KSB Technology – Gets Clean to the Heart of the Matter.
For over 130 years, KSB has been making pumps that transport chemically aggressive and abrasive fluids 24 hours a day. Flue gas desulphurization (FGD) plants around the world already use more than 1000 of our scrubber pumps, well over 2000 process pumps in secondary circuits, plus several 1000 valves. Contractors, consultants, private and municipal operators all benefit from our full range of skills. KSB invests in materials research, manufactures high alloy cast steels, and provides global service for our pumps, valves and innovative automation products.
Legislators and industry put more emphasis than ever on all around protection of the environment and natural resources. FGD plants are a prime example. Whether in coal fired power stations, refuse incinerators or other settings, the authorities set the strictest of standards. Today, that is as true for the Far East as it is for the USA and Europe.

Industrial furnaces give off flue gases into the atmosphere, and most of these contain sulphur dioxide. Modern equipment, however, can remove over 95% of this pollutant before emission. While this is a major challenge, even for advanced desulphurization technology, KSB pumps and valves help make it possible, time after time.

“In a world of change, technical advances and economic growth must always go hand in hand with environmental care.”

KSB supports this all the way.
Reliable flue gas desulphurization has become a basic demand for power station operators across the globe. Electrical and mechanical filters are unable to absorb sulphur, so chemistry has to do the cleaning instead.

Worldwide, modern operators choose the limestone based wet scrubbing process. This converts sulphur dioxide (SO₂) into virtually pure calcium sulphate (CaSO₄). The process uses buffers and oxidation to produce what is better known as gypsum. Easily dried, this end product is ideally suited for the building sector. Another advantage is that limestone is economically available all over the world.

However, this desulphurization process puts major demands on all the plant technical fittings. Abrasive and corrosive particles in the limestone slurry pose a massive threat of wear, particularly to pump and valve components.

The solution is simple. KSB supplies all the necessary pumps and valves for the main and ancillary FGD processes. Specially developed corrosion and wear resistant materials combined with decades of manufacturing progress make our products the leader in reliable technology.
Schematic view of a limestone gypsum FGD process

1 = Absorber recirculation (scrubber) pumps
2 = Limestone slurry pumps
3 = Gypsum slurry extraction pumps
4 = Recirculation water pump
5 = Thickener pumps
6 = Filtrate pumps
7 = Waste water sump pumps
8 = Process water pumps

Plus: various drainage, cooling and fire-fighting pumps

Centrifugal pump
Butterfly/globe valve

Gypsum dewatering
(by centrifuge and/or band filter)

Mammouth
Isoria
KE
Danaïs
Sisto
We are a global leader in the pumps and valves market for fossil fuel power stations and chemical facilities. Research and new developments are crucial to KSB, and so are constant improvements to our established products. One example of successful materials development is the highly wear resistant CeramikPolySiC. This is used for the components of KWPK scrubber pumps that are in contact with the fluid pumped.

We do everything to ensure that our products keep your world flowing round.

“KSB stands for an uncompromising drive for quality, and a unique ability to innovate. Over 12,000 employees worldwide are committed to turning those into success for you.”
Extreme conditions demand uncompromising materials engineering. KSB developed CeramikPolySiC in cooperation with well known experts. The aim was to provide a highly durable ceramic/polymer composite material specially designed for flue gas desulphurization plants.

Material wear takes several forms. These often combine to affect components in other ways. Overall, permanent limestone slurry circulation puts enormously high demands on the system. KSB uses CeramikPolySiC for KWPK scrubber pump components in contact with the fluid. This material is highly wear resistant and completely corrosion proof, providing operators with considerably longer running times. As with all our materials, KSB performed extensive practical tests on CeramikPolySiC in company labs before applying it to commercial FGD applications.
The large KWPK scrubber pump reveals its true qualities inside: casing, wear plate and discharge cover all are made of innovative Ceramik-PolySiC. In combination with our impeller made of NORIDUR® DAS, this novel material makes for excellent reliability. For pumps that run and run.
KSB is a leader in the FGD market thanks to decades of success with the KWPK scrubber pump. Popular worldwide, this unit now benefits from major new developments in materials technology.
Horizontal, radially split volute casing pump in back pull out design. Used as absorber recirculation (scrubber) pump.

