. All wheels are all driven which means that the self-propelled unit can circumnavigate obstacles without difficulty.

### 04\_Working robot 3.5 with feed mechanism

KASRO working robots can operate in pipes in four degrees of freedom within the nominal diameters already mentioned: Rotation, feed, raise and lower tool head and tilt tool head. All movements can be performed simultaneously whereby the speed can be regulated thus enabling operation in three dimensions. The self-propelled unit moves the working robot to the work location in the sewer pipe. Once there it is pressed onto the pipe's inner wall using a compressed air operated cushion wedging it in a stable working position. This stable position ensures that the working robot can be operated with great precision.



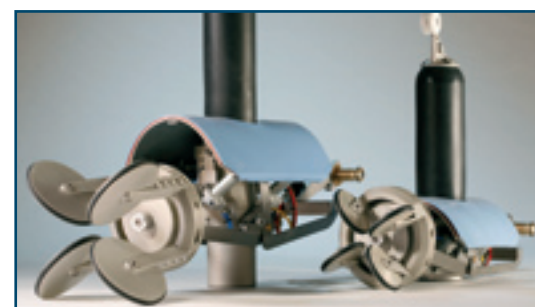




# Branch pipe rehabilitation



- Rotary module
  - Epoxy injection sealing system, DN200-DN600
  - Cartridge attachment (PUR cartridges) for epoxy resin injection sealing system
  - 2K injection sealing system with 2K pump and 80 m 2K hose, DN200-DN600
  - Laminated cap placement system, DN200-DN600
  - Metre cap placement system, DN250-DN600
  - Laminated cap placement system, oval profile, DN250/DN375 to DN500/DN750



## KASRO injection sealing systems

The KASRO injection sealing system is used to seal leaking branch pipe joints with nominal diameters from DN100 to DN200. The flexibility of the balloon enables the sealing of a wide variety of pipe geometries.

The injection sealing system is positioned by a self-propelled unit, a rotation module and a camera. The system is braced in the main sewer with pneumatic cylinders, after which the balloon is inserted into the branch pipe and inflated with air. Then the sealing material is injected. The injection process is monitored with a camera that is integrated in the balloon pot.

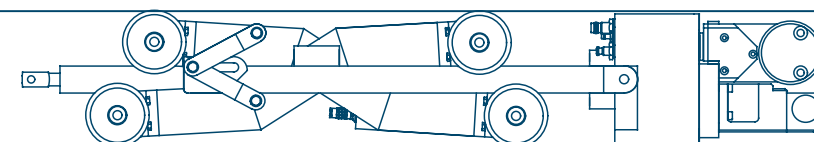
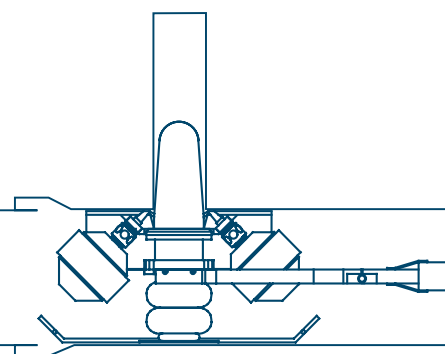
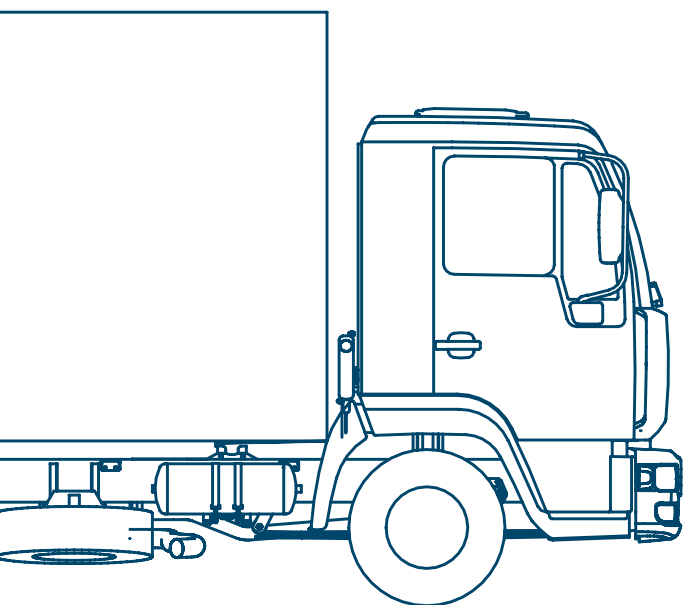
The epoxy resin is pre-mixed by hand in bags, injected into the leak by the injection sealing system and cured with the balloon and plate heater. The material has a limited pot life, and the material quantity is limited.

