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Launch Bulletin

RICHARD WOLF

spirit of excellence

Pulvis 60+

60 W Thulium Fiber Laser (TFL)

Contents

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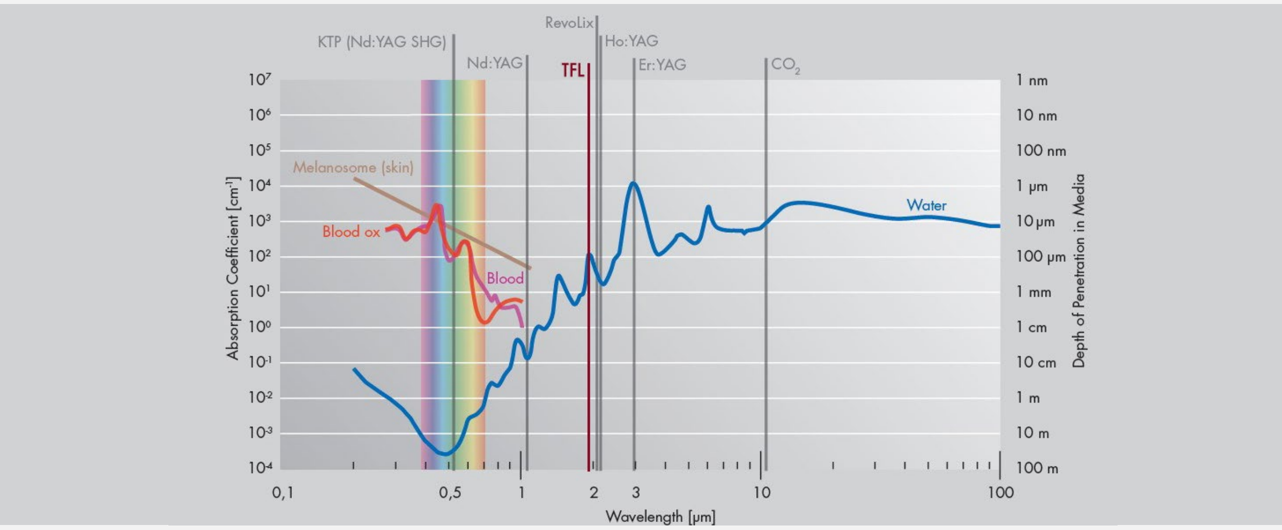
Urological Lasers and Their Wavelengths

Back in 1917, Albert Einstein predicted that light could be aligned and focused in parallel. It was not until 1960, however, that Gordon Gould laid the foundations for making this prediction a real-life technical solution. Nowadays, it is impossible to imagine modern medicine without lasers. The key property of every laser is the individual wavelength of the laser emission. The human eye can perceive wavelengths ranging between approximately 400 nm and 780 nm as visible light. Light with a longer or shorter wavelength is referred to as infrared or ultraviolet radiation.

Modern urological lasers operate in an infrared wavelength range that is close to the absorption peak of water in its liquid state. To reach wavelength ranges of this kind, urological lasers work with rare earths such as holmium and thulium. In a similar way to other rare-earth ions, trivalent holmium and thulium ions have a unique set of emission wavelengths, particularly in the near-infrared region. These wavelengths demonstrate different absorption coefficients of the laser's energy in water, and different ablation effects. This thermal expansion, along with water vaporization, form the main mechanisms that enable the laser emission to trigger ablation.

Holmium:YAG lasers (Ho:YAG) operate at 2120 nm and Thulium:YAG lasers (Tm:YAG) at 2010 or 2013 nm. In this wavelength range, the laser emission is heavily absorbed by liquid water (target chromophore). Furthermore, this interaction with water contributes to the safety profile of medical lasers by limiting the optical penetration depth (0.4 mm).

Potassium titanyl phosphate (KTP) lasers, better known as GreenLight lasers, operate at a wavelength of 532 nm, for example, and have almost no absorption in water. Their target chromophore is blood with a penetration depth of 0.8 mm. In practice, the energy of a green laser beam is completely absorbed by red tissue surfaces (prostate tissue, blood vessels, etc.), ensuring excellent vaporization properties. Due to an almost complete lack of water absorption, side-fire laser fibers must be used in combination with KTP lasers so that damage to the opposite bladder wall is reduced and the laser emission is restricted exclusively to the target tissue.



Overview of the individual laser types based on wavelength and absorption in the target medium

Fundamentals of Lasers

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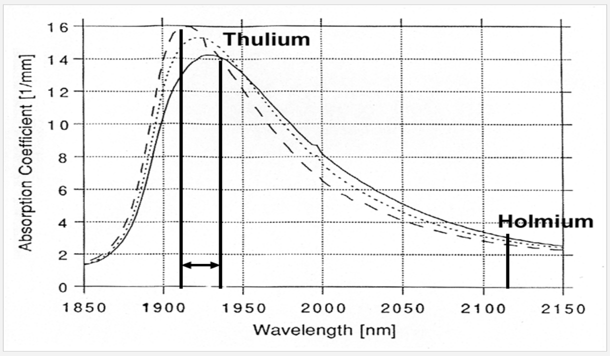
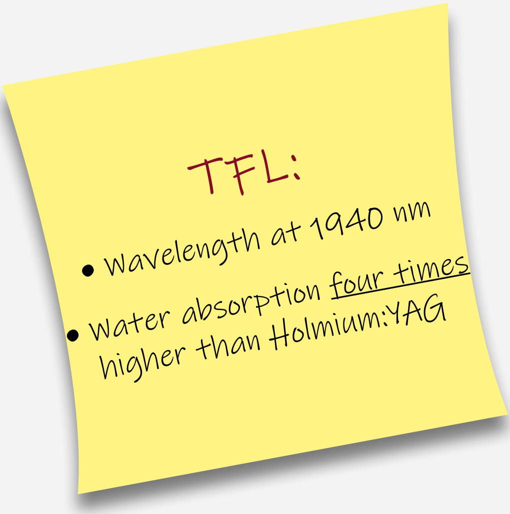
Thulium fiber lasers (TFLs) emit the laser beam at a wavelength of 1940 nm. This wavelength corresponds to the absorption peak of water in the lower and higher temperature ranges. The absorption coefficient of a TFL is around four times as high as that of a Ho:YAG laser and higher than that of a conventional Tm:YAG laser. Therefore, at equivalent pulse energy levels, the TFL is associated with a lower threshold and higher ablation efficiency. The lower tissue and water penetration depth (0.15 mm) is another contributing factor to the laser's safety profile. Additionally, TFLs feature exceptional hemostasis capabilities.



With a wavelength of 1940 nm, TFLs demonstrate a water absorption coefficient that is four times higher than Ho:YAG lasers at 2120 nm

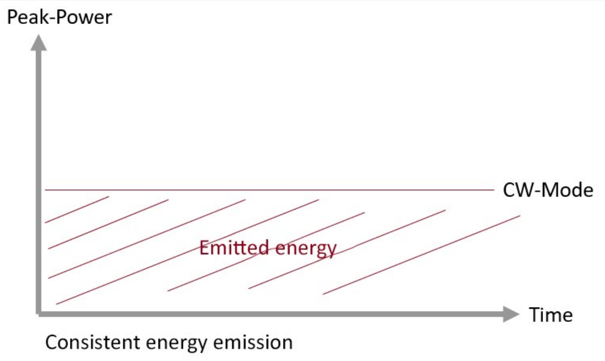


Urological Lasers and Their Pulse Profile

Ho:YAG lasers, Tm:YAG lasers, KTP (Nd:YAG) lasers, and TFLs differ from one another in more than just their wavelengths. The pulse profile of the laser emission is also a key determining factor in which laser should be used for the indication in question. In principle, lasers that were commonly used in the past (Ho:YAG, conventional Tm:YAG, KTP) are relatively easy to distinguish from pulsed Tm:YAG and TFLs. Conventional Tm:YAG and KTP lasers operate using a pure continuous-wave mode (CW mode). In CW mode, the laser is emitted continuously while it is activated. Depending on the power of the laser in question, conventional Tm:YAG and the KTP lasers can achieve a peak power of up to 180–200 W. Due to CW mode, these two laser types can only be used for cutting, vaporizing, and resecting tissue; they are not used in lithotripsy.

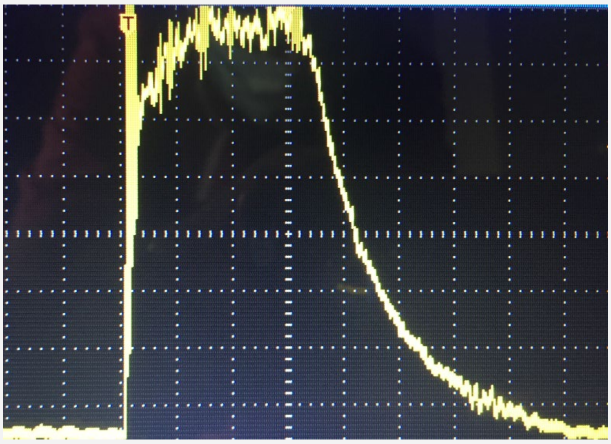
Ho:YAG lasers, however, feature a pure pulsed mode and a peak power between 2000 and 10,000 W – depending on the power of the laser in question (30–150 W). Powerful pieces of equipment, Ho:YAG lasers (60–150 W) were primarily developed for ablative tissue applications such as holmium laser enucleation of the prostate (HoLEP). The pulsed emission and high peak power demonstrated by a Ho:YAG laser creates a gas bubble that is used for tissue ablation and stone fragmentation. The pulse profile of a Ho:YAG laser features an irregular pulse while energy is being released, and its pulse duration lasts between 0.5 ms and 1.3 ms. This means that the Ho:YAG laser generates a very high peak power over a very short period of time – creating a gas bubble and causing the pulse to be immediately weakened again. The strength, duration, and repetition of these individual pulses can be controlled using the laser. However, the peak power during the individual pulses is highly variable. Ho:YAG lasers generate pulse energy between a minimum of 0.2 J and a maximum of 6.0 J, and a maximum pulse frequency of 100 Hz. These different pulse lengths are referred to as short pulses, medium pulses, and long pulses. The pulsed Tm:YAG lasers from OmniGuide (RevoLix HTL) and Dornier (Thulio) also operate using pulsed emissions. In contrast to Ho:YAG lasers, retropulsion is reduced as the peak power is lower. Compared to Ho:YAG lasers, these pulsed Tm:YAG lasers operate with pulse frequencies of up to 300 Hz. Pulsed Tm:YAG lasers cannot be operated in CW mode – it is only possible to change the pulse length and work in long-pulse mode. However, the pulse length is limited to a maximum of 4.75 ms for the RevoLix HTL and 1.0 ms for the Thulio.

In CW mode, the laser is emitted continuously and the gas bubble that is generated is much finer – for cutting, vaporization, resection, and enucleation. This is only possible with conventional Tm:YAG lasers, KTP lasers, and TFLs, NOT with Ho:YAG and pulsed Tm:YAG lasers

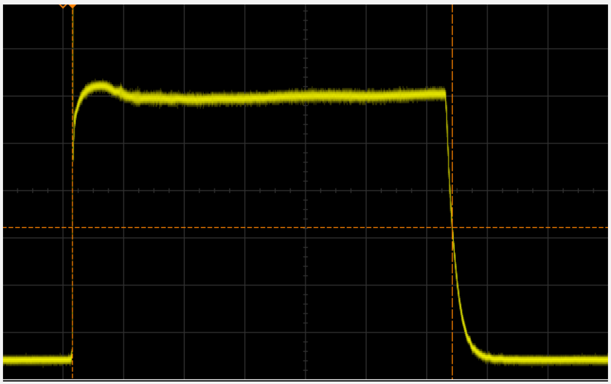


The pulse profile of conventional Tm:YAG & KTP lasers

TFLs can be operated in both continuous-wave mode (CW) and pulsed mode. The maximum peak power of TFLs is 500 W, which means they can be used in a similar way to conventional Tm:YAG lasers and offer similar properties to Ho:YAG lasers. However, demand for lasers with lower pulse energy levels and higher frequencies has increased in recent years, particularly in stone therapy. Conventional Ho:YAG lasers are restricted in this case due to their pulse profile, and the technical options available are limited. What makes TFLs especially different from Ho:YAG lasers are their highly symmetrical pulse profile and corresponding constant peak power. In pulsed mode, the pulse length varies between 0.2 ms and 12 ms, and the frequency can be set freely between 5 Hz and 2400 Hz (in theory). Applications in practice do not work in such an extensive frequency range, however. The combination of these parameters allows TFLs to ablate tissue and stones very quickly and precisely. Furthermore, in lithotripsy in particular, retropulsion is lower compared to Ho:YAG lasers and the stone fragments are much finer. This unique, symmetrical pulse profile makes it possible to use smaller laser fibers with constant peak power. In general, laser emissions from TFLs are more focused than those from Ho:YAG lasers and can be used more precisely.