- Volute casing made of nodular cast iron JS 1025
- High grade CeramikPolySiC lining
- Dry shaft
- All joints sealed without gaskets by using O-rings and metal to metal contact.
- Maintenance friendly back pull out design
- Front pull out possible as impeller and mechanical seal can also be removed from the suction side.

**KWPK**

**Economical**
- High efficiencies
- Extensive selection chart enables optimum adaptation to system conditions
- Mostly direct driven

**Robust**
- Single piece volute casing made of ductile material
- Optimized with wear and corrosion resistant CeramikPolySiC lining

**Optimum operation**
- Suction side clearance gap can be easily set with the adjustable bearing assembly
- Optimum efficiencies
- Product lubricated mechanical seal with SiC/SiC contact faces

**Long service life**
thanks to corrosion and wear resistant CeramikPolySiC.

**Maintenance friendly**
thanks to back pull out design. When the pump is dismantled, the pump casing can remain connected to the piping.

**Economical**
- High efficiencies
- Extensive selection chart enables optimum adaptation to system conditions
- Mostly direct driven

**Robust**
- Single piece volute casing made of ductile material
- Optimized with wear and corrosion resistant CeramikPolySiC lining

**Optimum operation**
- Suction side clearance gap can be easily set with the adjustable bearing assembly
- Optimum efficiencies
- Product lubricated mechanical seal with SiC/SiC contact faces

**Long service life**
thanks to corrosion and wear resistant CeramikPolySiC.
With its FGD pump, KSB is able to offer another high performance pump in nominal sizes from 460 mm (18 in.) to 965 mm (38 in.) for the scrubber suspension loop of flue gas desulphurization (FGD) plants. This pump was specially developed for FGD applications by our US subsidiary GIW Industries Inc. With its high chrome metal wet end, it ensures maximum wear resistance and offers top efficiencies in excess of 90 % on some models.

The coarse grained and sharp particles frequently occurring in scrubber suspension loops may result in premature failure in pump models with rubber lined casings. Thanks to its high chromium content, the all metal casing of the FGD pump ensures longer running time.
FGD
All-metal horizontal volute casing pump

- High reliability due to heavy wear sections and modern hydraulic design.
- Various impeller and casing configurations make for high efficiency and long wear life.
- Alloy shaft sleeves protect shaft from damage.
- Minimum vibration and low noise to meet the Hydraulic Institute Standards.

<table>
<thead>
<tr>
<th>DN:</th>
<th>460 to 956 mm (18 to 38 in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q max:</td>
<td>18,000 m³/h (80,000 gpm)</td>
</tr>
<tr>
<td>H max:</td>
<td>33.5 m (110 ft)</td>
</tr>
<tr>
<td>t max:</td>
<td>+120°C (+248°F)</td>
</tr>
</tbody>
</table>

Casing materials
Gasite 28G® and Gasite 40G®
*CPK* Standardized chemical pump to EN 22858 / ISO 2858 / ISO 5199 and Directive 94/9/EC (ATEX 95).

- A wide variety of hydraulic systems for excellent efficiencies and NPSH values, which can reduce energy costs.
- The large number of variants available provides optimum solutions for every application:
  - wide range of impeller and casing designs
  - various shaft seal designs
  - extensive range of materials
- The pump’s uniform concept from DN 25 to DN 400 reduces spare parts inventory and simplifies maintenance work.
- Large multinational companies specify CPKs in their works standards.

**KW PK** Horizontal, radially split volute casing pump in back pull out design. Used in the secondary circuits as limestone slurry pump, gypsum slurry extraction pump, recirculation water pump and thickener pump.

- Adjustable suction side gap enables high efficiencies and optimum operation.
- Economically efficient thanks to extensive selection chart. Optimum adaptation to system conditions.
- Maintenance friendly back pull out design
- Long service lives ensured by a wide selection of wear and corrosion resistant materials. Optimum material for every application.
- Robust design pump casing with replaceable wear plate.
- Dry shaft
- Optimum mechanical seal design for every application.