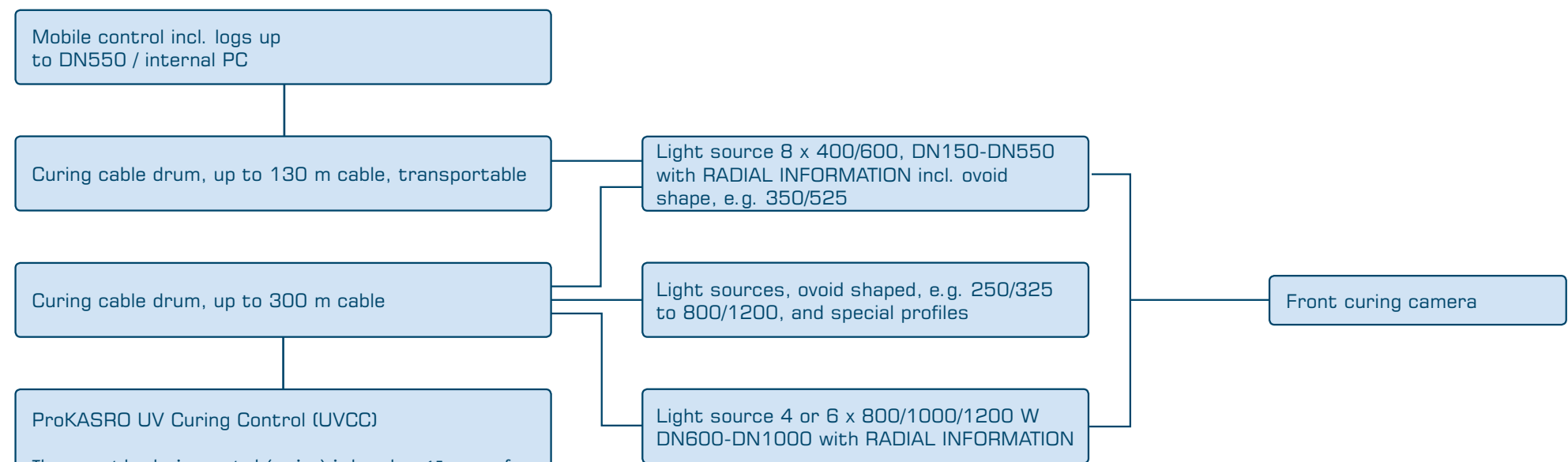
The cartridge attachment for this injection sealing system makes heating unnecessary, since the PUR resin is injected into the leak through cartridges by a static mixer and cures immediately. The material quantity is limited, however.

The 2K injection sealing system allows the direct injection of the material into the leak from 200-litre tanks through a static mixer. The material cures immediately. Since the material quantity is not limited any more, cracks, shards and collars may also be injected with the packer. The mixing ratio, the material quantity and other system parameters are controlled at the flow control unit.

## KASRO cap systems

Similar to the KASRO injection sealing system, leaking branch pipe connections with nominal diameters of DN100 to DN200 can be sealed with a laminated cap. The laminated cap is soaked in epoxy resin. For shorter caps, it is inserted, while for longer caps (1 m) it is reverse-drawn. The curing process is accelerated with the plate and balloon heater.