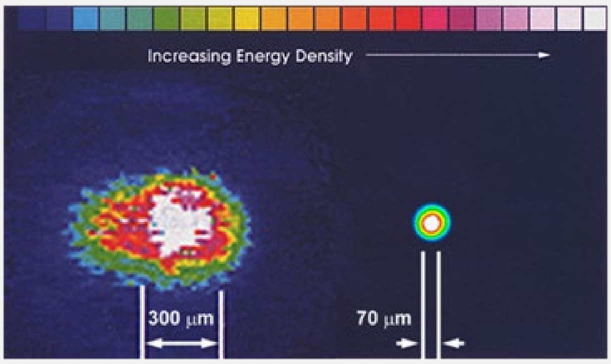
The pulse profile of a Ho:YAG laser



The pulse profile of a TFL

TFL:

- Constant pulse profile
- Frequency and pulse duration can be freely adjusted



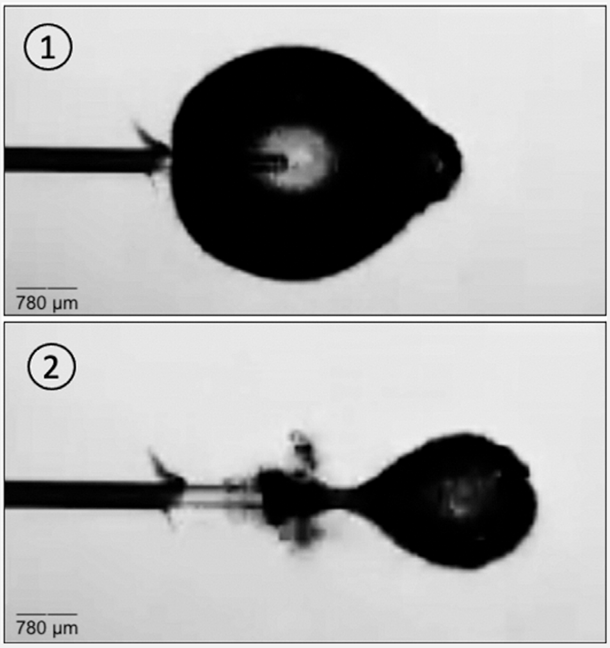
Comparison of laser emission quality: Ho:YAG vs. TFL

Fundamentals of Lasers

In recent years, demand for lower retropulsion and more efficient ablation has also increased in comparison to Ho:YAG lasers. This has led to the development of pulse-modified Ho:YAG lasers, while the terms "MOSES 2.0" and "Virtual Basket Effect" are becoming hot topics of discussion at international conferences.

To understand these pulse modulations, we need to look at what happens in general when the laser pedal is activated. When a laser pedal is pressed, part of the initial laser energy is absorbed by the surrounding fluid, vaporizing the surrounding water until a vapor bubble is formed at the tip of the laser fiber. This bubble expands outward and guides the laser pulse directly to the target, something also known as the MOSES™ effect. In this way, the stone is heated and chemical decomposition begins (a photothermal mechanism). Simultaneously, the water in the pores of the stone surface absorbs the laser energy and vaporizes, causing microexplosions and stone bursting from the inside (thermomechanical ablation). However, half or more of the laser pulse is lost in the process of the bubble being formed. MOSES™ technology was developed with the aim of controlling the MOSES™ effect present in every single instance of Ho:YAG laser lithotripsy. The ability to divide the energy pulse into two sub-pulses gained popularity due to the fact that most of the energy is emitted in the second pulse. This concept modulated one pulse in such a way that it contained two sub-pulses, each with a different peak power. A short, low-energy initiation pulse generates the vapor bubble and is followed by a longer, higher-energy, full-strength pulse. It was not until 2017 that the concept, known as MOSES™ technology (MT, Lumenis®), became available on the urology market. Developed by Lumenis, the laser involved is a 120 W holmium laser. Recently, Lumenis released MOSES™ 2.0, a new version of this high-power (HP) laser that can generate a pulse frequency of up to 120 Hz. The counterpart to this is the Virtual Basket Effect from Quanta, available in the latest Cyber Ho product family (from 60 W). These new pulse modulations reduce retropulsion, optimize lithotripsy, and – theoretically – shorten stone removal time. In laser enucleation of the prostate, pulse modulation also appears to improve hemostasis and shorten operating times.

Pulsed mode generates a gas bubble that is used for ablation



MOSES™ 2.0 effect

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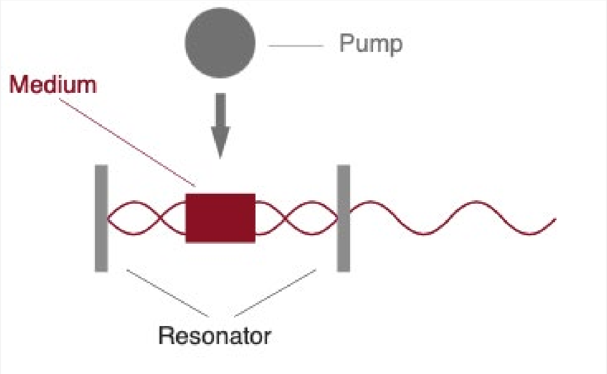
Urological Lasers and Their Architecture

There are also differences in the technical architecture used among the various urological lasers. As a rule, conventional Ho:YAG, Tm:YAG, and KTP lasers (Nd:YAG) are referred to as solid-state lasers. These are optically excited lasers whose amplifying (active) medium consists of a crystalline or glassy (amorphous) solid. This host material or host crystal contains ions that activate the laser (holmium/thulium, etc.) in a certain concentration (doping).

A pump (flash lamp/diode), a medium (e.g., YAG crystal), and a resonator system (multiplication of the light wavelength) are required to generate the laser emission in all cases.

The pump generates the natural light, which is charged with the corresponding ions in the medium. The resonator system amplifies the charge to the characteristic wavelength. Actuating the laser opens the coupling with the laser fiber, which in turn causes the laser beam to be emitted to the laser fiber.



Fundamentals of Lasers

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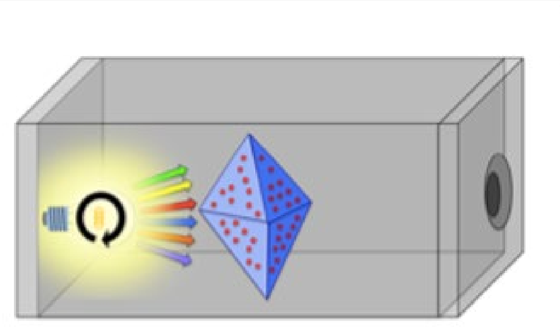
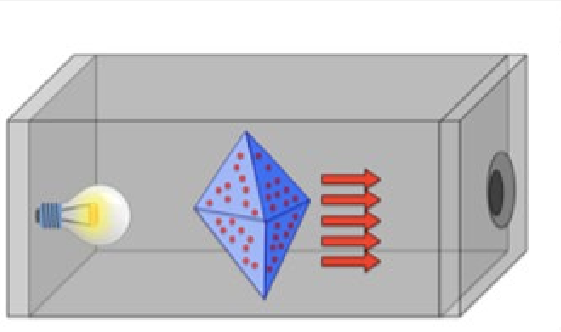
Ho:YAG lasers generate the laser emission as follows:



1

A flash lamp generates natural light (pump).



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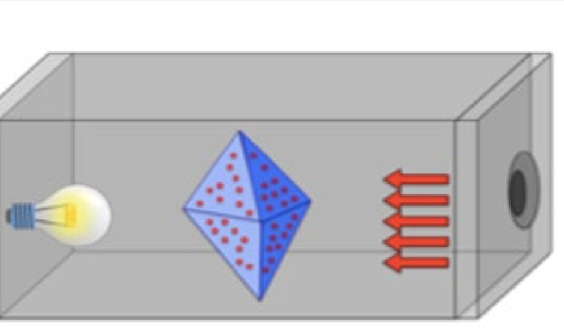
The white light hits the YAG crystal (medium). The holmium electrons are increased to a higher energy level, causing photons with a wavelength of 2120 nm to be emitted. This happens repeatedly and is known as laser pumping.



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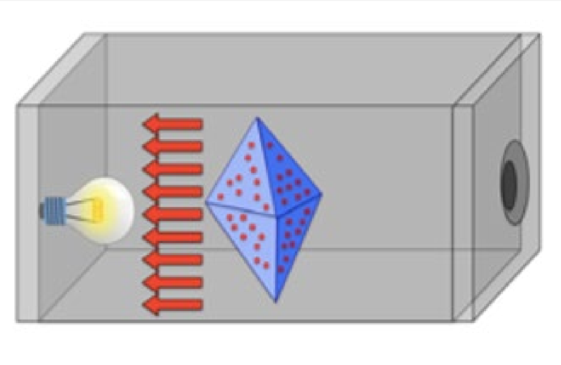
The radiation is reflected by mirrors.



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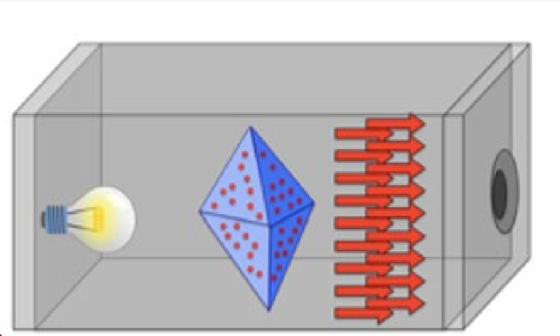
What happens next explains the origin of the term "LASER" (Light Amplification by Stimulated Emission of Radiation). The previously excited holmium ions are reflected again and produce more photons (ions at a higher energy level).



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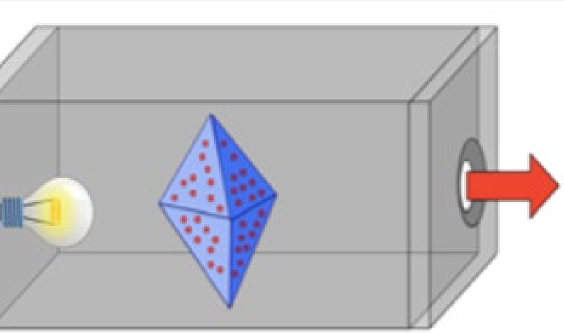
The resonator system stimulates the emission of radiation and amplifies the light.



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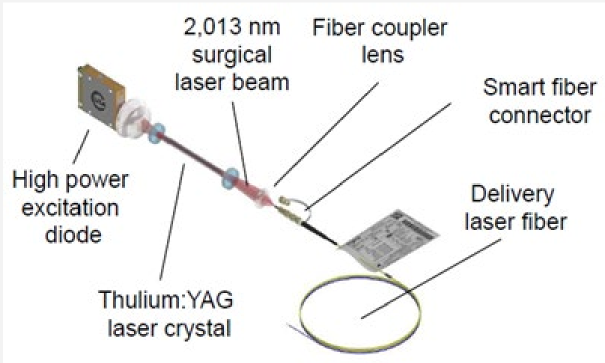
At the end of the process, the pulsed laser beam emerges from the chamber.

