50 years (1965 - 2015)
KAISER mobile walking excavators

To mark the occasion of the 50th anniversary of the KAISER mobile walking excavator, we have compiled an extract from our book "100 Years of Innovation. 100 Years of Kaiser." with the complete history of KAISER excavators. In addition to the historical facts, interviews and excerpts from brochures, this publication is illustrated with many fascinating photos from past and present. KAISER AG wishes you happy reading!

Please note: the full edition of the anniversary book is available from Buchzentrum Liechtenstein (www.buchzentrum.li, ISBN: 978-3-905437-37-9).

An excavator for the mountains – development of the Kaiser mobile walking excavator

Kaiser AG ranks amongst the world's leading manufacturers of mobile walking excavators. The first prototype was produced in 1965.

In the mid-1960s, Josef Kaiser developed a special excavator for deployment in steep terrain. This was a “single-axle” excavator, later to become known as a “walking excavator”. The defining feature of this type of excavator was the absence of a separate travel drive. Instead, the vehicle propelled itself forwards using the boom and bucket as its front foot.

This was nothing new. Similar models were already on the market at the time, one example being the single-axle excavator developed by the British engineer Richard Smalley. However, the well-known machines all proved to be useless when it came to working in Alpine regions with their seasonal streams and steep slopes. This gave Josef Kaiser the idea of developing his own excavator.

The prototype of the new excavator was built at the premises of Ernst Menzi AG, based not far away in the Swiss town of Widnau, as Kaiser’s capacity was taken up with the production of slurry tankers. As previously mentioned, Ernst Menzi was already a long-s tanding supplier to Kaiser and the two company owners enjoyed a good rapport. The envis-aged collaboration with Menzi related to the production. The product was to be marketed and sold by Kaiser who also took care of the patent formalities in conjunction with the new excavator type. The name agreed for the excavator by the two companies was the MUK 2000, an amalgamation of the names Menzi and Kaiser.

Practical trials with the prototype were carried out in Schaanwald. On 22 September 1966, the Liechtensteiner Vaterland reported on the deployment of the excavator in the Mauren fens: “Clearance work is currently in full swing in the Maurer Esche district and is proceeding at a rapid pace with the aid of a modern single-axle excavator. The Schaanwald-based vehicle manufacturer Josef Kaiser provided the machine on a trial basis and it has proved to be ideal for this work. In one hour, this machine can achieve the work of at least 12 to 15 men. The Esche once again resembles a neat drainage channel. Stream bank stones which lay covered for years are now visible. The pond-forming blockages and flooding seen in the past have been virtually eliminated. The drainage function has also been fully restored.”

The MUK 2000, prototype of the Kaiser walking excavator, built in 1965.

Left-hand page:
The KAMO 3X climbs a steep slope, driven by Josef Kaiser, ca. 1970.

The first walking excavator series – the MUK 3000

The first series of ten walking excavators, type designation MUK 3000, was manufactured in Widnau in 1966. In the same year, Kaiser presented this novel machine at the Olma trade fair in St. Gallen, which was then Switzerland's biggest exhibition for the agricultural sector.

When the first walking excavators were sold, the entrepreneurs Josef Kaiser and Ernst Menzi went their separate ways. Menzi claimed they had developed the excavator and in autumn 1966 began selling it as the MUCK 3000, in other words as their own product under a different name.

Right-hand page:
The MUK 3000;
brochure, October 1966.

The excavator's ability to make its own way onto the back of a truck always amazed onlookers. The MUK 3000 in front of the factory of Ernst Menzi AG in Widnau, 1966.

From the outset, the emphasis was on deployment in difficult terrain. The walking excavator digging a trench on the Jodaböchel in Eschen.

MUK 3000

In- und Auslandpatente ang.

Was leistet der MUK 3000?

Der MUK ist ein absolut neuartiger Bagger, der für den Baumeister und Unternehmer ausserordentliche Vorteile bietet, denn es gibt praktisch kein Gelände, wo er nicht eingesetzt werden kann: im Sumpf, im Morast, am Hang, ja selbst am Steilhang, in den Bergen, in Bächen, überall leistet er Erstaunliches. Dabei kostet er nur einen Bruchteil dessen, was man für einen Bagger der üblichen Bauart zahlen muss.

Der MUK 3000 ist viel mehr wert als er kostet

Bei der Arbeit bewegt er sich mittels des Auslegers und des Löffels fort. Für den Transport zur Arbeitsstelle wird er entweder auf einen Lastwagen oder einen Anhänger verladen, oder er kann als Einachs-Anhänger nachgezogen werden.

Technische Daten

Motor	Zwei-Zylinder Diesel, 29 PS	
Baggermasse	Gesamthöhe mit Kabine 2500 mm Länge ohne Deichsel (Arbeitsstellung) 3200 mm Totale Breite aussen Pneus 2000 mm Bereifung 13—16, 6 Ply (86 cm hoch, 33 cm breit) Innenbackenbremsen innerer Ø 282 mm Gewicht ca. 2000 kg	
Arbeitsleistung	Grabtiefe	2500 mm
	Ausladung	3900 mm
	Ausschütthöhe	2850 mm
	Schaufelbreite	400 mm, Inhalt 87 Liter
		600 mm, Inhalt 130 Liter
		800 mm, Inhalt 174 Liter
	Breite der Planierschaufel 1250 mm	
	Schwenkbereich 360°	
	Fortbewegung pro «Schritt» 2500 mm	
	Zahnkraft	7000 kg max.
	Reisskraft	2500 kg max.
	Stosskraft	1700 kg max.
	Hydraulikdruck	150 atü
Garantie	6 Monate.	

Josef Kaiser, Fahrzeugwerk FL
9493 **Schaanwald**

Telefon (075) 3 14 73

Setting up excavator production in Italy

The KAMO 3X

Following the rift with Ernst Menzi, Josef Kaiser decided to set up his own excavator production in collaboration with the Italian company Moro in Pordenone. The first walking excavator produced, known as the KAMO X3 or 3X, was launched onto the market in 1967. The name KAMO was derived from Kaiser and Moro, the X stood for the four legs and the 3 for the weight of the mini excavator, which was just three tonnes. The paint finish of the KAMO was in blue and red, Liechtenstein's national colours.

In spring 1970, the KAMO 3X was used on a mountainside construction project in Tyrol/Austria after Josef Kaiser had personally demonstrated the excavator on site. In a report on the deployment under the title "Mini excavator replaces manual excavation", forestry engineer Josef Hopf wrote as follows: "With the KAMO 3X mini excavator, it was possible to carry out the excavation work for 9 average-sized retaining walls in the Freudenbach [stream], originally planned as a manual operation, for roughly 1/3 of the estimated cost. The machine showed an unprecedented terrain capability on inclines. The excavator appears to be suitable for excavation work in areas requiring torrent and avalanche control, which up to now had to be performed manually. This means it will be able to fill a long-standing gap in the machinery sector." Josef Hopf: Report on the deployment of the KAMO 3X in the Freudenbach in Tyrol, Kaiser AG company archive.

The KAMO 3X in operation on a torrent control job.

Technical specifications of the KAMO 3X; extract from brochure, ca. 1969.

TECHNISCHE ANGABEN

Gesamtgewicht Kg 3.800 ca.
Fortbewegung mittels des Baggerarmes
Tieflöffel
Zweizylinder Dieselmotor mit Luftkühlung, 35 PS
Bereifung 40-12 (13.00-18)
Hydraulikanlage, Betriebsdruck 180 Atü
Ausfahrmöglichkeit der Abstützungen und des Auslegers
Manuell und hydraulisch ausziehbare Abstützungen
Leicht abnehmbares Führerhaus mit grosser Sichtfläche

ARBEITSLEISTUNGEN

Reisskraft am Zahn	Kg	3.200 ca.
Hublast (Ausleger m 2,70)	Kg	3.300 ca.
Bodendruck	Kg/cm²	0,20 ca.
Fortbewegung pro - Schritt -	m	3 ca.
Drehbereich 360°	U/Min	9 ca.
Auslegergeschwindigkeit	Zyklen/Min	7 ca.
Ueberwindbare Steigung	über	100%

The demand for an excavator which was even capable of climbing over walls was particularly strong in the 1970s. As a consequence, Kaiser and Moro were able to sell more than 1,800 walking excavators by November 1979.