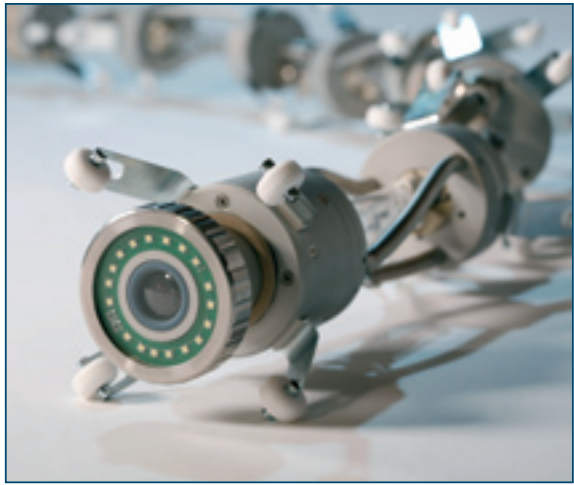


**ProKASRO UV Curing Control (UVCC)**

The current hardening control (curing) is based on 15 years of experience using UV light curing and a large number of different liner materials. It has become increasingly important for engineering offices and local authorities to be able to correctly interpret the log data (such as diameter, wall thickness, profile etc.) which has been recorded on-site. For example it was previously extremely difficult to match the surface temperature values of the light source sensors with the light sources actually used with the specific diameters and the axial positions. The new ProKASRO UVCC contributes greatly to making the displayed and logged data more transparent and thus, more comprehensible.

- Determining the distance of surface sensors to laminate
- Displaying radial and axial position of light source
- Measuring the UV intensity of the spotlights of the light source
- Second UV camera for visually monitoring both directions
- Recording video data and curing data within easy dds (digital documenting system) on installed video PC
- GPRS/GSM remote diagnostics as standard
- Extension of visual monitoring by two cameras

This in turn means that the data – which is of course recorded online – such as liner interior pressure, surface reaction temperatures, radial and axial light source positions, distance travelled in metres, speed, intensity of spotlights, selected spotlight output, selected light source profile etc. are more representative in terms of quality assurance for the customer.



## ProKASRO UV spotlight U600 and U800 / light source technology

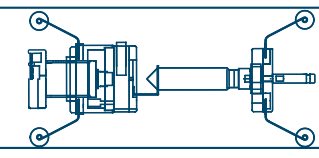
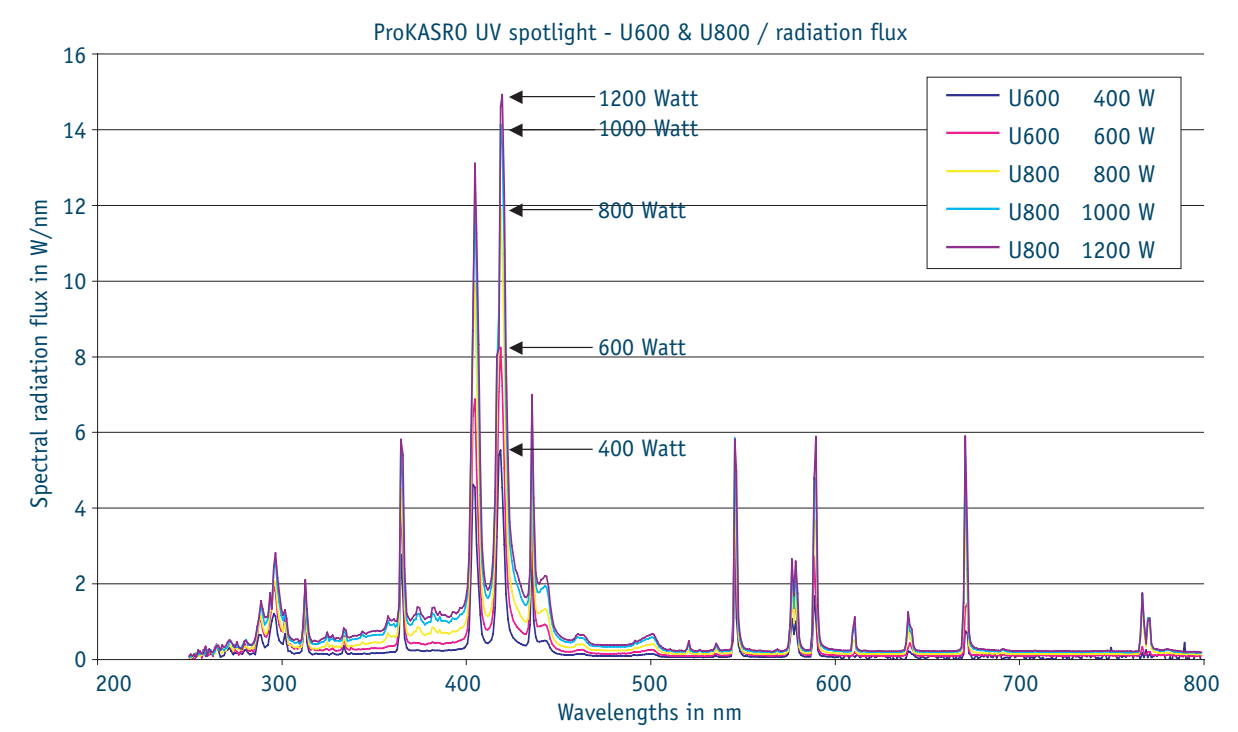
ProKASRO has, together with other recognised UV liner manufacturers and HERAEUS, developed a new generation of UV spotlights which permit optimised polymerisation of UV hose liners, in the range of 400 W to 1200 W. This was enabled by using only two different types of spotlight models (U600 and U800).