However, with a maximum power of 30 W, the laser cavity has a limit.

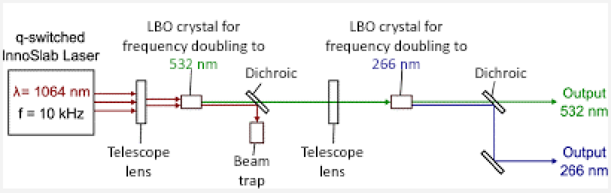
In the case of high-power holmium lasers with power levels of up to 150 W, several cavities must be connected to one another and synchronized. The technical architecture of Ho:YAG lasers requires a relatively large amount of energy. This explains why these lasers also require a high-voltage connection to operate. Furthermore, they generate high temperatures, which means that a water cooling circuit is also required. This has an additional negative impact on energy efficiency.

In the case of YAG lasers, a laser diode (pump) generates the natural light and a thulium:YAG crystal (medium) is used to charge the light to a wavelength of 2010 or 2013 nm. This design requires less energy and generates less heat than Ho:YAG lasers. As a result, Tm:YAG lasers do not require anything more than air cooling and a standard power plug.

In the case of KTP lasers, a very high-energy red light beam (pump) is emitted. This is then converted to 532 nm via a neodymium-doped YAG crystal (medium) by doubling the frequency. The resulting laser emission is visible as a green laser beam. With a wavelength of 532 nm, this laser beam is heavily absorbed by red hemoglobin, which enables photoselective vaporization of the prostate (PVP). However, KTP lasers demonstrate virtually no absorption in water and their use in urology is limited.

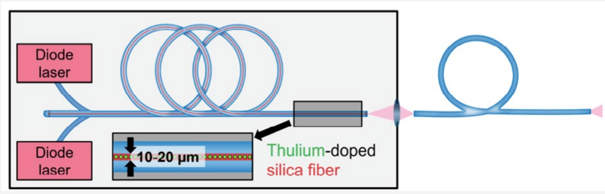


Technical design of a Tm:YAG laser



Technical design of a KTP laser

The laser is emitted through electronic modulation of laser diodes (pump). A 10–30 m quartz fiber doped with thulium and featuring a core diameter of 10–20 µm is used as the amplification medium for generating a laser beam (medium). This technology is relatively low-maintenance (the laser diodes have a service life of up to 70,000 hours) and very energy-efficient. As it generally requires less energy, it can operate with simply a standard plug; additionally, its limited heat generation means that it only needs a simple air-cooling system. The TFL cavity provides up to 60 W of output power and ensures a very even pulse, which can be emitted in both continuous-wave and pulsed mode. In addition, unlike Holmium:YAG generators, the architecture of fiber lasers is highly resistant to shocks as it does not use mirrors.



TFL structure

2

Use in Anatomical Endoscopic Enucleation of the Prostate (AEEP)

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Everything for Thulium Fiber Laser Enucleation (ThuFLEP) from a Single Source

As a full-range supplier for AEEP, Richard Wolf offers a perfectly coordinated system solution for this indication. Rounding off the package is the new Pulvis 60+ thulium fiber laser.

Laser resectoscopes

in 26 Fr and 24 Fr

Shark

Continuous-irrigation laser resectoscope sheaths

with ceramic and stainless steel tips

Shark

Tissue morcellation

Piranha

Large selection of laser guide tubes

Shark

2

Use in Anatomical Endoscopic Enucleation of the Prostate (AEEP)

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In recent years, AEEP has proven to be a safe and efficient alternative to transurethral resection of the prostate (TUR-P) and other procedures for removing a benign prostatic obstruction (BPO). In international guidelines, this has led AEEP to be described as one of the techniques of choice in this area. However, most of the data on AEEP supports the fact that the effectiveness of the procedure is not linked to the type of energy source that is used (laser or HF energy). Nevertheless, the unique properties of TFL make it an appealing alternative to holmium laser enucleation (HoLEP) – previously considered the gold standard. This means that thulium fiber laser enucleation (ThuFLEP) is an option with at least equivalent properties.

The high water absorption of the laser emission at a wavelength of 1940 nm and the associated low tissue penetration depth of 0.15 mm, combined with a constant super pulse profile, ensure both effective tissue ablation and highly efficient hemostasis. Compared to Holmium:YAG lasers, which tend to produce coarser tissue incisions due to their higher peak power, TFLs ensure clearer and flatter incisions. This new technical design for TFLs changes the interaction between the laser emission and tissue, and contributes to the laser safety profile.

The individual temporal pulse profiles (pulse shapes in time) of TFLs are symmetrical and demonstrate virtually perfect square waves with uniform energy distribution over time, as well as constant peak power (super pulse). Due to this property, TFLs show highly efficient ablation behavior and hemostasis properties. In contrast, the pulse profile of Ho:YAG lasers is asymmetrical, presenting several initial energy peaks during the same pulse, followed by a rapid drop, but with a higher peak power by comparison. As with Holmium:YAG lasers, the user can choose between short, medium, and longer pulse durations; however, TFLs can achieve theoretical pulse durations of up to 12 ms and can also be used in continuous-wave mode.

TFL:

- High absorption of laser emissions in water (wavelength: 1940 nm)
- High hemostasis capabilities
- Low tissue penetration depth
- Very uniform pulse profile
- Highly precise and controlled cuts
- Pulsed and CW mode available

We recommend using the following initial settings:

Cutting / Coagulation

Pulse energy	Pulse frequency	Laser power	Pulse duration (SP, MP, LP)	Laser fiber	Information
1.5 J	40 Hz	60 W	LP	550 µm	Common setting ThuFLEP (LP – excellent hemostasis even during cutting)
-	-	20 W	CW	550 µm	Continuous-wave mode for coagulation (excellent hemostasis)

Use in Stone Therapy

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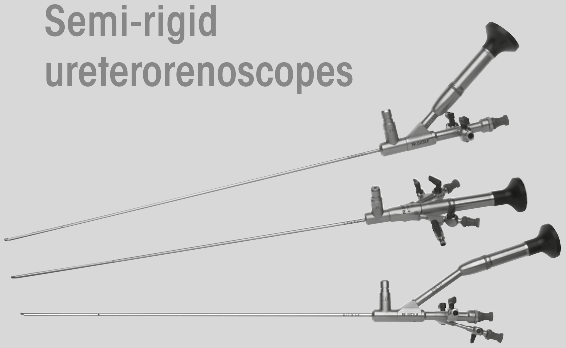
Everything From a Single Source for Stone Therapy

Richard Wolf offers a complete product portfolio for lithotripsy and provides users with the right instruments for a whole host of indications. In ureterorenoscopy in particular, Richard Wolf creates ideal synergies for using thulium fiber laser technology with 2-channel and 3-channel endoscopes.

Semi-rigid ureterorenoscopes



Flexible sensor endoscopes and cystoscopes

Suction & irrigation pump

for urology

FLUID CONTROL 2225

Percutaneous universal nephroscopes

3 Use in Stone Therapy

Holmium:YAG laser technology has also become the gold standard in laser lithotripsy in recent years. At the same time, however, users have become increasingly interested in laser lithotripsy with lower pulse energy and the finer stone fragmentation that results from this. The advantage of these finer stone concretions is that – in a best-case scenario – they can be removed and excreted spontaneously, eliminating the need to collect them with a stone basket. At this pulse setting, Holmium:YAG technology reveals its limits but TFL technology comes into its own.

Compared to Holmium:YAG lasers, thulium fiber lasers offer more scope for adjusting the pulse and feature a much more uniform pulse profile. This ensures that the laser is emitted in a more uniform and focused manner with very low retropulsion. TFL technology produces very fine, small stone fragments with comparatively low pulse energy. The targeted laser emission processes a smaller area of the stone surface, reducing the likelihood of large fragments coming loose.

TFL technology generates three to four times as much stone dust as a conventional Holmium:YAG laser. Additionally, it is faster at ablating stones and can produce stone particles that are smaller than 0.1 mm. Regardless of the stone composition, it produces a greater number of fine stone fragments under 0.5 mm than Ho:YAG lasers. To ensure a clear endoscopic view when using a TFL, the endoscope must provide excellent irrigation properties.

In addition, higher power settings generally cause higher temperatures to develop in the renal pelvis. Larger laser fibers also cause higher temperatures. When using a surgical laser within the ureter or the renal pelvicalyceal system, it is important to ensure excellent irrigation and backwashing as well as the maximum laser power (W). For lithotripsy purposes, we recommend a maximum power of 12 W in the ureter and a maximum power of 30 W within the renal pelvicalyceal system.

TFL:

- Very fast dusting
- Hardly any retropulsion
- Very small and fine stone fragments
- Dusting, fragmentation, & popcorning possible

Use in Stone Therapy

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We recommend using the following initial settings:

Kidney (max. 30 W)

Dusting / Fragmentation

Pulse energy	Pulse frequency	Laser power	Pulse duration (SP, MP, LP)	Laser fiber
0.3–0.5 J	15–30 Hz	4.5–15 W	Start LP / SP possible	150–272 µm
1.2–1.4 J	5–15 Hz	6–21 W	SP	150–272 µm

Power fragmentation / Popcorning

Pulse energy	Pulse frequency	Laser power	Pulse duration (SP, MP, LP)	Laser fiber
1.5–2 J	5–15 Hz	7.5–30 W	SP	150–272 µm
1.0–1.2 J	10–15 Hz	10–18 W	MP	150–272 µm

Ureter (max. 12 W)

Dusting / Fragmentation

Pulse energy	Pulse frequency	Laser power	Pulse duration (SP, MP, LP)	Laser fiber
0.2–0.4 J	15–30 Hz	3–12 W	LP	150–272 µm
0.8–1.2 J	5–10 Hz	4–12 W	SP	150–272 µm

PCNL

Dusting / Fragmentation

Pulse energy	Pulse frequency	Laser power	Pulse duration (SP, MP, LP)	Laser fiber
0.5–1 J	15–30 Hz	7.5–30 W	LP	150–365 µm
1.5–2 J	5–15 Hz	7.5–30 W	SP	150–365 µm

Bladder

Dusting / Fragmentation

Pulse energy	Pulse frequency	Laser power	Pulse duration (SP, MP, LP)	Laser fiber
0.5–1 J	15–30 Hz	7.5–30 W	LP	365–550 µm
1.5–2 J	5–15 Hz	7.5–30 W	SP	365–550 µm

Use in Stone Therapy

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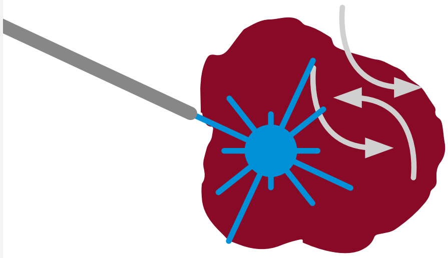
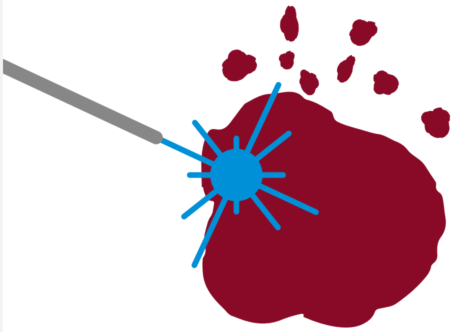
Tips & Tricks



Painting

For softer stones

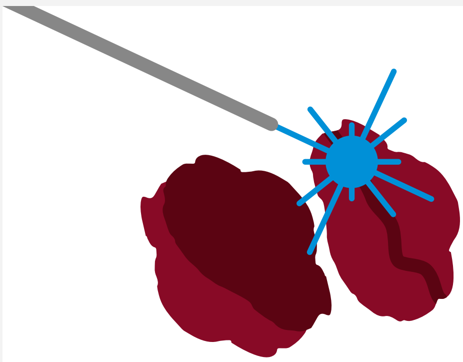
Position the laser fiber in contact with the stone and brush over the stone. This removes the stone layer by layer.