An excavator driver who soon set up his own business with a KAMO 3X was Josef Meier (b. 1937) from Mauren. One of his biggest contracts was the drainage of the Liechtenstein fens:

> *"From 1970 to 1984; I dug the drainage channels throughout the country with the walking excavator. Needless to say, Josef was keen to hear about my experience with the excavator. Sometimes he would drop by on a Sunday. One issue, for instance, was the fact that my feet always froze in the cab. In the Schellenberg fens, the temperature would sometimes drop to -22 degrees. It wasn't long before Josef fitted a heater for me. He simply used the hot exhaust air from the engine. Another new product was the hydraulic shoring for trenches, which Kaiser provided during the work on the drainage channels in the Vaduz fens. The Kaiser walking excavator was far superior to all the usual machines when it came to the drainage work."* Josef Meier, Mauren, 23 March 2013.

Drainage work in the Vaduz fens with hydraulic shoring of the trench, ca. 1980.


Kamo fix
moro kaiser
mk

The KAMO 3X working on the moon; brochure probably from 1969 recalling the first moon landing.

Setting up excavator production in Liechtenstein

The Kaiser X4 excavator

A demand for higher-capacity machines soon developed in Kaiser's core markets, Switzerland and Austria. This prompted Josef Kaiser to establish his own excavator production facilities in Liechtenstein. The first walking excavator made in Schaanwald, the "Kaiser excavator X4", was presented to trade circles in 1976. New competitors started to appear on the scene around the same time. In 1977, the Italian company Euromach began making walking excavators, and 1978 saw the first construction machinery manufacturer – the German company Karl Schaeff KG – enter the market. In spite of the growing competition, Kaiser succeeded in expanding its sales network in the 1970s. By 1980, the company was present on four continents with its excavator range and had distributors in Switzerland, Austria, France, Yugoslavia, the USA, Australia and South Africa.

Right-hand page:
The Kaiser X4 excavator, 1977.

Technical specifications of the Kaiser X4 excavator; extract from brochure, 1976.

The excavator assembly team outside the factory in Schaanwald, ca. 1980.

Allgemeine technische Daten

Motor

Viertakt-Dieselmotor mit 2 Zylindern, Marke Deutz, Typ F2L-912, luftgekühlt mit Axialgebläse (schallisoliert, speziell gegen Kabine).

Leistung:	37,5 PS
Hubraum	1,88 lt
Kraftstoffverbrauch	183 g/Psh
Bohrung/Hub	100/120 mm
Elektrische Anlage	12 V

Trockenluftfilter, Geländeölwanne, Heizung, Schalldämpfer.

Hydraulikanlage

Serienmässig 2-Kreis-Anlage mit leistungsgeregelter Kolbenpumpe und Hochdruckzahnradpumpe

Arbeitsdruck	200/230 atü
Steuerblock	für Verstellung Parker Hanifin 4-fach Monoblock für Arbeitsfunktionen Rexroth Segmentblock Simultanbedienung, Serien-Parallelschaltung mit Primär- und Sekundärdruckbegrenzungsventilen
Hydro-Schwenkmotor	Kolbenmotor selbsthemmend und selbsthaltend mit zusätzlichem Dämpfungsventil
Hydrauliktankinhalt	140 lt
Betriebstemperatur	75°
Hydrauliköl	Shell Tellus 33 oder nachweislich gleichwertige Produkte
Hydraulikzylinder	Die Kolben sind gehärtet und hartverchromt, Zylinder gehohnt, Abdichtungen mit langer Lebensdauer. Die Hydraulik-Abstützzylinder sind mit Sicherheits-Sperrventilen ausgerüstet.
Reisskraft	zwischen 2000 kp und 3400 kp
Zahnkraft des Löffels	ca. 6000 kp
Arbeitsleistung	bis 75 m^3 pro Stunde je nach Boden

Gewicht (Teleskopausführung mit Drehwechselkopf) 5200 kp

Zusatzausrüstung

Löffel: Löffelbreite/Wassermass	300 mm	70 l
	400 mm	100 l
	600 mm	140 l
	800 mm	180 l
Planierschaufel	1200 mm	
Planierschaufel hydraulisch, verstellbar für Böschung	1500 mm	± 60°

Drehwechselkopf

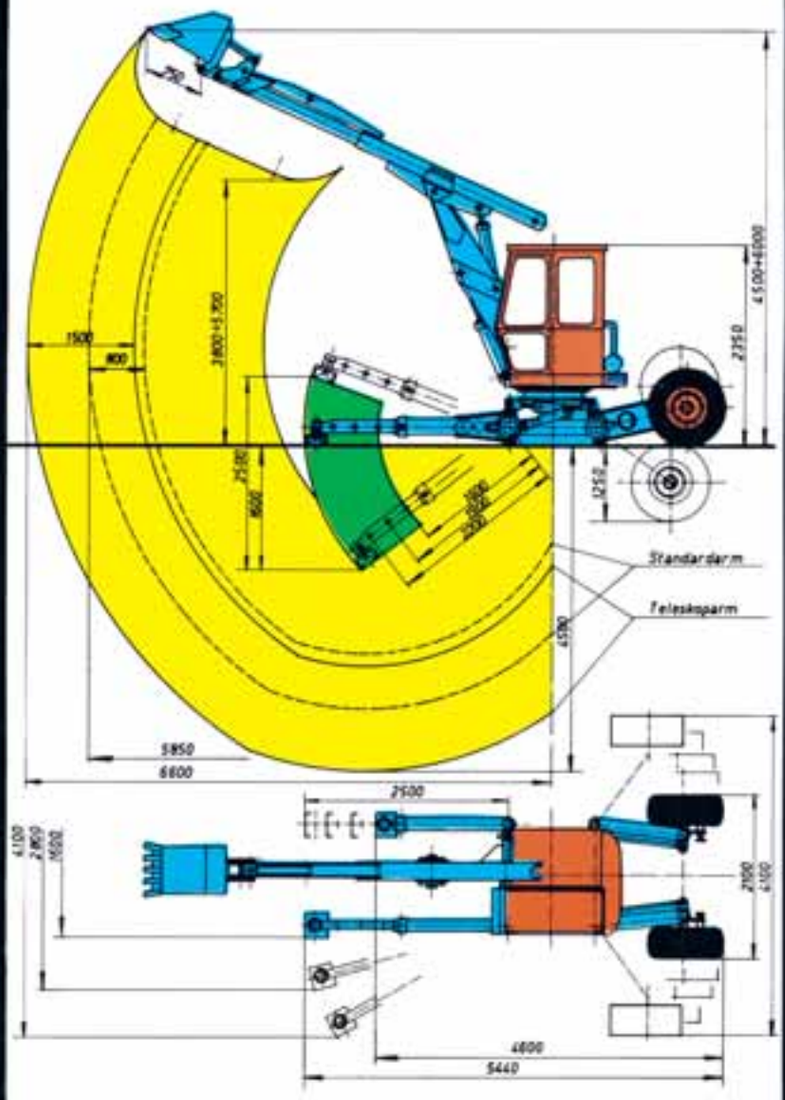
Teleskoparm mit Teleskopierbereich 1500 mm

1 Satz Hartgummitatzen mit Kugelgelenk

Seilwinde mit 3000 kg Zugkraft

Hydraulischer Abbauhammer

KAISER Schreitbagger
Grabtiefe und Verstellmöglichkeit



Grösser Verstellbereich des Planierschildes

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Left-hand page:
The Kaiser X4 excavator; brochure, 1976.

The walking excavator is taught how to drive

Equipping the excavator with a travel drive revolutionised the walking excavator concept. This was the equivalent of teaching the walking excavator how to drive. Kaiser built the first four-wheel model in 1979. On 26 February 1980, the machine was entered in the register of trade marks under the designation "Mobile Walking Excavator". While the wheels on the first models (X4 M and X5 M) were primarily designed to provide support in steep terrain, Kaiser brought out the X4 TurboMobil in 1986, which was also suitable for driving on the road. In the early 1980s, Kaiser had also developed a crawler excavator, known as the X6, with width-adjustable crawler tracks. By the mid-1980s, therefore, customers had several types of excavator to choose from.

1981 saw the presentation of the X4 M mobile walking excavator at an international trade show for construction machinery in Houston/USA. The American financial magazine «Fortune» was sufficiently impressed to report on the unconventional excavator: "The machine may look like some fantastic insect, but it is actually a multipurpose backhoe, made by a small Liechtenstein company called Kaiser and distributed in the U.S. by Industrial & Municipal Engineering Inc. Aptly named the X4 M SPYDER, this creature, which costs between $50,000 and $85,000 depending on attachments, can operate on grades as steep as 70 degrees and in water up to 8 feet [2.4 metres] deep." Quoted in the Liechtensteiner Volksblatt, 2 May 1981.