**CP K**

<table>
<thead>
<tr>
<th>DN</th>
<th>Q max:</th>
<th>H max:</th>
<th>t max:</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 to 350 mm</td>
<td>3,000 m³/h</td>
<td>60 m</td>
<td>+120 °C</td>
</tr>
<tr>
<td>25 to 400 mm</td>
<td>4,800 m³/h</td>
<td>275 m</td>
<td>-40 °C to +400 °C</td>
</tr>
</tbody>
</table>
**AMAREX KRT**  
**Submersible motor pump**  
with channel impeller

- Economically efficient thanks to extensive selection chart. Optimum adaptation to system conditions.
- Variable hydraulic systems offer the right impeller for every fluid. Optimum efficiencies. High operating reliability due to wide free passages.
- Two bi-rotational mechanical seals make for a long service life.
- Motors specially developed for submersible motor pumps. Thermal overload protection provides maximum operating safety.
- Long service lives ensured by a wide selection of wear and corrosion resistant materials. Optimum material for every application.

**DN:** 40 to 700 mm  
**Q max:** 10,000 m$^3$/h  
**H max:** 100 m  
**t max:** +60 ºC

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**LCC**  
**Abrasion and corrosion resistant slurry pump**  
for aggressive solids laden fluids.

- State of the art hydraulic design for excellent suction performance and efficiency.
- Impeller suction side pump out vanes minimize wear.
- Easily replacable suction wear plate for fast assembly and maintenance.
- Interchangeable rubber and metal designs allow best material choice for any application.
- Heavy duty mechanical end with roller bearings for high loads and minimal shaft deflection.

**DN:** 50 to 300 mm (2 to 12 in.)  
**Q max (metal):** 3,870 m$^3$/h (17,000 gpm)  
**H max (metal):** 90 m (300 ft)  
**t max (metal):** +120 ºC (+248 ºF)  
**Q max (rubber):** 2,260 m$^3$/h (9,850 gpm)  
**H max (rubber):** 45 m (150 ft)  
**t max (rubber):** +60 ºC (+140 ºF)
“Flue gas desulphurization processes benefit rapidly from intelligent diagnosis and control systems.”

The intelligent PumpExpert diagnostic system provides permanent information on the pump, system and process conditions. PumpExpert also makes clear recommendations on appropriate action. That reduces repair costs, and minimizes or even avoids expensive equipment failures.
PumpExpert

Intelligence keeps track of everything: PumpExpert is the only pump diagnostic system that — based on pump specific condition monitoring — recommends suitable courses of action.

Information at your fingertips – quickly.
1. Local output via display and “traffic light” signals
2. “Takeaway” information via PDA: operation and status data, maintenance history, parameterization
3. Permanent transmission of data to control station via field bus

PumpExpert constantly keeps an eye on all relevant variables: fill level, motor and bearing temperature, power, inlet and discharge pressure, vibrations ...

Our solution to the requirements of the future.

New or changed requirements give rise to new technical developments. The demand for greater automation has had a significant impact on technical developments in the past 15 years. KSB pumps used in flue gas desulphurization plants can fully exploit the functional capabilities of our intelligent PumpExpert diagnostic and monitoring system, and the resulting advantages.

Local PumpExpert solutions are one option. Teleservice via the internet is another, providing online condition monitoring of your system. Malfunctions are detected early, and escalated to the operator or service staff.

Your benefit:
Minimized maintenance, prevention of pump failure and consequent damage.

• Information on system and process status
• Integrated expert knowledge
• Easy planning and system integration
• Integrated, well matched systems solution
• Minimized wiring integration

PumpExpert won the 2004 USEWARE award for its user-friendly interface and operating concept.
KSB globe, butterfly and gate valves are designed for maximum process requirements and worldwide engineering standards. Our valves offer good value for money and a first-class solution for any pressure class in the flue gas desulphurization circuit. Maximum resistance to both corrosion and wear is achieved by optimally matched materials and the use of high-quality linings and coatings.

“130 years of experience in the production of valves spell maximum safety, even under the toughest operating conditions in industrial and power station engineering.”
KSB Mammouth – the giant butterfly valve for applications in flue gas desulphurization, available with nominal diameters up to an incredible **4000 mm**.