Chipping

For hard stones

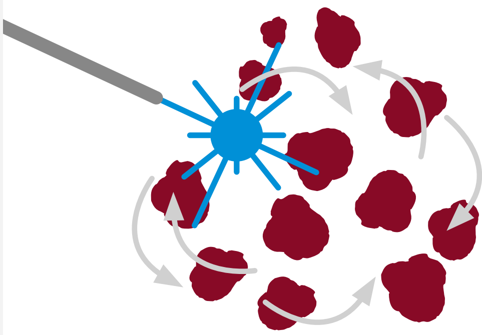
Position the laser fiber at the edge of the stone and slowly remove smaller fragments.



Fragmenting

Best for individual stones

Bring the laser fiber into contact with the stone and press it against the urothelium. Then direct the laser emission at a point until the stone breaks.



Popcorning

Best for a group of 3–4 mm fragments

Move the laser fiber close to the stone, but do not make contact with the urothelium. The laser emission causes the stone fragments to move around the laser fiber in this case, fragmenting them further.

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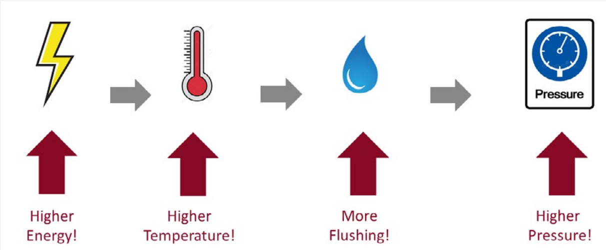
An Outlook on Stone Therapy 2.0: Intrarenal Pressure & Temperature Management

Stable intrarenal pressure and temperature conditions are a major topic of discussion at every urological event and have also become a factor in everyday clinical practice. Parameters that lead to stable temperature and pressure conditions must be maintained in every RIRS (Retrograde Intrarenal Surgery) performed in combination with a surgical laser. Ultimately, this ensures the safety of every patient. Cases that involve thin-lumen passages and natural curvatures inside the kidney present a particular risk of undesirable excess pressure and a rise in temperature. Maintaining an intraoperative irrigation pressure of < 30 mmHg within the kidney is important for preventing postoperative sepsis. In addition, during lithotripsy with a laser surgery device, energy is released into the irrigation water, heating it up even further. This problem is particularly evident in the day-to-day operation of a flexible URS. During these procedures, two factors are particularly important to surgeons:

1. A good endoscopic view during lithotripsy (by means of irrigation)
2. Stone fragmentation that takes place as quickly as possible (using laser energy)

The challenge here lies in the fact that good irrigation properties are usually associated with an increase in internal renal pressure and the water inside the kidney heats up when laser energy is output. It is also important not to work with laser settings that are too high. This effect is further intensified during procedures that involve a thin ureteral access sheath and leave hardly any space between the endoscope and the inside of the sheath for the irrigation fluid to flow back adequately. In addition, the ureteral access sheath used may not be the correct length (i.e., may be too short). This could cause the ureter to wrap around the instrument at the entrance to the renal pelvicalyceal system, thereby closing the ureteral access sheath and severely restricting the backflow of the irrigation fluid. In an attempt to combat this effect, there is a trend toward using increasingly thinner endoscopes – as well as endoscopes with multiple channels – that will ensure good irrigation and enable the heated irrigation fluid to flow back properly. The RIWO D-URS, specially developed for this situation, is an ideal choice for maintaining constant pressure and temperature conditions thanks to its two separate working channels and backflow channel integrated in the sheath. The advantages of the instrument in intrarenal pressure and temperature management are currently being evaluated as part of a clinical study.

Modern fluid management systems are used to improve control of the irrigation flow in general. As presented in "Invisible PNL – first step towards puncture-free nephrolitholapaxy", a method designed to ensure constant pressure and temperature conditions is currently being developed. Controlled by pressure, the irrigation fluid is supplied via the FLUID CONTROL 2225 suction and irrigation pump. The pump also allows the fine stone dust (and the heated irrigation fluid) to be actively extracted during lithotripsy. However, the suction function only works in combination with TFL technology. In combination with a Ho:YAG laser, initial experience has shown that the stone fragments are not small enough and can block the channel during suction. This procedure will also form part of the clinical study.



Situation during a procedure with increased pressure and temperature conditions

Method for preventing increased pressure and temperature conditions

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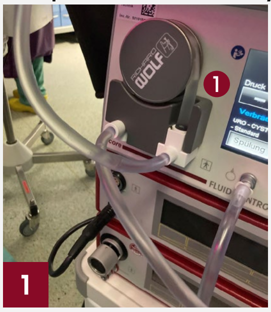
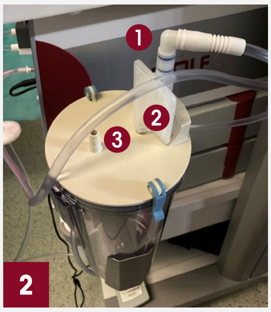
Setup for Invisible PNL by Straub:



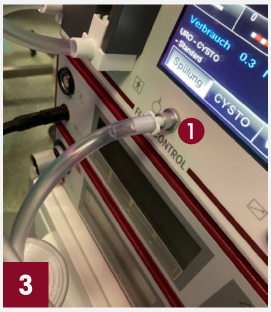
1) Insert the irrigation tube



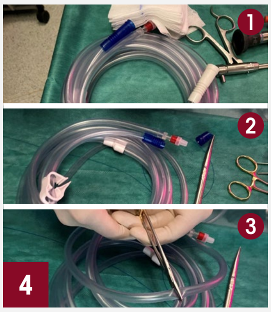
1) Attach the elbow to the suction tube and filter

2) Insert the filter into the lid (the opening that is sealed from below with the white valve when the container is full)

3) Opening for suction tube



1) Connect the vacuum tube (tube with filter) to the Luer on the pump



Prepare the suction tube:

1) Connect the white end to the container and the blue end to the three-way valve, and clamp off the red end

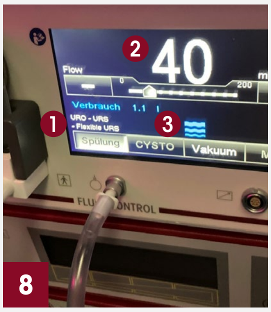
2) Cut off the blue end up to the corrugation and attach to the three-way valve

3) Clamp off the tube at the red end with the clamp

1) Connect the suction tube (white end) to the container

1) Start the pump, select Endourology mode and then Flexible URS

1) Press Irrigation and wait for the tube filling phase



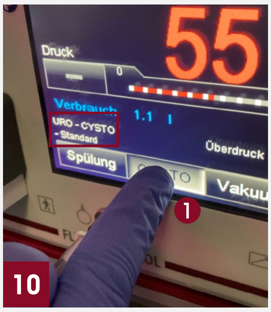
1) Pump ready for operation for Flexible URS

2) 40 ml/min is sufficient here

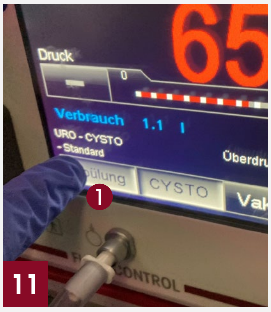
3) All three waves must be visible (for the best flow)

Starting with a cystoscope:
If you are starting with a cystoscope, you need to switch to this mode briefly

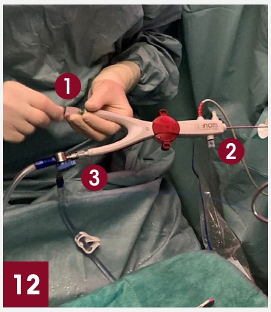
1) First switch off the irrigation



1) Select CYSTO mode (the pump then switches to URO-CYSTO)



1) Activate irrigation
The pump is now working in Cystoscopy mode



Changing from a cystoscope to RIWO D-URS:

1) Screw the universal sealing valve onto the laser channel (green)

2) Close the inlet (blue) with a Luer sealing cap

3) Connect the two-way valve to the large working channel (gray)

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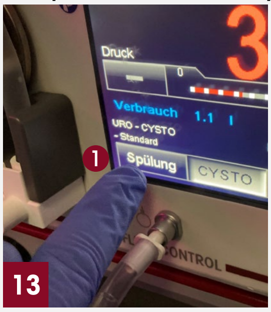
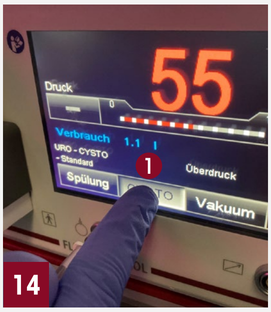
Setup for Invisible PNL by Straub:

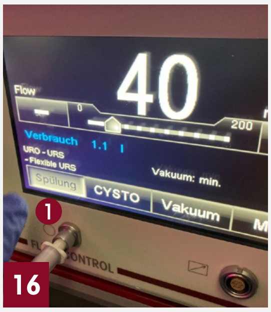


1) Switch off the irrigation



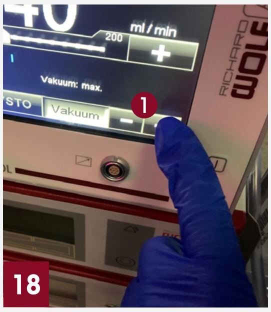
1) Switch off CYSTO mode

1) Pump switches back to Flexible URS



1) Reactivate irrigation and continue working with the RIWO D-URS

Activate suction:
1) Select Vacuum mode



1) Set the vacuum to maximum

Components for Invisible PNL by Straub:

Sensor ureterorenoscope
9 Fr WL 600 mm, PU = 3 PCS **473572076**

ENDOCAM D camera control unit bundle
Consisting of:
ENDOCAM D camera control unit (5522101),
HDMI/DVI-D cable, lockable 3.0 m (103843),
Vector Plus coaxial cable 3.0 m (DZGR-0300-SW-GN),
license for open-source software (72321911),
power cable (2440.03).................................. **55221011**

Two-way valve, maintenance-free **88350**

Suction and irrigation pump + container:
FLUID CONTROL 2225,
incl. power cable **22250011**

Cart module **2225023**

Secretion container 2000 ml........................... **8170.655**

Bacteria filter
PU = 10 pcs **2228.901**

Angled 90° plug coupling
(PU = 10 pcs).. **077.1019**

Tubes:
Irrigation tube set* with piercing spike
L 3 m (PU = 10 pcs, sterile) **4171223**

or

Irrigation tube set* with care-lock
L 3 m (PU = 10 pcs, sterile) **4171224**

Tube set for vacuum
incl. filter **2206207**

Tube set for suction* (2 connections)
for single use **T0503-01**

Sealing valves:
Luer sealing cap... **15023205**

Universal sealing valve 1–6 Fr
(PU = 5 PCS), sterile, for single use, for inserting auxiliary instruments of 1–6 Fr **4712348**

Use in Transurethral (Laser) Resection of Bladder Tumors (TUR-B)

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Everything From a Single Source for Transurethral En Bloc Resection of Bladder Tumors (ERBT) and Photodynamic Diagnostics

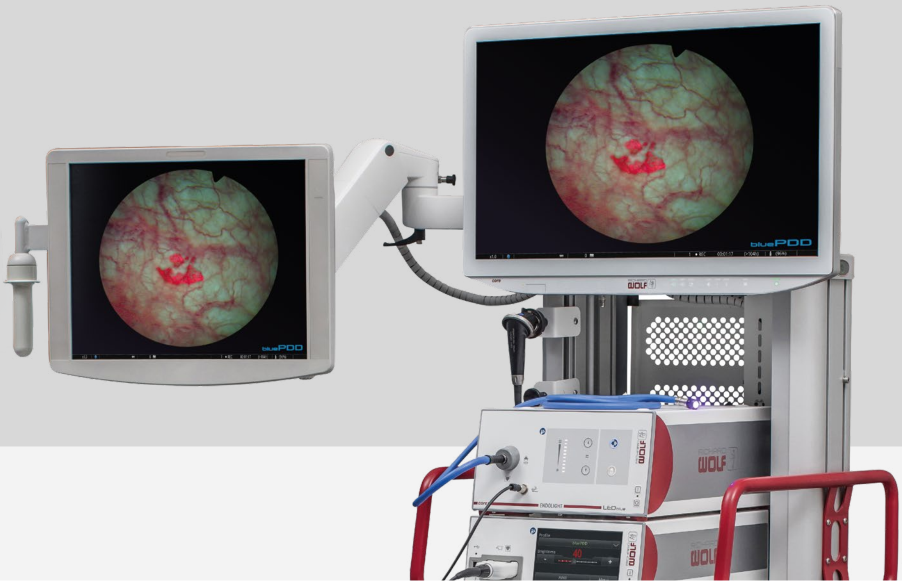
As a full-range supplier for ERBT, Richard Wolf offers a perfectly coordinated system solution for this indication. Rounding off the package is the new Pulvis 60+ thulium fiber laser.