The revolutionary mobile walking excavator concept also attracted the attention of the German newspaper, Frankfurter Allgemeine Zeitung (FAZ). The edition of 19 November 1982 carried an article headlined "The 'wheel motor' brings new solutions in vehicle and machine construction": "Another entirely new application for hydraulically operated wheel motors is the universal travelling and 'walking excavator' as built by Kaiser AG in Schaanwald (Liechtenstein). These machines, now with a new dimension in mobility, can also be used in marshlands as well as on steep mountain slopes such as for torrent and avalanche control construction work or for building terraces, where conventional hydraulic excavators are often unable to cope. In addition to being able to travel, as both rear wheels are fitted with Rotatrac drives, the new 4-wheel excavator model can also climb over obstacles and, as already mentioned, 'walk'. This it does by using its extended boom positioned on the ground, which it pushes against and uses rather like a crutch to heave itself over an obstacle. A lot of work which previously could not be mechanised is now possible with this new type of excavator – including cases where the work has to be carried out in confined spaces such as urban renewal projects or even in underground sewers."

1 The Kaiser X4 M, the first walking excavator that could also drive.

2 The X5 M working on streambed clearance.

3 The X5 M being used on the demolition of a skyscraper in New York, 1982.

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4 The X6 crawler excavator with rotator for 360° continuous boom rotation loading onto a truck.

5 The X6 in the early 1980s. At the time, the width-adjustable crawler tracks and the machine's ability to load onto a truck were revolutionary.

6 In 1986, the Kaiser X4 TurboMobil became the technical benchmark for mobile walking excavators. Its defining features were mobility, capacity and the load sensing system.

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The bestseller among mobile walking excavators: the Kaiser X4 TurboMobil, 1986–1991

An excavator that customers fought over was the Kaiser X4 TurboMobil which was launched onto the market in 1986. It was equipped to drive on the road, had almost twice the capacity of its predecessor model and was the first walking excavator to have a load sensing system. Another hallmark of the Kaiser X4 TurboMobil was its cabin with all-round vision as well as its functional design.

The Kaiser X4 M TurboStar: a new star among construction machines, 1991–1997

The Kaiser X4 M TurboStar, which was launched onto the market in 1991, was one of the most successful models and soon became synonymous with walking excavators. Its hallmark features were capacity and operator comfort. The undercarriage functions could now be operated via the joystick. A benefit for both the driver and the environment was the low noise level. Customers retain fond memories of this model because of its performance and reliability. The last TurboStar left the factory in Schaanwald in 1997.

Right-hand page:
X4 Turbo/TurboMobil data sheet; brochure 1986.

The “must-have” excavator Kaiser X4 TurboMobil, 1986.

In Munich in 1995, the TurboStar was received like a pop star at the bauma trade fair for construction, building material and mining machines.

TECHNISCHE DATEN KAISER X 4 TURBO / TURBO-MOBIL

Motor:
VM – 4-Zyl. 4-Takt Turbo Diesel 64 kW (87 PS) wassergekühlt.

Hydraulik:
Load Sensing System (lastfühlend) mit leistungsgeregelter Axialkolbenpumpe für sämtliche Funktionen des Baggers.
Förderleistung 0 - 170 Liter/min., max. Betriebsdruck 250 bar.
Betätigung der Steuerelemente über hydraulische Vorsteuerung.

Schwenkantrieb:
2-stufiges Planetengetriebe mit Lamellenhaltebremse und Hydraulik-Verstellmotor.

Fahrantrieb Turbo-Mobil:
Hydr. Radnabenantrieb mit 3-stufigem Planetengetriebe und in Oel laufender Lamellenhaltebremse.

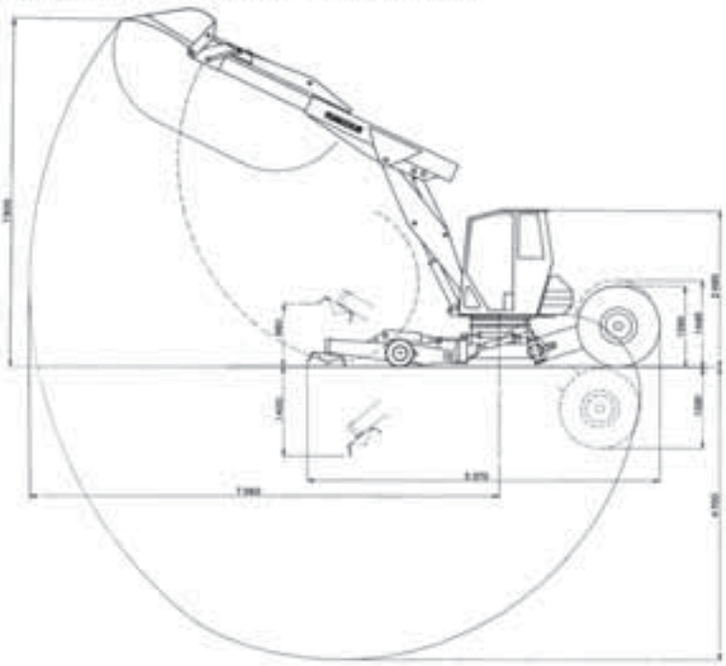
Hauptarm-, Pendel-, Kübel- und Teleskopzylinder:
mit hydr. Endlagendämpfung (weiches Abbremsen) schont Fahrer und Maschine.

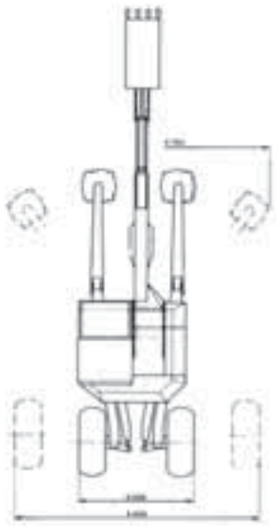
Serienmässige Ausrüstung:
Vollrundsicht-Kabine, überrollsicher (ROPS-Test nach DIN 24090), hydraulisch nach vorne kippbar, Oberteil abnehmbar. Grosser Dieseltank (78 Liter), Reservetank (150 Liter). Vielseitig verstellbarer Sitz mit hydr. Schwingungsdämpfung. Kabine ausgerüstet mit Warmwasserheizung und Lüftung; Armaturenblock mit Radio, Stundenzähler und Quarzuhr. Ausserdem sind an der Kabine Arbeitsscheinwerfer und Signalhorn montiert. Motorhaube, Seitenverkleidung, Dieseltank und Kabinentüre sind abschliessbar.

Bereifung: X4 T / X4 TM 1300 x 530 12 ply
Lenkräder X4 TM 11,5 x 14,5 24 ply

Reisskraft: 61 kN (6220 kp)
Losbrechkraft: 89 kN (9070 kp)

Gewichte: X4 T ca. 6500 kg / X4 TM ca. 7000 kg





KAISER ag Fahrzeugwerk

FL-9486 Schaanwald
Fürstentum Liechtenstein
Telefon 075 / 32255
Telex 889166 kais fl
Telefax 075 / 32318

Technische Änderungen vorbehalten.