Our selection of highly corrosion and abrasion resistant metals is complemented by hard rubber coated discs specially developed by KSB AMRI’s material scientists.
**MAMMOUTH**

Thanks to the special valve design only disc and liner are in contact with the fluid. The shaft has no fluid contact.

- Highly corrosion and abrasion resistant metallic and hard rubber coated discs
- Elastomer liner specially developed and manufactured by KSB AMRI
- Permanent and absolute tightness even at low pressure
- Maintenance-free

**Specifications**

- **DN:** 1050 to 4000 mm
- **t:** 0 °C to +120 °C
- **PN:** 6 to 25 bar

**Materials**

- Body: nodular cast iron
- Disc: duplex stainless steel, nickel based alloy, hard rubber coatings
- Liner: EPDM

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**ISORIA**

Only two components – disc and liner – are in contact with the fluid. The shaft has no fluid contact.

- Highly corrosion and abrasion resistant metallic and hard rubber coated discs
- Elastomer liner specially developed and manufactured by KSB AMRI
- A wide selection of disc and elastomer materials ensures top corrosion and wear resistance
- Permanent and absolute tightness even at low pressure
- Maintenance-free

**Specifications**

- **DN:** 40 to 1000 mm
- **t:** -10 °C to +200 °C
- **PN:** up to 25 bar

**Materials**

- Body: nodular cast iron, grey cast iron, nodular cast iron
- Disc: nodular cast iron, stainless steel, duplex stainless steel, nickel based alloy, hard rubber coatings
- Liner: EPDM, NBR, Viton®, Hypalon®

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**KE**

The butterfly valve with Teflon® or elastomer liner for toxic and highly corrosive fluids.

- Liners made of PFA (Teflon®) and PFA lined discs ensure excellent resistance to aggressive liquids and gases
- Double safety – thanks to primary and secondary seal at the shaft passage, and reliable sealing to atmosphere
- KE butterfly valves are fully maintenance free

**Specifications**

- **DN:** 40 to 600 mm
- **t:** -20 °C to +200 °C
- **PN:** up to 10 bar

**Materials**

- Body: nodular cast iron
- Disc: stainless steel, PFA (Teflon®) lined stainless steel, Norihard®
- Liner: PFA (Teflon®), EPDM, Viton®, Hypalon®
**DANAIS 150 / MTII**

AMRI butterfly valve types DANAIS 150 and MTII meet the most stringent requirements for safety, longevity and perfect tightness in both flow directions. Space saving, low weight, easy to install, extremely service friendly.

Fire-safe!

- **DN:** 50 to 1500 mm
- **t:** -50 °C to +380 °C
- **PN:** up to 50 bar

**Materials**
- **Body:** carbon steel, stainless steel
- **Disc:** stainless steel
- **Seat ring:** stainless steel, PTFE, nickel

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**SISTO-KB**

Its straight-line flow path makes this valve particularly suitable for abrasive, solids laden fluids. The body liner ensures a long service life. Diaphragm valve for suspensions and crystallizing acids with both corrosive and abrasive properties.

- **DN:** 15 to 200 mm
- **t:** -10 to 140°C
- **PN:** up to 10 bar

**Materials**
- **Body:** grey cast iron, nodular cast iron
- **Membrane:** EPDM
- **Liner:** hard rubber (NRH), soft rubber (Butyl)

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**SISTO-10, -20**

A choice of body liners and coatings – rubber, polyamide, Halar, plus PTFE for the top-grade variant – makes SISTO diaphragm valves highly suitable for handling aggressive fluids.

The SISTO-10 valve features a weir-type body that substantially reduces the diaphragm’s flexing work and thus increases the service life considerably. Even valves with large nominal diameters can be used without any limitations up to the specified operating pressure.

- **DN:** 15 to 300 mm
- **t:** -10 °C to +160 °C
- **PN:** 10/16 bar (DIN)
  - 20 bar (ISO)

**Materials**
- **Body:** grey cast iron, nodular cast iron, stainless steel
- **Membrane:** EPDM, Butyl, PTFE
- **Liner:** hard rubber (NRH), soft rubber (Butyl), PTFE (for SISTO 20), Halar coating
Today, no plant should be designed without the benefits of systematic process optimization by automated products.