Laser resectoscopes

in 26 Fr and 24 Fr

Shark

PDD



System blue

4 Use in Transurethral (Laser) Resection of Bladder Tumors (TUR-B)

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The current standard treatment for non-muscle-invasive bladder cancer (NMIBC) is conventional transurethral resection of bladder tumors (TUR-B). In recent years, however, transurethral en bloc resection of bladder tumors (ERBT) has gained in popularity due to the improved integrity of specimens. The ERBT procedure demonstrates better pathological results and may contribute to a lower rate of complications. Using TFL technology has the advantage of excellent vaporization and efficient tissue hemostasis. Due to the technical properties of the laser, it is emitted to the tissue in a highly precise and controlled manner.

The special wavelength of 1940 nm, the low penetration depth (0.15 mm), the option of performing the procedure in both continuous-wave and pulsed working mode, and the special pulse profile make the TFL an outstanding precision machine for transurethral laser en bloc resection of NMIBC tumors. These technical features enable highly precise cutting, coagulation, and vaporization. The uniform pulse profile boasts highly precise cutting properties and improves how the tissue absorbs the laser emission due to the special wavelength of the laser. By combining cutting and vaporization modes, the TFL seals the vascular wound efficiently, reducing the bleeding and the risk of bladder perforation. What's more, the tumor can be carefully separated from the benign tissue.

Thanks to the new TFL technology combined with photodynamic diagnostics (PDD), Richard Wolf is setting a new standard in the detection and resection of NMIBC. System blue using Hexvix® allows users to perform the laser resection under blue light, significantly improving their ability to differentiate between malignant and benign tissue. At the same time, the site appears brighter and more natural than under white light. During laser resection, this technology improves the visual delineation of the tumor edges, which allows them to be mapped out even more efficiently.

We recommend using the following initial settings:

Pulse energy	Pulse frequency	Laser power	Pulse duration (SP, MP, LP)	Laser fiber
0.8 J	30 Hz	24 W	SP	365 µm
0.6 J	50 Hz	30 W	LP	365 µm

TFL:

- High absorption of laser emissions in water (wavelength: 1940 nm)
- High hemostasis capabilities
- Low tissue penetration depth
- Very uniform pulse profile
- Very precise and controlled cuts
- Pulsed and CW mode possible

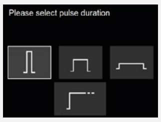
5 Pulse Setting

To gain a better understanding of the effect of a laser, it is essential to examine the parameters that are relevant to the pulse profile. The most important parameters are the pulse energy (J), the pulse duration (ms), the pulse frequency (Hz), the maximum peak power (W) within the pulse, and the laser power used (W).

The following parameters can be set directly via the GUI on the Pulvis 60+:

- Pulse energy (joules)
- Pulse frequency (Hertz)
- Pulse duration (milliseconds) and peak power (watts): short, medium, and long pulses, and CW mode

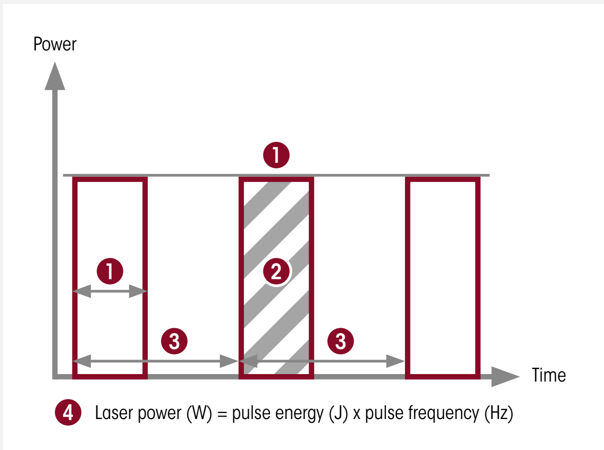
❶ Pulse duration (ms) and peak power (W)



❷ Pulse energy (J)

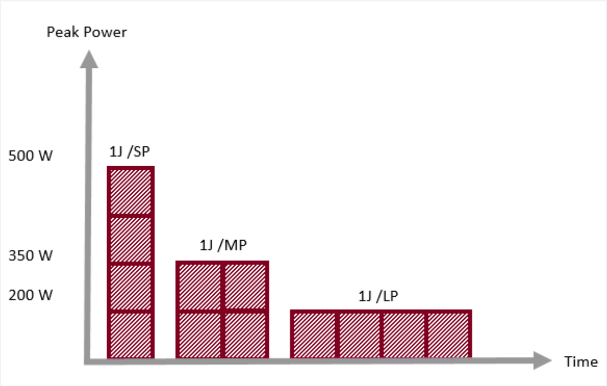
❸ Pulse frequency (Hz)

❹ Laser power (W) =
pulse energy (J) x pulse frequency (Hz)



Pulse Setting

The maximum peak power (W) for a TFL is 500 W. There are relatively few TFL setting ranges that use a peak power (W) below 500 W. Furthermore, the peak power (W) is emitted very constantly and precisely.



Pulse duration (ms):

The variation in pulse duration (ms) has a direct impact on the maximum peak power (W). In the case of TFLs, the power peaks at 500 W in short-pulse mode (SP). When switched to medium-pulse mode (MP), the peak power is 350 W; in long-pulse mode (LP), it reaches 200 W. This means there are three ways to influence the peak power (W) of TFLs.

The pulse duration (ms) itself depends on the selected pulse energy (J) and the peak power (W) that applies to each mode.

Modes	Peak power (W)
Short-pulse mode (SP)	500 W
Medium-pulse mode (SP)	350 W
Long-pulse mode (LP)	200 W

Pulse duration (ms) = pulse energy (J) / (peak power (W)*1000)

Pulse Setting

The pulse duration (ms) can be scaled within the individual modes as follows (e.g., for pulse energy from 0.1 J to 2.0 J):

Short-pulse mode (SP)

Pulse energy	Peak power	Pulse duration
0.1 J	500 W	0.2 ms
0.2 J	500 W	0.4 ms
0.3 J	500 W	0.6 ms
0.4 J	500 W	0.8 ms
0.5 J	500 W	1.0 ms
0.6 J	500 W	1.2 ms
0.7 J	500 W	1.4 ms
0.8 J	500 W	1.6 ms
0.9 J	500 W	1.8 ms
1.0 J	500 W	2.0 ms
1.1 J	500 W	2.2 ms
1.2 J	500 W	2.4 ms
1.3 J	500 W	2.6 ms
1.4 J	500 W	2.8 ms
1.5 J	500 W	3.0 ms
1.6 J	500 W	3.2 ms
1.7 J	500 W	3.4 ms
1.8 J	500 W	3.6 ms
1.9 J	500 W	3.8 ms
2.0 J	500 W	4.0 ms
etc.	500 W	etc.

Medium-pulse mode (MP)

Pulse energy	Peak power	Pulse duration
0.1 J	350 W	0.29 ms
0.2 J	350 W	0.57 ms
0.3 J	350 W	0.86 ms
0.4 J	350 W	1.14 ms
0.5 J	350 W	1.42 ms
0.6 J	350 W	1.71 ms
0.7 J	350 W	2.0 ms
0.8 J	350 W	2.29 ms
0.9 J	350 W	2.57 ms
1.0 J	350 W	2.89 ms
1.1 J	350 W	3.14 ms
1.2 J	350 W	3.43 ms
1.3 J	350 W	3.7 ms
1.4 J	350 W	4.0 ms
1.5 J	350 W	4.29 ms
1.6 J	350 W	4.57 ms
1.7 J	350 W	4.86 ms
1.8 J	350 W	5.14 ms
1.9 J	350 W	5.43 ms
2.0 J	350 W	5.71 ms
etc.	350 W	etc.

Pulse Setting

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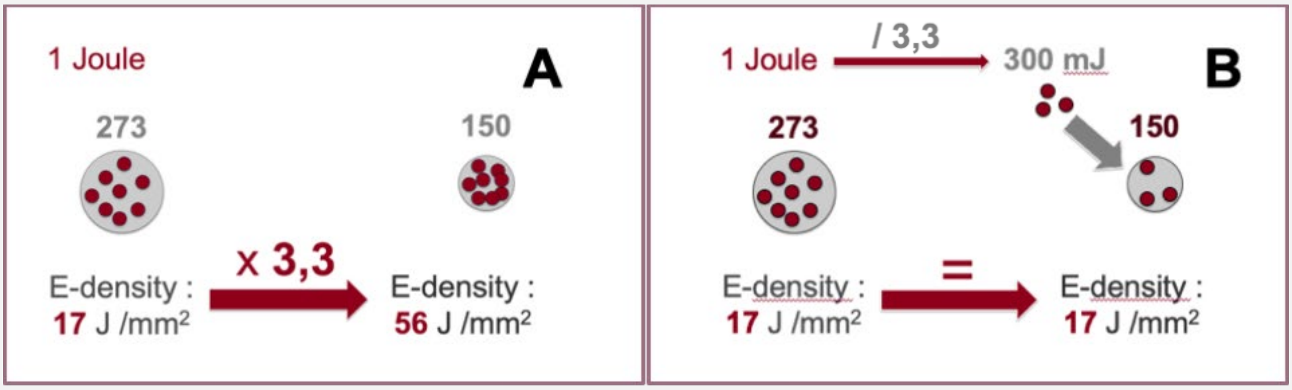
Long-pulse mode (LP)

Pulse energy	Peak power	Pulse duration
0.1 J	200 W	0.5 ms
0.2 J	200 W	1.0 ms
0.3 J	200 W	1.5 ms
0.4 J	200 W	2.0 ms
0.5 J	200 W	2.5 ms
0.6 J	200 W	3.0 ms
0.7 J	200 W	3.5 ms
0.8 J	200 W	4.0 ms
0.9 J	200 W	4.5 ms
1.0 J	200 W	5.0 ms
1.1 J	200 W	5.5 ms
1.2 J	200 W	6.0 ms
1.3 J	200 W	6.5 ms
1.4 J	200 W	7.0 ms
1.5 J	200 W	7.5 ms
1.6 J	200 W	8.0 ms
1.7 J	200 W	8.5 ms
1.8 J	200 W	9.0 ms
1.9 J	200 W	9.5 ms
2.0 J	200 W	10.0 ms
etc.	200 W	etc.

Pulse Setting

The pulse setting is not the only important criterion to consider when using TFLs. The energy density also plays an important role when changing the fiber size in laser applications.



Change in the transmitted energy density when switching from a 273 µm to a 150 µm laser fiber at 1 J pulse energy

This example illustrates how important it is to consider the effect of retaining the laser settings when a change is made to thinner fibers. Crucially, if a 150 µm laser fiber is used with the same settings as a 272 µm fiber, the fiber can quickly burn onto the stone and become stuck. Therefore, the set laser energy must be reduced to accommodate the change. A recurring point of discussion at present is using a 365 µm fiber instead of a 550 µm within the context of AEEP. The same settings are currently being used for both 365 µm fibers and 550 µm fibers, with the difference being that one produces a much stronger cutting effect on the tissue. Experience has shown that the effect of higher energy density also comes into play in cases where thinner fibers are involved. Clinical results will be available in the near future.