Vertretungen:

Switzerland:	Carl Heusser AG, Baumaschinen, 6330 Cham; Tel. 042 / 382244, Telex 868871
Austria:	Josef Laurer KG, Baumaschinen, 6200 Jenbach; Tel. (05244) 2304, Telex 05-3746
Jugoslavia:	Poljoopskrba, Import-Export, Varsavska Ul. 5, Zagreb; Tel. 041 / 424444, Telex 21-185
France:	Camuc S.A.R.L. «La Combe», 74540 Alby-sur-Chéran; Tel. 50 / 682610, Telex 385497
USA:	L.M.T., 30 N.E., 8th Avenue, Galva, Illinois 61434; ph 309-932-3311
Australia:	FLEXIBLE Pipe Cleaning Tools, 6a Aristoc Road, Glen Waverley 3150; ph (03) 560 2843
Rep. of South Africa:	C. D. Dargie Eng. PTY Ltd., 16 Edendale Road, Eastleigh Edenvale, 1610; Tel. 011 / 6098631, Telex 4-20130
Rheinland-Pfalz (D):	ABS Baumaschinen-Vertriebs-Ges., 6738 Elmstein/Pfalz; Tel. 06328 / 1516

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Kaiser X4M Turbostar -
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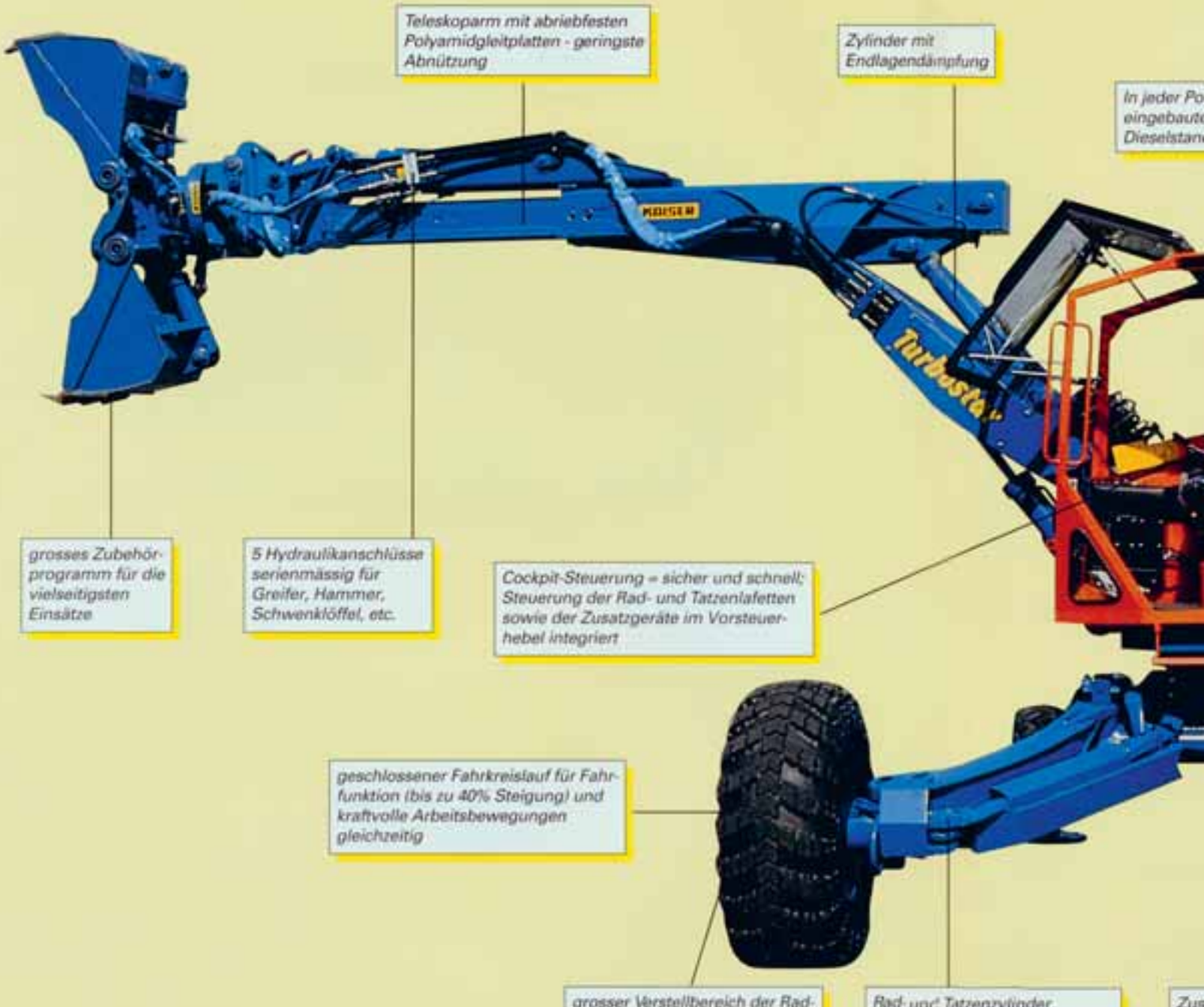

+++ Universell +++ Komfortabel +++ Leistungsstark +++

Kaiser X4M TurboStar;
brochure 1995.

A walking excavator is only as good as the person driving it

The first training programme for walking excavator drivers

Kaiser attached great importance to training for excavator drivers from an early stage. For this reason, Kaiser set up its own training programme back in 1985, based on the idea that “a walking excavator is only as good as the person driving it”. The company continues to provide training courses for both beginners and advanced drivers.

Walking excavator competition

In 1986, Kaiser staged its first walking excavator competition in Mauren/Schaanwald. The “Walking Excavator Olympics”, as it was humorously referred to, attracted no less than 110 drivers. The competition has now been held six times. At the fifth edition of the games held in 2007, around 5,000 visitors came to watch the 60 drivers put the vehicles through their paces. There was even a German television crew on site.

The Spyder Club

Kaiser AG founded the Spyder Club as a platform for professional walking excavator drivers in 2002. The appearance of the mobile walking excavator gave rise to the term “spider excavator” in the English-speaking world and, for this reason, “Spyder” was adopted as the name for the club. 2011 saw the launch of the Spyder Club for fans, which is split into Spyder Juniors (up to age 16), Spyder Members and Spyder Pros. Kaiser AG provides club members with the latest excavator news and offers various concessions.

Excavator training session, 2009.

1 Precision and speed are the key driver skills in the competition.

2 And the winners are...! At the 2007 edition of the walking excavator games, Markus Metzler came in first, Robert Nesensohn second and Peter Willi third.

3 'Tis early practice only makes the master – children trying out the Kaiser kids' excavator.

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That was a huge leap forward

Hans Senn (b. 1956) joined the Kaiser company in 1981 and is now responsible for special attachments and prototypes in collaboration with the excavator development department. In the following interview, he talks about excavator construction during the era of Josef Kaiser.

Hans, you joined the Kaiser company in 1981 as a repair welder, but soon went on to work in a wide range of areas: in customer service, field sales – for sewer cleaning vehicles as well as excavators – in the development of the dual-mode vehicles, setting up training courses; in other words: wherever someone was needed. How did you come to work for Kaiser?

I met Josef Kaiser through my previous employer, the earth-works contactor Edi Dürr in Sevelen. Dürr was a customer of Kaiser's. When the work got scarce for Dürr following the completion of the Haag-Trübbach motorway, he advised me to give Kaiser a call. I rang them up at around 3 o'clock in the afternoon and asked Josef whether he had a job for me. No application, nothing – after all, we knew each other. At half five, my wife phoned me and said a man was asking for me and looked like a farmer. When I got home, Josef was standing in the living room and wanted to know when I could start.

You then joined Kaiser and can now look back on 30 years of experience in excavator construction. Which model stands out most in your memory?

In 1986, we launched the Kaiser X4 TurboMobil onto the market. That was the first walking excavator that could really drive. The earlier models, the X4 M and X5 M, did have four wheels, but their prime function was to provide support so that the vehicle could negotiate an incline in steep terrain. They weren't intended for driving on the road.

There's a nice story related to the X4 TurboMobil. One Saturday afternoon, Josef suddenly phoned me up at home. He said he had an idea and that I should come at once. When I got to the firm, I was then told: «What you've got to do for me is fit the wheels in the middle of the front legs, then take the hoses around like this and the machine can be steered.»

No sooner said than done! By about three in the morning we had it sorted – and the walking excavator could drive. That was a huge leap forward. We were two years ahead of our competitors. I know that it was two years because the drive in the wheel rims had been specially developed for Kaiser and we had the exclusive right to purchase these wheels for a two-year period.

You built all sorts of machines with Josef. What was Josef like as an inventor?

Josef was an innovator who really listened to what customers had to say. He would soak up every word like a sponge. He knew exactly where the market was going, took a close look at what was needed, adopted existing solutions, then implemented them in a way that was more straightforward and ingenious. At the same time, he wasn't afraid to take business risks.

But Josef was also a doer. His motto was: first we'll do it the way I think, and then we'll modify it. Back then there were 50 to 60 of us and you simply went ahead – huge projects that were implemented in a perfectly simple way. And the crazy thing about it was that as soon as something worked, Josef was no longer interested in it. By then he was already light years ahead.

Something that was typical of Josef was drawing his ideas on the floor with chalk. There's one little episode I can recall in that connection. Once, we were tinkering around with a small slurry tanker and Josef drew the solution on the tanker. Later on, someone put the tanker outside and at some stage it started to rain. The next day, Josef then had to explain it all again and that made him really furious.