### U600 for DN150-DN550

- Output 400/600 W
- Can be used in any conventional light source (power option)
- Spotlight dimensions identical to standard 400 W spotlights
- Curing speed up to 3m/min (DN155)
- Dual-bulb technology (no spectral shift in air flow)
- Long service life

### U800 for DN550-DN1000

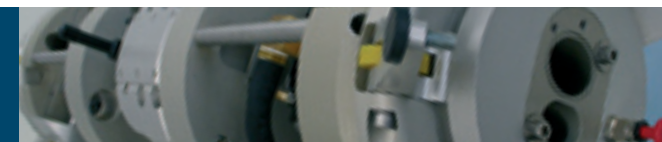
- Output 800/1000/1200 W
- Can be used in any conventional light source (power option)
- Spotlight dimensions identical to standard 1000 W spotlights
- Dual-bulb technology (no spectral shift in air flow)
- High service life
- Designed for ProKASRO special light sources



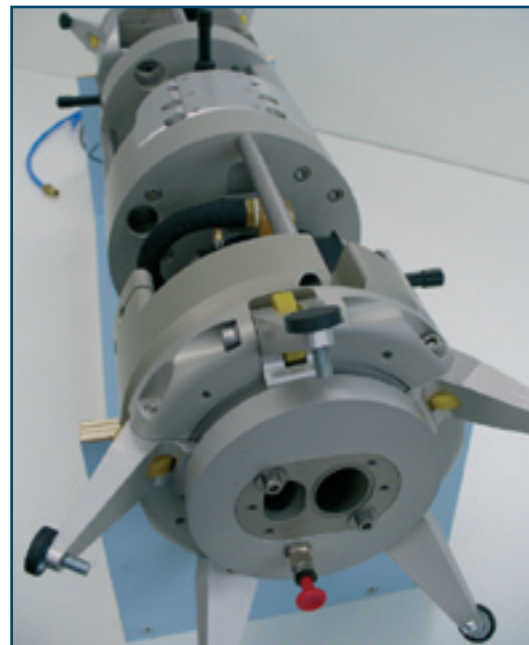




## Special projects



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### Developments and special projects

ProKASRO has been involved over the years not only with the development and production of rehabilitation systems which form the core business, but have also initiated and successfully completed special research and design projects based on the requirements of individual customers and research institutions.

A development project for rehabilitation and re-opening sewer lines within the track bed of railway lines has been recently completed.

After rehabilitation the drainage holes are positioned using a ProKASRO special drill point (3x/6x).

The system is PC-controlled whereby the operating modules are installed on individual cubes which can be lifted onto the rails with a crane.

ProKASRO and the Fraunhofer Institute in Karlsruhe closely co-operate in the field of pipe surface analysis using laser triangulation sensor technology.

A further field of expertise by the ProKASRO company is its research and design work in various projects with companies and public institutions on the topics of ground radar (transparent underground) and controlled inner pipe coating.