The KSB AUTOMATION product range is the answer to actual-position feedback, valve measurement and control. It is mounted directly onto the actuator without brackets, thus offering an integrated and extremely compact solution. Automation system and actuator are a perfect match. Synergy at its best.
Manual actuators
A complete range of manual actuators designed to operate any type of 1/4 turn valves in all industrial environments. Actuator non-reversible in any position. Range available for any specification and/or customer requirements:
- any type of control device:
  - handwheel (standard)
  - cardan joint
  - chain wheel
  - fountain square
  - remote control
- limit switch box
- special coating for corrosive environments
- version with electric actuator

Electric actuators
A large range of electric actuators tailored to customer requirements:
- ON/OFF or control duty
- integral (local/remote) or non-integral (remote) control
- alternating (3-phase / 1-phase) or direct current

Direct part turn electric actuators (small valves) or combination of gear and multi-turn electric actuators from various manufacturers, according to customer specification.

Pneumatic actuators
A complete range of double acting (ACTAIR) and single acting (DYNACTAIR) pneumatic actuators.

Available with the whole range of KSB automation features:
- position detection (AMTROBOX)
- ON/OFF control (AMTRONIC)

A manual override (RMD) can be installed between the actuator and the valve for operation in case of lack of pneumatic air supply and/or control signal.

AMTRONIC
The integrated control box AMTRONIC with position indicator, open/closed detection and actual position feedback, if applicable, is used on pneumatic actuators ACTAIR or DYNACTAIR for ON/OFF applications. No pneumatic lines are needed between AMTRONIC and the actuator thanks to the integrated pneumatic valve. All products are bus compatible.

Automated AMRI valves from KSB
Benefits that will convince you!
- Simplified cabling, line layout and plant design
- Reduced installation time and costs
- Low space requirements
- Very robust: enclosure IP67, corrosion and shock resistant due to metal housing
“Our global manufacturing and service networks put ideal solutions at your disposal, wherever you are.”

Our high-performance manufacturing sites on every continent meet a market demand: they allow us to produce ideally priced pumps and valves close to our customers.

Take China, for example: Shanghai lies at the heart of one of the world’s largest growth markets. The KSB site there is one of several internationally offering a full choice of one-stop services. In Shanghai, these range from an inhouse foundry to a modern customer service center.
**Materials**

_Safely cast in a quality role_

With our own foundries in Germany, China, the US, Brazil, Mexico, India, Indonesia and Pakistan, we hold one of the crucial keys to product quality. Top-engineered materials and economic efficiency let us shape more than 40 cast materials into first-rate components every day. The result is the wide variety of pumps and valves you’ve come to expect from KSB.

Our design, foundry, manufacturing and materials development departments make maximum use of synergy to give you bespoke solutions for every application. And KSB’s inhouse materials laboratories, eagle-eyed, use all their high tech equipment to ensure that every component fully meets our stringent quality standards.

Our materials specialists and laboratories are at your disposal any time, to provide damage analysis and assessment, or answer any questions you have on material selection for your application. That’s what we mean by “Service”!