You also spent many years working in field sales. What has changed in that area?

As time went on, you had to cover ever greater distances in field sales. Initially, I only used to work in Switzerland, then Tyrol was added, then Alsace, the South of France, Hamburg – the geographical area got bigger and bigger. The Eastern

Bloc opened up, the Czech Republic was added, Slovakia, Poland, then Lithuania, where I gave training sessions for the operators and drivers of sewer cleaning vehicles. Then South Africa and so on.

If you compare a KAMO 3X with one of today's mobile walking excavators, it's hard to believe that it's the same type of vehicle. Can you say something about the development of the walking excavator?

In the 1970s and 80s, the walking excavator was one of the mini excavators on the market. Back then it sold well. Then around 1990, the mini excavator market virtually exploded. The mini excavators built during that period were significantly cheaper and robbed the walking excavator of the small jobs – the kind of work performed at the back of a house or in confined spaces. Nowadays, the power-weight ratio of the mini excavators is so high that they can even be used for working on inclines. That also had an impact on the development of walking excavators.

Today's walking excavator is no longer first and foremost an excavator but a carrier that enables attachments that need a lot of power such as drill rigs or mulchers, for instance, to be operated with a compact machine. That's also the reason why the engine fitted on today's walking excavator has a similar power rating to the engine on a 25-tonne machine. That's also changed the type of work performed, of course. Nowadays, you don't use a walking excavator to dig a phone line trench because it's cheaper to do it with a mini excavator.

The operators have also changed since the 1980s. At one time, virtually every building firm had a walking excavator. Today, the owner is usually a specialised company because it takes great skill to operate the modern machines.

Hans Senn joined Kaiser in 1980.

New developments in the last 20 years

Right-hand page:
The Kaiser all-wheel mobile walking excavator; brochure, 1996.

1996: The first mobile walking excavator with all-wheel drive

Kaiser built its first walking excavator with all-wheel drive in 1996 on the basis of the TurboStar. A further development was the 4x4 Knickfuss, a concept which exists to this day. In the early days, the all-wheel mobile walking excavator was used primarily for water management and landscaping applications. When equipped with special attachments, however, the machine could also be used for drilling and forestry work. A special job was the construction of a halfpipe on the Laax Glacier in Graubünden/Switzerland in winter 1996. For the return trip from the cable car station at an altitude of 2,228 metres on Crap Sogn Gion, the all-wheel mobile walking excavator was suspended beneath a gondola.

The Kaiser S1: Continuation of the KAMO line in Liechtenstein from 2001

In 2001, Kaiser's longstanding partner in excavator construction, the Italian company Moro in Pordenone, withdrew from the walking excavator market. As a result, Kaiser took on Moro's markets and sales structures, and added a lighter-weight excavator model to its production range in Liechtenstein. Since then, Kaiser has offered a mobile walking excavator in the 7-tonne class, known as the Kaiser S1. This machine can be used for lighter work in steep terrain and, thanks to its low weight, offers low ground pressure and high stability.

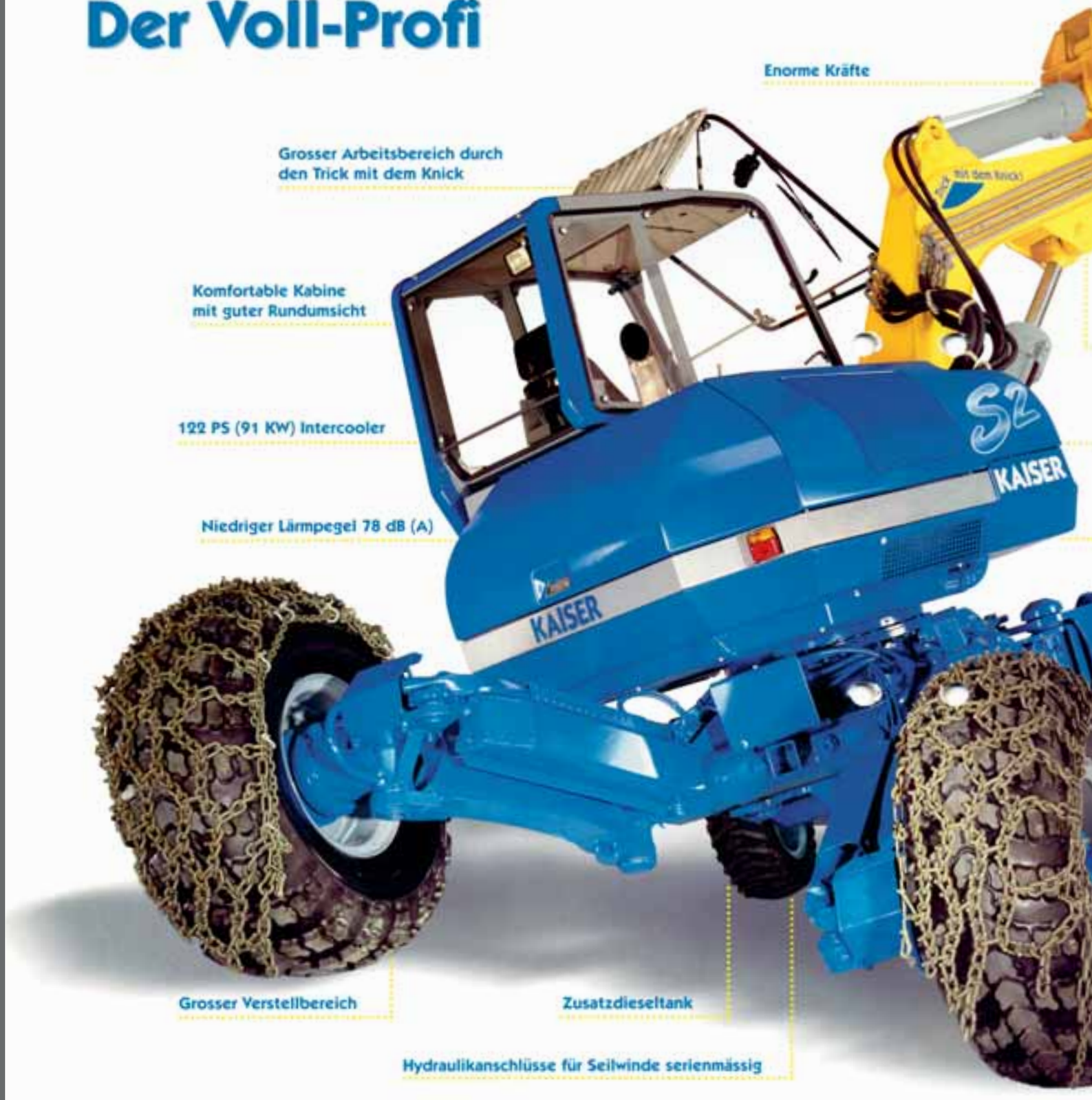
The all-wheel mobile walking excavator on its way from Crap Sogn Gion to Laax, winter 1996.

The Kaiser S1 in operation, 2005.


KAISER
NEU
4 X 4
ALLRAD
Minimalste Flurschäden und
gleichzeitig höchste Sicherheit
▸ im nassen oder sumpfigen Boden
▸ im weichen oder sandigen Gebiet
▸ im Forst wie auch auf dem Gletscher
▸ im steilsten Gelände,.....
KAISER
Fahrzeugwerk AG
FL-9486 Schaanwald
Fürstentum Liechtenstein
Telefon +41 - 75 / 377 21 21
Telefax +41 - 75 / 377 21 10

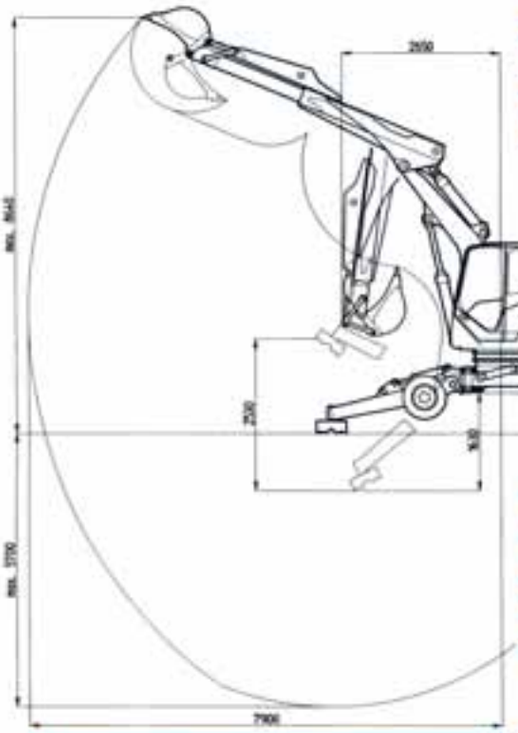
KAISER S2

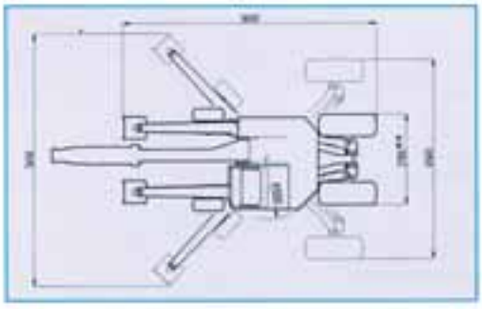
Der Voll-Profi



The Kaiser S2; brochure, 1998.