6 Advantages at a Glance

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*This information is based on a comparison with a conventional Holmium:YAG laser

Technical Data

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Laser classification	Class 4 – thulium fiber laser
Maximum peak output	500 W
Wavelength	1920–1960 nm
Laser energy	0.020–6 J
Laser frequency	Up to 2500 Hz
Maximum output power	60 W (pulsed/CW)
Pulse duration	50 µs – CW
Smallest fiber	150 µm
Electrical requirements	100–240 VAC; 50/60 Hz; 1000 VA
Max. operating temperature	10–30 °C
Pilot beam	Green, brightness can be adjusted
Device design	Tower with castors
Dimensions (W x H x D)	47.0 x 94.0 x 81.0 cm (display closed)
Weight	100 kg
Laser cooling system	Air

8

Competition

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Properties	Pulvis 60+ Richard Wolf	MultiLASE Karl Storz	Fiber Dust PRO Quanta	LaserClast EMS	TFL Drive Coloplast	Fiber Dust Quanta	Sirius Rocamed
Laser Classification	Class 4 – Thulium Fiber Laser (TFL)	Class 4 – Thulium Fiber Laser (TFL)	Class 4 – Thulium Fiber Laser (TFL)	Class 4 – Thulium Fiber Laser (TFL)	Class 4 – Thulium Fiber Laser (TFL)	Class 4 – Thulium Fiber Laser (TFL)	Class 4 – Thulium Fiber Laser (TFL)
Max. Peak Power	500 W	500 W	500 W	500 W	500 W	500 W	500 W
Wavelength	1940 nm	1940 nm	1940 nm	1940 nm	1940 nm	1940 nm	1940 nm
Laser Energy	0.020–6 J	0.020–6 J	0.020–6 J	0.020–6 J	0.020–6 J	0.020–6 J	0.020–6 J
Laser Frequency	Up to 2500 Hz	Up to 2500 Hz	Up to 2500 Hz	Up to 2500 Hz	Up to 2500 Hz	Up to 2500 Hz	Up to 2500 Hz
Continuous Emission Mode	✓	✓	✓	✓	✓	✓	✓
Average Power	Max. 60 W	Max. 60 W	Max. 60 W	Max. 60 W	Max. 60 W	Max. 60 W	Max. 60 W
Pulse Duration	50 µs – CW	50 µs – CW	50 µs – CW	50 µs – CW	50 µs – CW	50 µs – CW	50 µs – CW
Reusable Fibers	✓	✓	✓	✓	✓	✓	✓
Disposable Fibers	✓	✓	✓	✓	✓	✓	✓
Smallest Fiber	150 µm	150 µm	150 µm	150 µm	150 µm	150 µm	150 µm
Aiming Beam	Green	Green	Green	Green	Green	Green	Green
Electrical Requirements	100–240 V at 1000 VA 50/60 Hz	100–240 V at 1200 VA 50/60 Hz	100–240 V at 1200 VA 50/60 Hz	100–240 V at 1200 VA 50/60 Hz	100–240 V at 1200 VA 50/60 Hz	100–240 V at 1200 VA 50/60 Hz	100–240 V at 1200 VA 50/60 Hz
Device Configuration	Tower	Tower	Tower	Tower	Tower	Desktop	Desktop
Needs a cart?	✗	✗	✗	✗	✗	✓	✓
Dimensions H x W x D	Approx. 95 x 45 x 85 cm (display closed)	Approx. 95 x 45 x 85 cm (display closed)	Approx. 95 x 45 x 85 cm (display closed)	Approx. 95 x 45 x 85 cm (display closed)	Approx. 95 x 45 x 85 cm (display closed)	47 x 60 x 35 cm	47 x 60 x 35 cm
Weight	< 110 kg	< 110 kg	< 110 kg	< 110 kg	< 110 kg	40 kg	40 kg
Laser Cooling System	Air	Air	Air	Air	Air	Air	Air
Full-range Supplier in Urology	✓	✓	✗	✗	✗	✗	✗
Note		▪ The company's first laser – expertise needs to be built up first ▪ Strong focus on US market		▪ Increasingly strong focus on stone therapy only ▪ Slightly complicated process of navigating the menus to find the correct setting ▪ No option to generate your own presettings	▪ Switching between the two operating modes requires laborious toggling of the footswitch	▪ Desktop version (generally perceived as louder)	

8 Competition

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Properties	**Pulvis 60+** Richard Wolf	**RevoLix HTL** OmniGuide- Lisa Laser	**RevoLix HTL Eco** OmniGuide- Lisa Laser	**Thulio** Dornier	**SOLTIVE Premium** OLYMPUS	**SOLTIVE Pro** OLYMPUS	**FiberLase U2** IPG	**FiberLase U3** IPG
Laser Classification	Class 4 – Thulium Fiber Laser (TFL)	Solid State Tm:YAG	Solid State Tm:YAG	Solid State Tm:YAG	Class 4 – Thulium Fiber Laser (TFL)	Class 4 – Thulium Fiber Laser (TFL)	Class 4 – Thulium Fiber Laser (TFL)	Class 4 – Thulium Fiber Laser (TFL)
Max. Peak Power	500 W	1300 W	1300 W	3500 W	500 W	500 W	500 W	500 W
Wavelength	1940 nm	2013 nm	2013 nm	2013 nm	1940 nm	1940 nm	1940 nm	1940 nm
Laser Energy	0.020–6 J	> 5 J	> 5 J	0.1–2.5 J	0.025–6 J	0.025–6 J	0.025–6 J	0.025–6 J
Laser Frequency	Up to 2500 Hz	10–300 Hz	10–300 Hz	5–300 Hz	Up to 2400 Hz	Up to 100 Hz	Up to 2400 Hz	Up to 2400 Hz
Continuous Emission Mode	✓	✗	✗	✗	✗	✗	✓	✓
Average Power	Max. 60 W	Max. 150 W	Max. 75 W	Max. 100 W	Max. 60 W	Max. 35 W	Max. 60 W	Max. 60 W
Pulse Duration	50 µs – CW	100 µs – 47.5 ms	100 µs – 47.5 ms	150 µs – 1 ms	200 µs – 50 ms	200 µs – 50 ms	200 µs – 50 ms	200 µs – 50 ms
Reusable Fibers	✓	✓	✓	✓	✗	✗	✓	✓
Disposable Fibers	✓	✓	✓	✓	✓	✓	✓	✓
Smallest Fiber	150 µm	200 µm	200 µm	270 µm	150 µm	150 µm	150 µm	150 µm
Aiming Beam	Green	Green	Green	Green	Green	Green	Green	Green
Electrical Requirements	100–240 V at 1000 VA 50/60 Hz	200–240 V, 50/60 Hz, 10 A 110–115 V, 50/60 Hz, 20 A	200–240 V, 50/60 Hz, 10 A 110–115 V, 50/60 Hz, 20 A	200–240 V, 50/60 Hz, 10 A 110–115 V, 50/60 Hz, 20 A	100–240 V at 1200 VA 50/60 Hz	100–240 V at 1200 VA 50/60 Hz	100–240 V at 1200 VA 50/60 Hz	100–240 V at 1200 VA 50/60 Hz
Device Configuration	Tower	Tower	Tower	Tower	Desktop	Desktop	Desktop	Desktop
Needs a cart?	No	No	No	No	✓	✓	✓	✓
Dimensions H x W x D	Approx. 95 x 45 x 85 cm (display closed)	103 x 45 x 74 cm	103 x 45 x 74 cm	N/A	29.5 x 37.0 x 56.0 cm	25.5 x 37.0 x 56.0 cm	28.6 x 46.0 x 54.5 cm	28.6 x 46.0 x 54.5 cm
Weight	< 110 kg	108 kg	108 kg	Approx. 110 kg	40 kg	33 kg	38 kg	38 kg
Laser Cooling System	Air	Air	Air	Air	Air	Air	Air	Air
Full-range Supplier in Urology	✓	✗	✗	✗	✓	✓	✗	✗
Note		■ No symmetrical pulse profile ■ GUI not user-friendly (calculations are required) ■ More expensive than TFLs ■ Frequency cannot be fine-tuned (above 25 Hz, it can only be adjusted in 25 Hz increments) ■ No proper CW mode	■ No symmetrical pulse profile ■ GUI not user-friendly (calculations are required) ■ More expensive than TFLs ■ Frequency cannot be fine-tuned (above 25 Hz, it can only be adjusted in 25 Hz increments) ■ No proper CW mode	■ Higher retropulsion than TFLs ■ No symmetrical pulse profile ■ More expensive than TFLs ■ Very few studies to date ■ Development strongly oriented toward the Ho:YAG laser ■ Frequency cannot be fine-tuned (above 25 Hz, it can only be adjusted in 25 Hz increments) ■ Only 2.5 J maximum pulse energy ■ No proper CW mode ■ No 150 µm & 200 µm fiber	■ No proper CW mode ■ Desktop version (generally perceived as louder) ■ No reusable fibers		■ Desktop version (generally perceived as louder) ■ Previously more focused on the Russian market	

Compatible product range*

HoLEP, ThuLEP SHARK continuous irrigation resectoscope

26 Fr, for blunt enucleation of the prostate

Laser working element **8654382**
Optional:
Laser working insert **8654383**

PANOVIEW telescope
30° **8654.422**
12° **8654.431**

Fiber light cable, 2.5 mm
2.3 m bundle **806625231**

Outer sheath
26 Fr **8675426**

Inner sheath with stainless steel tip
24 Fr **8675524**

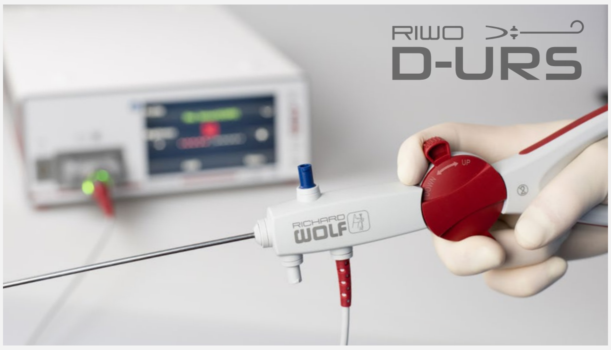
Obturator
24 Fr **8673324**

Laser fiber guide tubes:
for inner sheath 24 Fr

600 µm, distal end straight **8654993**
600 µm, distal end inclined **8654995**
600 µm, with distal bracket **8654997**

Curette (suitable only for 8654382)
for prostate chips from 22 Fr
600 µm **8654998**

Suction and irrigation pump:
FLUID CONTROL 2225 .... **See page 38**



RIWO D-URS

Semi-flexible 3-channel sensor ureterorenoscope
for single use

Sensor ureterorenoscope, 9 Fr, WL 600 mm
PU = 3 PCS **473572076**

Camera control unit:

ENDOCAM D camera control unit bundle
Consisting of:
ENDOCAM D camera control unit (5522101),
HDMI/DVI-D cable, lockable 3.0 m (103843),
Vector Plus coaxial cable 3.0 m (DZGR-0300-SW-GN),
license for open-source software (72321911),
power cable (2440.03) **55221011**

For this:
Hand-held remote control USB **5525401**

Adapter for control unit 5525XXX **5525410**

Suction and irrigation pump:
FLUID CONTROL 2225 .... **See page 38**

* These are recommended instrument combinations. Further information can be found at **www.richard-wolf.com**

Compatible product range*

RICHARD WOLF
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BOA vision

Flexible 1-channel sensor ureterorenoscope

Sensor ureterorenoscope BNDL
BOA vision with control lever pointing downward – angled downward **73550712**

Sensor ureterorenoscope BNDL
BOA vision with control lever pointing downward – angled upward **73550762**

Spare parts included:
Leakage tester **163.903**
Pressure equalization valve **163.904**
Disposable cleaning brush
(PU = 10 pcs) for working channel **7990001**

Camera control unit:

ENDOCAM Logic HD
camera control unit **5525101**

ENDOCAM Logic 4K
camera control unit **5525301**

Suction and irrigation pump:
FLUID CONTROL 2225 .... **See page 38**

COBRA vision

Flexible 2-channel sensor ureterorenoscope

Sensor ureterorenoscope BNDL
COBRA vision with control lever pointing downward – angled downward **73560712**