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### KSB Material Portfolio

<table>
<thead>
<tr>
<th>Material</th>
<th>Designation</th>
<th>Material No.</th>
<th>Description</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norihard®</td>
<td>GX250CrMo15-3</td>
<td>–</td>
<td>Highly wear resistant white iron</td>
<td>Bauxite and sinter slurries, milk of lime and limestone suspensions, wash water and effluent with a high sand content, bauxite and aluminium oxide suspensions</td>
</tr>
<tr>
<td>Gasite® WD28G</td>
<td>–</td>
<td>–</td>
<td>Specially refined, high chromium white iron alloy</td>
<td>Products of semi-dry processes in waste incineration plants, milk of lime and limestone suspensions, aggressive pit water containing ore, coal or mine tailings, acidic heavily solids laden waste water and slurries</td>
</tr>
<tr>
<td>Noriloy®</td>
<td>GX170CrMo25-2</td>
<td>–</td>
<td>Wear and corrosion resistant CrMo alloyed white iron</td>
<td>Highly abrasive and mildly corrosive applications such as FGD absorber recycle &amp; process pumps, hydraulic transportation, industrial minerals, hard rock mining, sand &amp; gravel, dredge &amp; mild chemical applications</td>
</tr>
<tr>
<td>Noridur® DAS</td>
<td>GX3CrNiMoCuN 24-6-2-3 specially heat treated</td>
<td>–</td>
<td>Wear resistant duplex stainless steel</td>
<td>For pump components subject to hydraulic loads and in contact with gypsum suspensions and limestone slurries in flue gas desulphurization systems</td>
</tr>
<tr>
<td>Gasite® T90G</td>
<td>–</td>
<td>–</td>
<td>Wear and corrosion resistant white iron alloy</td>
<td>Medium abrasion and high corrosion applications such as industrial minerals, phosphoric acid, sulfuric acid, high sulfur, coal gasification, high chlorides and strong chemical applications with solids</td>
</tr>
<tr>
<td>Noricrom®</td>
<td>GX150CrNiMoCuN 41-6-2</td>
<td>1.4475</td>
<td>Corrosion and wear resistant triplex stainless steel</td>
<td>Highly acidic, chloride-containing fluids with very high solids content</td>
</tr>
<tr>
<td>Noridur®</td>
<td>GX3CrNiMoCuN 24-6-2-3</td>
<td>1.4593</td>
<td>Duplex stainless steel</td>
<td>Chloride-containing fluids of all kinds, reducing acids and acidic process water, scrubber suspensions</td>
</tr>
<tr>
<td>CeramikPolySiC</td>
<td>CPS</td>
<td>–</td>
<td>Wear and corrosion resistant ceramic/polymer composite material</td>
<td>Acidic, chloride-containing slurries with high solids content in FGD plants</td>
</tr>
<tr>
<td>Noriclor®</td>
<td>GX3CrNiMoCuN 24-6-5</td>
<td>1.4573</td>
<td>Super duplex stainless steel</td>
<td>Aggressive fluids in chemical processes, waste water transport and environmental engineering</td>
</tr>
</tbody>
</table>
**PUMP MATERIALS**

**Composites: True strength through combination**

By realizing the technically challenging combination of ceramics with plastic, we have succeeded in providing the benefits of two materials in a single composite. Our newly developed Ceramik-PolySiC (CPS) is a good example. Its properties increase the service life of elementary components, particularly in flue gas desulphurization plants.

**Well-tried materials of the NORI® series developed further**

New fields of application and ever increasing requirements demand new solutions. With its Noridur® DAS, KSB has developed a material that reliably withstands the abrasive and corrosive slurries handled in flue gas desulphurization, and enables substantially longer service lives. So life cycle costs are noticeably reduced.

**VALVE MATERIALS**

**Elastomer materials: An economical alternative**

The hard rubber coatings specially developed by KSB-AMRI are a viable alternative to metals wherever corrosion and abrasion protection is required. These materials have proved their worth in FGD applications for more than 22 years. We use them for our AMRI butterfly valves.

The liners used in AMRI butterfly valves, too, are made of elastomer materials specially developed and processed by KSB AMRI.

Comprehensive quality testing in our production departments ensures a high standard of safety and a long service life.
**Service for all your needs, around the clock, around the world.**

As well as first-class products for modern FGD plants, KSB also offers comprehensive service. This covers installation and commissioning, maintenance, repair, overhaul and modular TPM – Total Pump Management. KSB can tailor solutions precisely to your facilities. At a fixed price if required. Our service experts are also happy to deal with other manufacturers’ products and related systems.

KSB takes care of your units throughout their entire lifecycle and on to replacement. Over 1,600 KSB service specialists at more than 100 service centers worldwide team up with 200 external service partners. They are all on call around the clock, providing rapid help wherever necessary. Our responsibility towards customers includes competent advice. Our service specialists are delighted to answer all your queries, for example about process optimization, energy saving, or ideal technical use of wear-resistant materials. Special certification for service in process plants is another important safety factor.

**KSB – Supplier to more than 300 flue gas desulphurization plants throughout the world.**
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