Die Datenübersicht





Technische Änderungen vorbehalten

Motor:
- 122 PS (91 KW) Perkins Intercooler TD – absolute Höchstleistung beim Baggern!
- Niedriger Schallpegel (78 dB(A))

Arbeitshydraulik
- Lastunabhängige Druckverteilung ermöglicht feinfühliges und bequemes Baggerfahren.
- Hydraulikzylinder mit Endlagendämpfung für weiches Abbremsen
  - Max. Förderstrom 190 ltr/min – Systemdruck 350 bar
  - Hubzylinder mit Sicherheitsventil
  - Vertikale Ansteuerung der Laufetten über Cockpit-Steuerung

Kühlung:
- Grosszügig dimensionierte, robuste Kühlanlage für Motor und Hydraulik auch bei tropischen Temperaturen
- Leise, langsam laufendes Lüfterrad
- Problemlosen Dauerbetrieb von Anbaugeräten (Mäher, Bohrlaffeten, Hammer, etc.)

Schwenkantrieb:
- Drehmoment-gesteuerter Antrieb für ruckfreies Anfahren
- Stufenlose Schwenkdrehzahl von 0 – 9 UPM, sowie Umschaltung auf 0 – 4 UPM für feinstes Positionieren möglich

Hydrostatischer Fahrantrieb:
- Separater, geschlossener Fahrkreis für höchste Fahrleistung ohne Hydrauliköl-Überhitzung
- Feinfühliges Fahrverhalten durch Leistungsregelung
  - Max. Förderstrom 145 ltr/min – hohe Steigfähigkeit (50%)

Kabine
- ROPS-Kabine für beste Rundumsicht und sicheres Arbeiten
- Durchgehende Frontscheibe (keine Querstrebe) gewährleistet freie Sicht zum Arbeitsgerät
- Kabinendach mit Schiebeteil für grösstmöglichen Blickwinkel
  - ROPS Test nach DIN 24000 (Überrollschutz)
  - Hydraulisch kippbar mittels Handpumpe
  - Kabinentüre und Motorhaube abschliessbar

Unterwagen
- Vorbereitung für Seilwindeninstallation mit Seilrollenhalterung
- integrierter 150 Liter Reserve-Dieseltank

Spezial-Ausleger
- **Der Trick mit dem Knick!**
  Bewirkt enorme Hubkraft, minimalen Wenderadius, maximale Grabtiefe und Grabhöhe, sowie eine enorme Reichweite!
- Zentral-Fix für einfaches und schnelles Löffel-Wechseln
  - 5 Hydraulikanschlüsse serienmässig für Zubehör wie Planierlöffel, Hammer, Greifer, etc.

Oberflächenbehandlung:
- Sämtliche Stahlteile sind sandgestrahlt und schwermetallfrei lackiert – schont unsere Umwelt

Gewichte und Abmessungen:

Gewicht:	ca. 8 200 kg
Hubkraft:	ca. 5,5 to bei 3m / ca. 3,8 to bei 5m / ca. 1,6 to bei 7m
Reisskraft:	ca. 51 kN *
Losbrechkraft:	ca. 73 kN *
Verladebreite:	ca. 2150 mm **
Dieseltank mit Elektro-Dieselförderpumpe:	ca. 270 l (150 l Reserve)
Inhalt Motorenöl:	ca. 7 Liter
Inhalt Hydrauliköl:	ca. 140 Liter (biologisch abbaubar)
Fahrgeschwindigkeit:	0 – 6,5 km/h
Bereifung Lenkräder:	30 x 11,5 – 14,5, 10 p/y, 6-Loch-Felgen
Bereifung Antriebsräder:	1300 x 530 – 533, 10 p/y, 18-Loch-Felgen
Schalldruckpegel:	LpA 78 dB(A)
Schallleistungspegel:	LwA 98 dB(A)

* nach ISO 6015 (mit Löffel 600) ** Sonderausführung möglich

Left-hand page:
S2 data sheet;
brochure, 2000.

The Kaiser S2: Entry into a new performance class in 1998

The Kaiser S2, which made its début at the construction machine trade fair in Munich in 1998, created a stunning visual impression. It had an articulating boom which made it look like a "real" excavator. Other salient features were the large working range and the small turning radius. However, what really set the Kaiser S2 apart was power and performance. The Kaiser S2 established a new performance benchmark but also showed limitations in terms of the steelwork. Modifications had to be made when the steel structure on the early models developed stress cracks.

It was not long before the Kaiser S2, which was equipped with all-wheel steering from 2002 onwards, became the technical benchmark for mobile walking excavators in the 10-tonne class. For this reason, it found imitators amongst others in China (XCMG) and Italy (Batemag). The four-wheel steering had led to a marked improvement in terrain capability, i.e. the machine was much easier to drive and manoeuvre than its predecessors and consequently had less impact on the ground. In keeping with the trend towards mobility, different undercarriages were developed to suit different applications: the S2 Telefuss, S2 Knickfuss 4x4, S2 Gator 4x4 and the S2 Cross 4x4.

Spectacular deployment of an S2 in Valais.

1

1 Copy of a Kaiser mobile walking excavator at bauma China 2010 in Shanghai.

2 In Florida, land is reclaimed for construction primarily by draining swampland. The channels have to be regularly cleared of plants to ensure an unhindered water flow. The S2 Gator was developed especially for the US market.

3 For the demolition of two 45-metre-tall grain silos, a S2 uses a concrete breaker to work its way down to a height of 26 metres so that demolition cranes can complete the job.

2

3

The Kaiser SX: Successor to the legendary Kaiser X4 TurboStar from 2009

In response to regular enquiries for attachments with low weight and nonetheless high power, Kaiser brought out a new excavator onto the market in 2009: the Kaiser SX. The SX is a mobile walking excavator in the medium power and weight class, and is predestined for typical mobile excavator work in steep terrain. Its low weight enables it to be transported on lighter trucks and consequently on roads and tracks which are not suitable for heavy vehicles. The Kaiser SX remains part of the company's range of mobile walking excavators to this day.

The Kaiser S3 Allroad: The universal carrier vehicle, 2007–2013

Kaiser presented the S3 Allroad for the first time at bauma 2007. The commercial success of this machine soon showed that the company had succeeded in opening up new market segments in the area of multifunctional carriers. The S3 Allroad was based on a new undercarriage design concept which had been specially developed for four-wheel steering and all-wheel drive. High mobility and optimum stability marked out this model. The machine also offered driver assistance systems such as travel direction recognition, different steering modes and accessory management. The Kaiser S3 was the carrier vehicle for high-power attachments such as mulchers and drill rigs.

One of the first Kaiser S3s went to Toni Ebnöther, managing director of the Swiss forestry and earthmoving contractor Toni Ebnöther Forst & Baggerarbeiten AG based in Siebnen. In an interview with Facts & News, the Kaiser AG customer magazine,

Excavator assembly at Kaiser.

Toni Ebnöther was asked about his experience with the machine: “Up to now, my experience has been entirely positive. That relates not only to the function of the mobile walking excavator but also to acceptance of the machine in the market. There is still work to be done, however, in getting the message across to customers about the wide range of possible applications. After all, it is precisely this versatility they are looking for. Once customers realise that the excavator can be used for other things, that can lead to more business. My partner and I were recently contracted to carry out the forestry work as well as the torrent control in the same area. In addition to the current focus on civil engineering applications and forestry work, I can well imagine investing in a harvester head. After building up familiarisation and a customer network to ensure contracts, I can then do mulching work as well or become more heavily involved in forestry work.” Facts & News, Kaiser AG customer magazine, December 2008.