Sensor ureterorenoscope BNDL
COBRA vision with control lever pointing downward – angled upward **73560762**

Spare parts included:

Leakage tester **163.903**

Pressure equalization valve **163.904**

Disposable cleaning brush
(PU = 10 pcs) for working channel **7990001**

Disposable cleaning brush
(PU = 10 pcs) for laser channel **7990003**

Clamping element
(PU = 20 pcs), orange **15394144**

Adapter **163914**

Camera control unit:

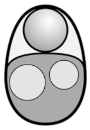
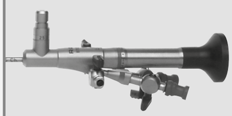
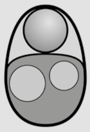
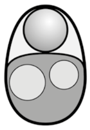
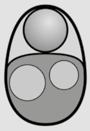
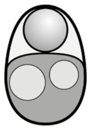
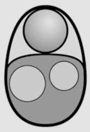
ENDOCAM Logic HD
camera control unit **5525101**

ENDOCAM Logic 4K
camera control unit **5525301**

Suction and irrigation pump
FLUID CONTROL 2225 .... **See page 38**

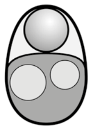
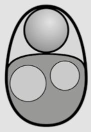
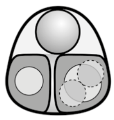
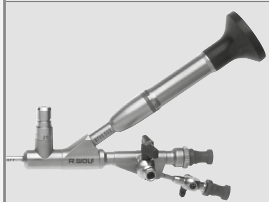
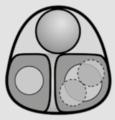
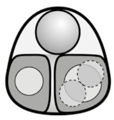
* These are recommended instrument combinations. Further information can be found at **www.richard-wolf.com**

Compatible product range*

Figure	Description	WL	TL	Direc-tion of view	Endoscope tip/sheath tube	Working channel	Product no.
	**Ureterorenoscope 5°** **4.5/6.5 FR WL 430 mm** Atraumatically shaped tip	430 mm	555 mm	5°	 4.5 / 6.5 Fr	3 Fr	**8701.534**
	**Ureterorenoscope 5°** **6/7.5 FR WL 430 mm** Atraumatically shaped tip	430 mm	558 mm	5°	 6 / 7.5 Fr	1 x 4 Fr or 2 x 2.2 Fr	**8702.514**
	**Ureterorenoscope 12°** **8/9.8 FR WL 430 mm** Atraumatically shaped tip	430 mm	558 mm	12°	 8 / 9.8 Fr	1 x 5 Fr or 2 x 3 Fr	**8703.514**
	**Ureterorenoscope 5°** **6/7.5 FR WL 430 mm** Atraumatically shaped tip	430 mm	599 mm	5°	 6 / 7.5 Fr	1 x 4 or (2 x 2.2) Fr	**8702.524**
	**Ureterorenoscope 12°** **8/9.8 FR WL 430 mm** Atraumatically shaped tip	430 mm	599 mm	12°	 8 / 9 Fr	1 x 5 or (2 x 3) Fr	**8703.524**
	**Ureterorenoscope 12°** **8.5/11.5 FR WL 430 mm** Atraumatically shaped tip	430 mm	599 mm	12°	 8.5 / 11.5 Fr	1 x 6 or (2 x 4) Fr	**8704.524**

* These are recommended instrument combinations. Further information can be found at **www.richard-wolf.com**

Compatible product range*

Figure	Description	WL	TL	Direc-tion of view	Endoscope tip/sheath tube	Working channel	Product no.
	**Ureterorenoscope 5°** **6/7.5 FR WL 430 mm** Atraumatically shaped tip	430 mm	563 mm	5°	 6 / 7.5 Fr	1 x 4 Fr or 2 x 2.2 Fr	**8702.534**
	**Ureterorenoscope 12°** **8/9.8 FR WL 430 mm** Atraumatically shaped tip	430 mm	563 mm	12°	 8 / 9.8 Fr	1 x 5 Fr or 2 x 3 Fr	**8703.534**
	**Ureterorenoscope 5°** **6.5/8.5 FR WL 430 mm** Atraumatically shaped tip	430 mm	572 mm	5°	 6.5 / 8.5 Fr	Working channel 1: 1 x 4 (2 x 2.2) Fr Working channel 2: 2.4 Fr	**8708.518**
	**Ureterorenoscope 5°** **6.5/8.5 FR WL 430 mm** Atraumatically shaped tip	430 mm	563 mm	5°	 6.5 / 8.5 Fr	1 x 4.2 Fr and 2 x 2.4 Fr	**8708.534**
	**Ureterorenoscope 12°** **8/9.8 FR WL 430 mm** Atraumatically shaped tip	430 mm	563 mm	12°	 8 / 9.8 Fr	1 x 5 or (2 x 3) Fr	**8703.534**

Suction and irrigation pump
FLUID CONTROL 2225 ....**See page 38**

* These are recommended instrument combinations. Further information can be found at **www.richard-wolf.com**

Compatible product range*

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MINI NEPHROSCOPE 15/18 FR from Lahme

also suitable for children and adolescents

Nephroscope 12° 12 FR WL 225 mm
with lateral eyepiece, working channel for instruments up to 6 FR.................................... **8968.421**

Sheath for nephroscope 15 FR........................**8968.001**

Obturator for nephroscope 15 FR **8968.101**

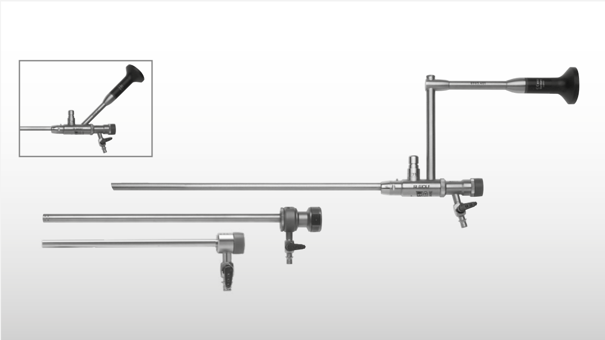
Sheath for nephroscope 18 FR
round, rotating irrigation valve...........................**8968.011**

Sheath for nephroscope 18 FR
round, fixed irrigation valve **8968.041**

Obturator for nephroscope 18 FR **8968.111**

Recommended accessories:
Universal sealing valve 1–6 FR
for inserting auxiliary instruments of 1–6 FR
sterile (PU = 5 PCS)...**4712348**

Suction and irrigation pump:
FLUID CONTROL 2225 ....**See page 38**



PERCUTANEOUS UNIVERSAL NEPHROSCOPES

24 Fr

Nephroscope 20° 24 FR WL 224 mm
with parallel eyepiece, working channel for instruments up to 10.5 FR **8965.401**

Nephroscope 20° 24 FR WL 224 mm
with lateral eyepiece, working channel for instruments up to 10.5 FR **8965.411**

Sheath for nephroscope 20.8 FR.....................**8964.021**

Obturator for nephroscope 20.8 FR **8964.121**

Alternative:
Sheath for nephroscope 24 FR........................**8965.041**

For this:
Obturator for nephroscope 24 FR **8965.141**

Amplatz sheath
for nephroscope 24.3 FR.................................**8964.041**

Sealing element...**15176.100**

Suction and irrigation pump:
FLUID CONTROL 2225 ....**See page 38**

* These are recommended instrument combinations. Further information can be found at **www.richard-wolf.com**

Compatible product range*

Photodynamic diagnostics (PDD) System blue

Bundle system

ENDOCAM Logic 4K
camera control unit BNDL **55253011**

ENDOLIGHT LED blue,
BNDL **51650011**

Special fiber light cable blue, set
2.3 m **806735231**

PANOVIEW telescope blue
70° **8650.515**
30° **8654.522**
12° **8654.531**
0° **8650.514**

PENDUAL blue HD camera head
Flexible housing for individual handling, integrated lens f = 17 mm
Cable length: 3 m.. **5525833**

Suction and irrigation pump:
FLUID CONTROL 2225 .... **See page 38**

TUR-B under blue light (PDD) SHARK continuous irrigation resectoscope

24/22 Fr, use with TFL

Laser working element **8654382**

Recommended
PANOVIEW telescope blue
30° **8654.522**
12° **8654.531**

Outer sheath
24 Fr **8675424**

Inner sheath
22 Fr **8675322**

Obturator
22 Fr **8673022**

Viewing obturator
22. Fr **8673122**

Laser fiber guide tubes:
for inner sheath 22 Fr
600 µm, distal end straight **8654992**
600 µm, distal end inclined **8654994**
600 µm, with distal bracket **8654996**

Suction and irrigation pump:
FLUID CONTROL 2225 .... **See page 38**

* These are recommended instrument combinations. Further information can be found at **www.richard-wolf.com**

Compatible product range*

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FLUID CONTROL 2225
Irrigation pump for HYS / URO / LAP

Bundle system

FLUID CONTROL 2225 .... **2225001**
FLUID CONTROL 2225, incl. power cable **22250011**

Footswitch **2204901**

Irrigation tubes:

Irrigation tube set
with piercing spike, 3 m,
with Y-piece, with Luer-Lock connection, PU = 10 pcs,
sterile, for single use... **4171223**

Irrigation tube set
with care-lock, 3 m, PU = 10 pcs,
sterile, for single use... **4171224**

Suction irrigation tube set
3 m, PU = 10 pcs,
sterile, for single use....................................... **4171225***

Irrigation tube set
with piercing spike, with Luer-Lock connection,
incl. 10 spare membranes,
20x autoclavable.. **8171223***

Tube set for suction
with 2 connections, 5 m, PU = 10 pcs,
sterile, for single use.. **T0503-01**

Vacuum tube with filter
1.7 m, PU = 10 pcs,
can be used for 30 days **2206207**

Tube attachment
with Luer-Lock connection, for suction irrigation handle
8385.901 and tube set 8171223 or 8170.223,
reusable **817123***

Suction tube
3 m, for suction irrigation handle 8385.901,
reusable **8171402***

Secretion container:

Secretion container, 2.5 liters, BNDL, for single use,
consisting of:
Secretion container, 2.5 liters (4170.6566) and secretion
bag, PU = 90 pcs (4170.6564) **4170.657**

Angled 90° plug coupling,
PU = 10 pcs **077.1019**

Secretion container, 2 liters, BNDL, reusable,
consisting of:
Secretion container, 2 liters (8170.6551) and lid for
secretion container (8170.6552)..................... **8170.655**

* These are recommended instrument combinations. Further information can be found at **www.richard-wolf.com**

Order Details/Availability

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Release date and availability: Available immediately following national approvals

Description	Type number
Pulvis 60+ Consisting of: Thulium fiber laser, EU power cable (EAM000045.00), footswitch, 2 pedals (EBM001308.01), 2 laser protection goggles (OBM003778.00), accessories box (KBM000103.01) consisting of: door contact plug (EAM000045.00), key set (MBQ000190.00), TFL blast shield (OAM002112.00), fiber-stripping forceps Ø 300–1000 µm (OBM001079.00), fiber-stripping forceps Ø 100–400 µm (OBM001080.00), ceramic cutter with silicone pad (AGM000080.00)	**PFMS00006**
Accessories	
Interlock Conn. Medical Devices Binder	**EAM000045.00**
Key	**MBQ000190.00**
Power cord – 5 m, Schuko plug 16 A EUR	**EAM001440.00**
Fiber stripper for optical fibers Ø 300–1000 µm	**OBM001079.00**
Fiber stripper for optical fibers Ø 100–400 µm	**OBM001080.00**
Case SALSA 1650 no brand accessories	**KBM000103.01**
Ceramic fiber cutter with slipcase	**AGM000080.00**
Goggle protection f18.P1d09.1003	**OBM003778.00**

Order Details/Availability

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Description	Type number
Optical fibers for single use	
Single use optical fiber 150 µm	**OFJ001511**
Single use optical fiber 200 µm	**OFJ002011**
Single use optical fiber 272 µm	**OFJ702711**
Single use optical fiber ball tip 272 µm	**OFJ302711**
Single use optical fiber 365 µm	**OFJ703611**
Single use optical fiber 550 µm	**OFJ005511**
Single use optical fiber lateral 600 µm	**OFJ506011**
Single use optical fiber 800 µm	**OFJ008011**
Single use optical fiber 1000 µm	**OFJ009911**
Reusable optical fibers	
Reusable 10x optical fiber 200 µm	**OFJ002013**
Reusable 10x optical fiber 272 µm	**OFJ702713**
Reusable 10x optical fiber 365 µm	**OFJ703613**
Reusable 10x optical fiber 500 µm	**OFJ005513**
Reusable 10x optical fiber 800 µm	**OFJ008013**
Reusable 10x optical fiber 1000 µm	**OFJ009913**

For further inquiries, please do not hesitate to contact the Urology Marketing Management team.