A spectacular job for a Kaiser S3 Allroad which attracted a great deal of public attention was the refurbishment of the “Alter Säntis” restaurant at an altitude of 2,502 metres on the Säntis in Switzerland. The mobile walking excavator did the 12-kilometre journey to the site «on foot», in other words it “walked” there. The route involved climbing up steep slopes and rock faces, covered a vertical rise of 1,400 metres and took a total of 40 hours to complete. In view of the difficult topographical conditions, the operation took place in the winter with the advantage of snow cover. The Kaiser S3 Allroad set off on its trek from Alp Laui near Unterwasser on 7 February 2011 and reached the summit after a six-day journey which had demanded the utmost from man and machine.

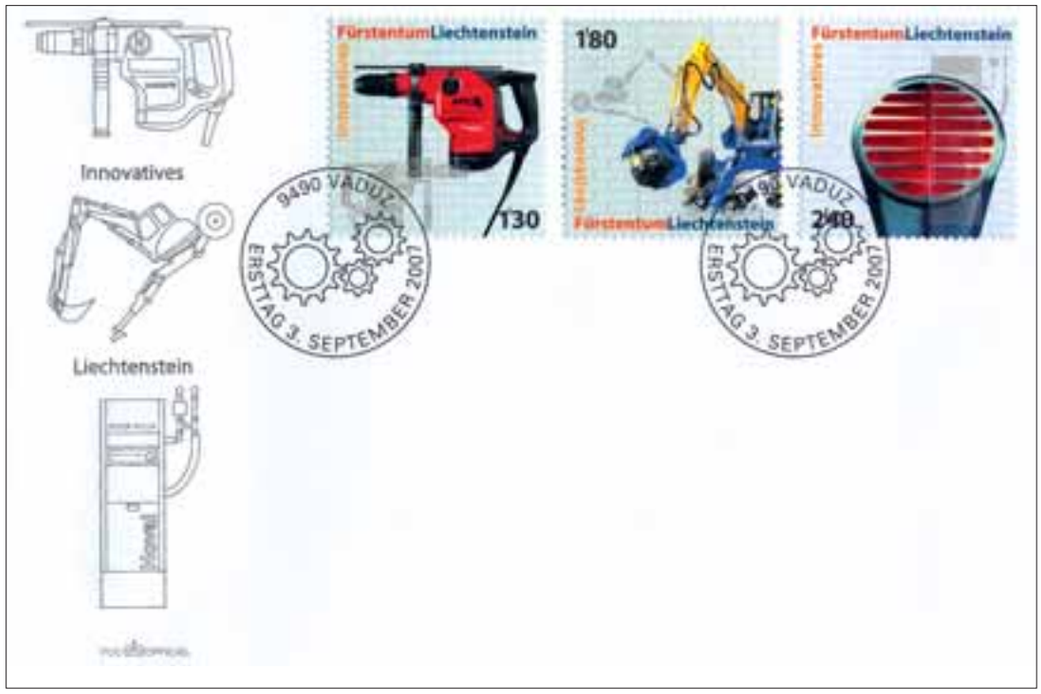
The S3 Allroad working with a feller-buncher attachment in Braunau/Austria.

The S3 Allroad with drill rig at work in Berner Oberland. In recent years, there has been a strong increase in the use of mobile walking excavators for drilling operations. The particular growth in demand in the Alpine region is attributable to the need for landslide repair and maintenance work on mountain roads built during the construction boom of the 1960s.

Left-hand page:
The Kaiser S3 Allroad on the Säntis; flyer 2011.

What's an excavator got to do with a stamp?

On 3 September 2007, Philately Liechtenstein issued a series of stamps inspired by the theme "Having outstanding ideas, putting them into effect and helping to popularise them worldwide" and dedicated to particularly innovative Liechtenstein companies. Alongside products from Hilti and Hoval, the S2 4x4 mobile walking excavator made by Kaiser AG was also featured.



Custom machines

In addition to its reputation for being close to the customer, Kaiser AG has made a name for itself as a manufacturer of custom-built machines. The company occupies an unrivalled position in the walking excavator segment. Kaiser custom machines are used around the globe in a wide range of applications such as mining and building ski lifts on glaciers. A few examples are illustrated below:

X6 tunnel excavator with width-adjustable crawler track frames and slewable boom. This machine was deployed in the Vereina Tunnel in the Swiss canton of Graubünden from 1994 to 1996. After the blasting work, it was used to remove the loose rubble. The boom was capable of 360° continuous rotation and the track frames had an adjustment range of 1000 mm.

Mine excavator, X5 M basic model, collapsible to a diameter of 2 m. The mine excavator was built for use in South African gold mines in the early 1980s. It was fitted with a recoil starter because battery-powered ignition would have been too dangerous because of the risk of explosion in the tunnels. The compact design was necessary due to the fact that the material and supply shafts measured a maximum of 2 x 2 m.

1

2

1 Tunnel excavator, S1 superstructure with electric motor and radio-frequency remote control.
The RF-controlled S1 superstructure is the centre-piece of the ROWA inclined shaft system which has been in use at the pumped storage hydro-power plant La Muela II in Malaga since 2009. The excavator is being used to build the 800-metre-long tunnel with a gradient of 45° required for this project. Depending on work require-ments, a demolition hammer, gunite lance or tunnelling bucket can be fitted. The excavator can be folded down to a diameter of 1.40 m.

2 Kaiser S2 with detachable chassis frame, mounted on a PistenBully 300. The machine was built in 2003 and is used in Zermatt, at the foot of the Matterhorn, for work on the glacier lift. The drive power is provided by the PistenBully's hydraulic system.

Change of perspective – the Kaiser company as viewed by the customer

A long-standing customer of Kaiser AG is the Swiss earthmoving contractor Albert Bucher AG in Kägiswil in the canton of Obwalden. Proprietor Albert Bucher bought his first Kaiser walking excavator, a KAMO 3X, well over forty years ago in 1972. To date, he has taken delivery of 15 Kaiser machines in total. Kaiser was initially chosen because Albert Bucher's brother had already been driving a KAMO 3X for some time. However, there are other factors which explain Albert Bucher's 40-year loyalty to Kaiser.

He first states the excellent service provided by Kaiser's Swiss distributor and service partner, Carl Heusser AG in Cham, since 1969, followed by Kaiser's willingness and ability to cater for special requests. "Heusser have always given us first-class service. We didn't have far to go and if they couldn't help, then we went straight to Kaiser. We had no problems whatsoever with Kaiser." Albert Bucher has never felt the need to try out a competitor product. However, his son-in-law did use another machine for a week when joining the firm, but was not particularly impressed with it.

When asked about his own particular wishes, Albert Bucher explains that he has never been able to buy an excavator «off the peg». He has always needed custom solutions and Josef Kaiser always accommodated him. "We got the machines exactly as we wanted them. That continues to be the case today."

The first direct contact with Josef Kaiser was in 1973/74 when Bucher AG purchased a new KAMO 3X. In this particular case, Albert Bucher wanted the Italian control blocks replaced by Rexroth control blocks. Not long afterwards, an order followed for a winch which was also specially manufactured. At the insistence of Albert Bucher, Josef Kaiser later designed a device that enabled the position of the terrain pads to be adjusted hydraulically. Normally, bolts had to be inserted by hand for this purpose, which was cumbersome. Albert Bucher then proudly relates that back in 1982, he was the first person to have an excavator with spreadable pads. When asked whether this feature proved to be successful, he is quick to respond: "Very much so. Before, whenever I wanted to load the excavator onto a truck, I first had to get out and adjust the pads by hand. It meant I could now remain seated and simply drive up."

Albert Bucher attached great importance to ensuring that his vehicle fleet was state of the art. Over the course of his 40-year career as a businessman and excavator driver, he continually bought new models. He waxes lyrical about the Kaiser X4 Turbo. "I clocked up 10,000 hours with that machine. And it's still in use today. Normally, I would drive a machine for around 4,000 hours."

Walking excavators are exposed to extreme wear and tear which inevitably affects the material. Albert Bucher concedes in this context that at one point he actually considered dispensing with walking excavators altogether. "But on 15 August 1997, a bad storm broke over Sachseln and devastated the entire village. Once again, the walking excavators were needed. Any other excavator wouldn't have stood a chance."

When asked about his personal relationship with Josef Kaiser, Albert Bucher says that Josef Kaiser never ceased to amaze him. In spite of Kaiser's advanced years back then, he simply did everything and was perfectly capable into the bargain. "With the crawler excavator, the X6, he drove over a bank out in the fens with the boom raised right up – I thought to myself: he's going to roll over. I'm not exactly faint-hearted, but he didn't bat an eyelid. I admired him. And what's even more important: he always accommodated his customers and always made every effort to somehow achieve what they wanted."

The Bucher firm started off as a one-man operation in 1971 and now employs between six and seven people. When a new walking excavator was needed at the beginning of the year, Bucher opted for the Kaiser S3. What fascinates Albert Bucher about this machine, apart from its high lifting capacity, is its exceptional stability. With the excavator standing in exceptionally steep terrain, he has even been able to lift a Rammax as if it were nothing. "I couldn't do that with a conventional model."

The conversation with Albert Bucher took place in Kägiswil on 3 July 2013.

Albert Bucher working on the bed of Lake Lungern, 1982.
The excavator is equipped with aluminium wheels and round terrain pads, a Kaiser custom vehicle for working on soft ground.

The S3 deployed after a storm in Kerns, June 2013.

The latest generation of mobile walking excavators – the Kaiser S10 and S12 Allroad

In April 2013, Kaiser presented a new generation of mobile walking excavators at the bauma trade fair in Munich. With the S10 and S12 Allroad, the company succeeded in bringing an efficient all-rounder onto the market, a machine which can be used as a carrier for an increasing range of applications.

Held once every three years, bauma Munich is the world's leading trade fair for construction, building material and mining machines, and is therefore the most important presentation platform for manufacturers of mobile walking excavators. Generally speaking, this niche segment of the international construction machinery market is dominated by the two key players Menzi Muck and Kaiser. Euromach, a third manufacturer based in Italy, plays a minor role by comparison. Chinese imitators who are trying to bulldoze their way into the market have so far failed to gain any significant foothold.

When developing the new series of models, Kaiser placed the emphasis on performance, efficiency and design. In terms of technology, the greatest innovation lies in the hydraulic system known as ELIS (Electronic Load Independent System). Performance and efficiency can be adjusted in line with specific applications and substantially increased even further thanks to this intelligent control system. ELIS enables the driver to actively influence the priority and performance of key functions via the display in order to adapt the mobile walking excavator to suit prevailing working conditions.

Markus Vetsch, excavator sales manager for the Swiss market, underlines the machine's versatility in the context of current market needs:

> *"When it comes to pure digging jobs, in other words working with a bucket and grapple, crawler excavators are used these days – even in steep terrain. This type of work is in decline for mobile walking excavators. To ensure that our customers can nonetheless make full use of their machines and also generate income, we have to enable them to work as efficiently as possible in all types of terrain and above all with any attachment. Nowadays, the application range of a mobile walking excavator covers everything from specialised foundation engineering with drill rigs or pile drivers, to landscaping with mowers and mulchers, through to demolition with shears, hammers and crushers. What's important is that the machine can be deployed rapidly and above all anywhere. With the new hydraulic system ELIS, the travel drive with infinitely variable transmission and a 129 kW engine, these machines have what it takes to meet those requirements."* Markus Vetsch, Kaiser AG, 12 December 2013.

At the heart of the S10 and the S12 lies a Perkins diesel engine with high power and high torque levels plus the option of either a 110 kW or a 129 kW version. Cutting-edge engine technology based on a four-valve and (on the 129 kW model) bi-turbo concept offers ample power reserves. The huge torque of up to 750 Nm at just 1400 rpm enables outstanding, efficient performance from the hydraulic system. The integrated diesel particulate filter meets the latest European emissions standards which are aimed at further reductions in environmental impact.

René Geiger, head of the excavator engineering department, explains today's technical challenges:

> *"The innovation process has changed radically compared to the past. It wasn't all that long ago that design drawings were produced by hand, whereas today's modern 3D CAD [Computer-Aided Design] systems enable much shorter development times. That means a much faster time to market for the product, which can be a decisive advantage. However, the ever shorter development cycles lead to more and more data that has to be managed. And nowadays, all development processes are documented, which means an additional challenge. But in my view, the decisive question in the development process is still: what does the customer need? The focus is on the market, but of course technical standards and statutory requirements also have to be complied with. It's important to differentiate yourself from your competitors, to offer a solution that's unique – and is aimed at providing the greatest possible benefit for the customer."* René Geiger, Kaiser AG, 17 December 2013.

Working in collaboration with the Austrian firm of industrial designers "Design Department", Kaiser achieved a masterstroke with the design of the S10 and S12. During the development phase, a consistent focus was placed on dynamic and at the same time functional design of every element of the vehicle – whether it was the cab interior, the field of vision inside and out of the cab or the positioning of the heating and air-conditioning system. The cab and superstructure form a single unit which in turn harmonises with the vehicle as a whole. Integration of the new, significantly more powerful drive and cooling system called for innovative technological concepts and presented a major challenge.

These design efforts were honoured with the presentation of the prestigious bauma Innovation Award in Munich in April 2013. Out of the 156 entries submitted from Germany and abroad, 15 groundbreaking new developments made it through to the final round. Winners were chosen in fi ve categories. Kaiser's mobile walking excavator was able to prevail over the innovations of fellow candidates, the two global players Liebherr and Wacker Neuson, in the Design category. This was a great source of justifie d pride and joy at Kaiser. Award presentation in Munich, April 2013. From left to right: Bavaria's Minister of Economic Affairs Martin Zeil, winner of the bauma Innovation Award in the Design category Markus Kaiser, and jury member Professor Dag Holmgren.


Leistung und Effizienz

The latest Kaiser excavator models, the S10 and S12 Allroad; brochure, 2013.

Das fahrerfreundlichste Cockpit

Vom Joystick bis zum Fahrersitz wurde alles konsequent auf die Bedürfnisse des Fahrers ausgerichtet. Sein Arbeitsplatz besticht durch Übersichtlichkeit, Ergonomie und Komfort. Grosser Wert wurde auch auf die sorgfältige Auswahl hochwertiger Materialien gelegt.

Eine Vielzahl technisch raffinierter Details, die optimale Lüftung/Heizung/Kühlung und eine bestmögliche Schalldämmung, sorgen für eine ermüdungsfreie Arbeitsumgebung. Damit bleibt die Konzentration des Fahrers auf seine Aufgabe erhalten.

Auf dem Display sind alle wichtigen Informationen gut lesbar in einer einheitlichen Benutzeroberfläche dargestellt. Die Menüführung ist intuitiv.

Left-hand page:
Kaiser cockpit and Kaiser design; brochure, 2013.

Right-hand page:
Data sheet for Kaiser mobile walking excavators S10 and S12 Allroad; brochure, 2013

Technische Daten

Motor		
Perkins 1204E-E44TA Drehmoment	max. Leistung	110 kW / 150 PS @ 2000 U/min 560 Nm @ 1400 U/min
Motorversion HP Perkins 1204E-E44TTA Drehmoment	max. Leistung	129 kW / 175 PS @ 2000 U/min 750 Nm @ 1400 U/min
Hubraum		4400 ccm
Abgasnorm		EU 97/68 Stufe IIIB US EPA Tier 4i
Spannung		24 Volt
Lichtmaschine		100 A
Batterie		2 x 80 Ah – 800 CCA
Kühlsystem		4-Kreislauf Kühlsystem, Kühler nebeneinander angeordnet mit Umkehrlüfter zur Reinigung der Kühler
Tankinhalt Diesel (Betriebstank / Chassistank) S10 und S12 4x4 S12 Allroad		410 Liter (140 l / 270 l) 280 Liter (140 l / 140 l)
Serviceintervall		500 Betriebsstunden

Hydraulik		
Fördermenge Arbeitspumpe		max. 290 Liter/min. 320 bar
Fördermenge Fahrpumpe		max. 170 Liter/min. 400 bar
Fördermenge Lüfterpumpe		max. 40 Liter/min. 200 bar
Hydrauliksystem Kapazität		200 Liter
Schwenkgeschwindigkeit (kraftvoll / schnell)		5 U/min, 10 U/min
Schwenkmoment		56'000 Nm
Drehkranz		Modul 10
Fahrgeschwindigkeit		Stufenlos, 0-15 km/h, je nach Typ und Reifendimension

Gewicht	Ab 10'180 kg
Kabine	ROPS ISO 12117 / FOPS ISO 10262
Zylinder	mit Pendelaugen, alle ziehenden Lasten leckfrei