Yours faithfully,

Benjamin Seidenspinner
Director Global Marketing

Stefan Tangel
Marketing Manager Urology

FAQs (Frequently Asked Questions)

RICHARD WOLF
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How do we differ from competitors that also feature Quanta lasers in their product range?

Among our competitors that feature Quanta lasers in their product range, there is only one that also operates as a full-range supplier on the market: Karl Storz. Rocamed, Coloplast, EMS, and even Quanta itself do not offer products to cover all possible indications.

Richard Wolf has what it takes to position itself as a full-range supplier in this case and to emphasize the advantages of TFL technology by highlighting the benefits of its own instruments. As such, we operate under the motto "sell the procedure".

This means that the customer has ONE point of contact for devices and instruments. We place our service concept at the forefront, ensuring that we will continue to have a real competitive advantage in the future – especially given the large number of me-too products.

How does our product differ from the TFL (SOLTIVE) from Olympus?

Like Richard Wolf, Olympus operates as a full-range supplier on the market and offers all the equipment for individual indications. The major disadvantage of the TFL (SOLTIVE) from Olympus is that there are no reusable fibers. This is a knock-out criterion – especially for the European market and highly price-sensitive reimbursement systems. Furthermore, the SOLTIVE laser does not offer a pure CW mode, which can be a knock-out criterion when it comes to calls for tenders.

How does what we offer differ from the pulsed thulium lasers from Dornier (Thulio) and Lisa Laser (RevoLix HTL)?

Once again, the primary difference is that Richard Wolf operates as a full-range supplier on the market, offering an all-inclusive package. Dornier and Lisa Laser are not able to do this.

The second distinction appears at the technical level. For more information, see Section 1 (Fundamentals of Lasers), which presents a brief summary of the technical differences and the resulting effects during the procedure:

- The wavelength of 2010 nm / 2013 nm results in lower laser absorption in water. Combined with a higher peak power (max. 3700 W for Thulio / max. 1500 W for RevoLix HTL) and an asymmetrical pulse profile (similar to Ho:YAG), the hemostasis function is poorer and the incision pattern is less precise. This is confirmed by verbal feedback from KOLs (clinical data to follow).
- There is only a pulsed mode; there is no pure continuous mode (CW mode). CW mode, in particular, enables the TFL to perform very precise incisions and backs up its excellent coagulation and vaporization functions (especially when using TUR-B or when a second resection and coagulation procedure is required during laser enucleation).
- The laser cannot be adjusted as finely and precisely as a TFL (the pulse duration is limited – in a similar way to Ho:YAG lasers – and, from 25 Hz, the frequency can only be adjusted in 25 Hz increments).
- Higher retropulsion due to higher peak power than TFL (but better than Ho:YAG).

FAQs (Frequently Asked Questions)

- Fibers only starting at 270 µm, which is a disadvantage in flexible ureterorenoscopy as the channel provides less space for irrigation, resulting in a negative impact on the temperature in the kidney (TFL: from 150 µm). The TFL's pulse profile is key in this case, as the laser emission is much finer and more precise. This also results in excellent laser energy output, especially with thin fibers.
- Louder during operation compared to the TFL and usually much more expensive.

How does the TFL differ from the conventional Ho:YAG laser for prostate enucleation? (See Chapter 2 "Use in AEEP")

Here is a brief summary of the key differences and the resulting effects during the procedure:

- With a Ho:YAG laser, the wavelength of 2120 nm results in lower absorption of laser energy in water. Combined with the high peak power (max. 10,000 W) and an asymmetrical pulse profile, the hemostasis function is poorer and the incision pattern is less precise. This is confirmed by verbal feedback from KOLs (clinical data to follow). Most procedures (especially HoLEP) still require a second bipolar coagulation.
- TFLs have a lower tissue penetration depth (0.15 mm) than Ho:YAG lasers (0.4 mm), which further adds to their safety profile.
- There is only a pulsed mode; there is no continuous mode (CW mode). CW mode, in particular, enables the TFL to perform very precise incisions and backs up its excellent coagulation and vaporization functions (especially when using TUR-B or when a second resection and coagulation procedure is required during laser enucleation).
- The laser cannot be adjusted as finely and precisely as a TFL (the pulse duration and frequency are limited and the peak power is very high).
- High retropulsion due to the very high peak power.

How does the TFL differ from the conventional Ho:YAG laser in stone therapy? (See Chapter 3 "Use in Stone Therapy")

Here is a brief summary of the key differences and the resulting effects during the procedure:

- High retropulsion of the Ho:YAG due to the very high peak power.
- The TFL's pulse profile (super pulse) is key in this case, as the laser emission is much finer and more precise. This also results in excellent laser energy output, especially with thin fibers.
- The Ho:YAG peak power is not adjustable in the low-power range.
- The TFL peak power can be easily adjusted between 500 W, 350 W, and 200 W.
- The pulse duration and pulse frequency of the TFL is much more variable than that of the Ho:YAG laser. This means that the laser emission can be adjusted more finely and ablation is faster.
- The TFL has a lower tissue penetration depth (0.15 mm) than the Ho:YAG laser (0.4 mm). Therefore, compared to procedures using the Ho:YAG laser, the distance between the laser fiber and the stone must be reduced. However, the energy output is more precise.

FAQs (Frequently Asked Questions)

RICHARD WOLF
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How does the TFL differ from a conventional Ho:YAG laser in (laser) TUR-B? (See Chapter 4 "Use in Transurethral (Laser) Resection of Bladder Tumors (TUR-B)")

- TFLs have a lower tissue penetration depth (0.15 mm) than Ho:YAG lasers (0.4 mm), which further adds to their safety profile.
- A wavelength of 1940 nm (Ho:YAG 2120 nm), a highly precise constant pulse profile, and the option of fine-tuning settings enable the TFL to perform very precise incisions with an excellent coagulation function at the same time.
- The ability to switch from pulsed mode to CW mode allows the laser to be used much more flexibly.

How does the technical architecture of the TFL differ from that of the Ho:YAG laser and what are the advantages? (See Chapter 1 "Urological Lasers and Their Architecture")

- Smaller
- Lighter
- Quieter
- More energy savings
- Higher energy efficiency
- Air-cooled
- Standard power plug
- More straightforward technical architecture
- Easier to maintain

Is a 60 W power level sufficient?

Looking back at the inflationary development of laser power in recent years, especially in the case of Ho:YAG lasers, it is easy to get the impression that laser power is the only thing that is important to consider. However, this power inflation has come with the disadvantage of increasingly higher peak powers and irregular pulse profiles. More recently, the advent of pulse-modulated Ho:YAG lasers (MOSES 2.0 effect, Virtual Basket Effect) has demonstrated that the aim has shifted towards reducing retropulsion and taming the uncontrollable pulse profile. The positive side effects have included faster stone ablation and improved hemostasis when used in soft tissue. This indicates that power is not (or no longer) everything. In the meantime, Ho:YAG lasers have also been reaching the limits of how much their technical architecture can be optimized further. The development of pulsed Tm:YAG lasers was based on the same background.

The emergence of TFLs (all 60 W) has rendered discussions about power obsolete thanks to their innovative technical properties. With thulium fiber lasers, the focus is clearly on efficiency. The significant variability in user settings within the pulse frequency and pulse duration, combined with a constant pulse profile and lower peak power, ensure that the laser works extremely efficiently and effectively. For more information, see Section 1: "Fundamentals of Lasers".

A striking example in this same area can be found in the historical evolution of BMW engines, which saw a significant increase in efficiency from the E30 to the F30, accompanied by a reduced number of cylinders and savings in fuel consumption:

Baureihe	E30	E36	E46	E90	F30
Modell	320i	320i	320i	320i	320i
Bauzeit*	1982 – 1985	1990 – 1995	2000 – 2007	2007 – 2012	Ab 2015
Motor	M20B20	M50B20	M54B20	N43B20	B48B20
Zylinder	6	6	6	4	4
Ventile	12	24	24	16	16
Hubraum cm^3	1990	1991	2171	1995	1998
Motortyp	Sauger	Sauger	Sauger	Sauger	Turbo
kW	92	110	125	125	135
PS	125	150	170	170	184
Drehmoment Nm	170	190	245	210	270
Verbrauch l (kombiniert)	14,0	8,6	8,2	7,0	5,7

FAQs (Frequently Asked Questions)

RICHARD WOLF
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Why should customers purchase the Richard Wolf TFL if they only require the laser?

As soon as the focus shifts exclusively to the laser itself, we will end up in a price war and the me-too market. Our aim is to achieve an attractive price and position the laser as a way to open doors to the market. It is essential to determine the indications for which the laser is used and whether there is a fundamental interest in expanding potential applications for the laser or a hospital's portfolio. This is where the work shadowing concept comes into play, giving customers the opportunity to learn new and innovative procedure methods involving our instruments.

Click here for more information:
www.richard-wolf.com/en/clinical-visits/clinical-visits-in-urology

Will there be a flight case?

We have created the WOLF Pulvis 60+ KGM000043.00 flight case and it is available to order.

Can customers use fibers from other providers?

No, the device recognizes third-party fibers immediately. It will not possible to start the device or emit any power if they are used.

Are the MegaPulse 70+ laser fibers compatible?

No – there are separate laser fibers for the Pulvis 60+. The list can be found in Chapter 9 under "Order Details/ Availability".

Which packaging units are available for the laser fibers?

Both disposable and reusable fibers are currently available in a packaging unit of 10 pieces.

We are working on providing reusable fibers in a packaging unit of 1 piece by the end of the year.

Why is there only a limited number of pre-configured presets for the Pulvis 60+ and will these be available in the future?

At the moment there is only a small fixed number of presets, which are considered the initial settings. Unfortunately, it is Quanta that determines whether any new presets will be available in the future. However, we plan to introduce more presets as soon as the relevant clinical studies are available.

Who is responsible for servicing the device?

Richard Wolf in Knittlingen is responsible for coordinating and fully servicing the Pulvis 60+ laser.

The relevant contact person is Thilo Musikant, Director Customer Service and Service Center.

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FAQs (Frequently Asked Questions)

What options are available to help persuade customers to purchase a Richard Wolf laser?

Richard Wolf offers customers the opportunity to experience surgical techniques by shadowing an expert. In selected shadowing centers, specialists with many years of experience are available to provide step-by-step instructions on a surgical procedure involving Richard Wolf instruments, along with information on the technology and advantages.

Click here for more information:
www.richard-wolf.com/en/clinical-visits/clinical-visits-in-urology

Which reference physicians can be named?

- Dr. med. Dr. habil. Christopher Netsch, FEBU, Fellow in Endourology, Senior Physician at the Clinic for Urology, Asklepios Hospital Barmbek, Hamburg, Germany
- Dr. med Michael Straub // Managing Senior Physician, Head of Endourology and Urinary Stone Center, Urology Clinic and Polyclinic at the Technical University of Munich Rechts der Isar Hospital, Germany
- Dr. med. Steffen Relecker, Chief Physician in Urology, Sankt Katharinen Hospital, Frankfurt, Germany

What training courses does Richard Wolf offer?

Advanced training, webcasts, workshops, and service training sessions spirit of excellence

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