

Makrofon®

Acoustic warning devices –
signal horns for rail vehicles



ZÖLLNER Makrofons®

Flexible, user-friendly, well-designed and supplied with all relevant certificates – ZÖLLNER Makrofons® provide the optimum solution with impressive durability.

In the first years after our foundation in 1946, ZÖLLNER compressed-air operated signal horns were already installed on rail vehicles. At that time, so-called whistles were used to warn of the approaching vehicles. Signal horns with different frequencies with 660 Hz and 370 Hz and often in duplicate are used for the same purpose in today's rail vehicles.

Since 2020, with our new electrical Makrofon EM660/370 TSI, we have been offering a solution for signalling that is independent of compressed air.

Increasing demands on the material, documentation and

safety support us in offering high-quality and reliable products. We place particular emphasis on compliance with environmental requirements such as REACH, ROHS and EN 45545.

Not least, developing individual solutions and modifying products together with our customers and partners is one of our passions.

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Fig. above After thorough testing by our specialist personnel, every ZÖLLNER signal horn receives the ZÖLLNER inspection stamp.

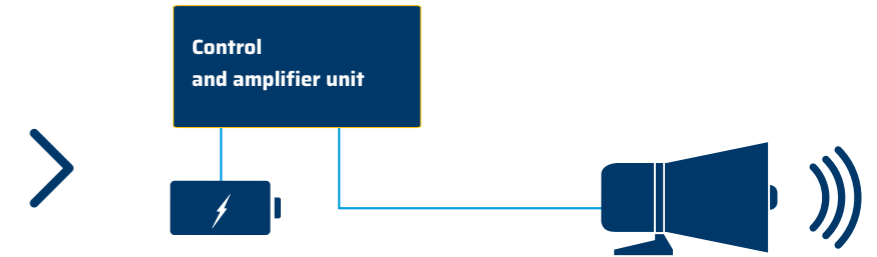
Our signal horns at a glance



We offer acoustic warning devices for the heavy rail industry as well as for the entire light rail sector.

Electrically operated signal horns

The electric actuation of our electrical Makrofon offers a signalling variant that is quickly operational and is independent of the compressed air supply.



Pneumatically operated signal horns

For decades, compressed air-operated Makrofon have guaranteed reliable signalling in railway transport.



Quality

Corrosion-resistant, REACH-compliant, durable material guarantees quality and durability.



Low maintenance costs

A durable product with simple and low-cost maintenance



Fire protection

The components of our Makrofon fulfil the high requirements of EN 45545.



Flexible areas of application

Can be used within the temperature range as per EN 50125. Heating systems for wintry conditions. Protective grid against entry of snow, dirt and bird strike



Certified products

Interoperability constituents with assessed EC conformity and corresponding certification.

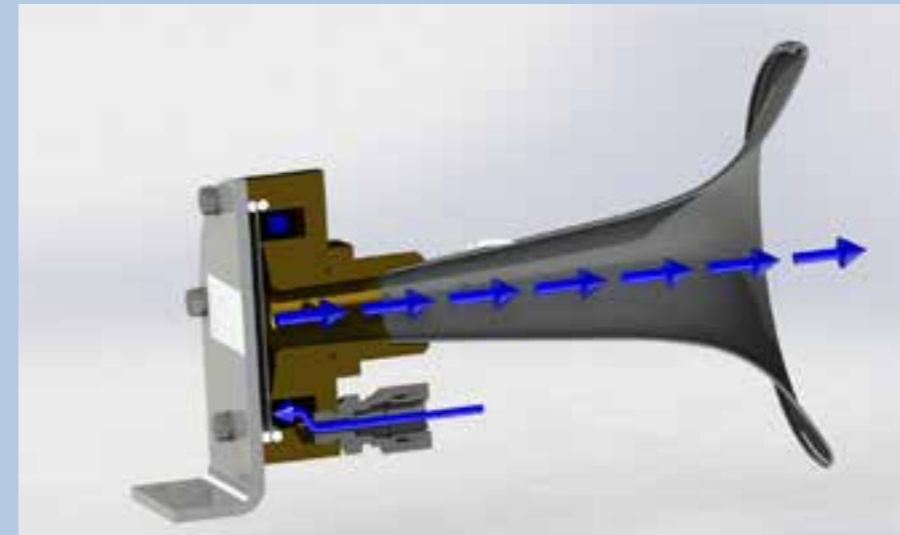


Individual solutions

Implementation of challenging customer requirements (adaptation to particular sound pressure levels, consideration of special installation situations).

ZÖLLNER Makrofons

The Zöllner Makrofons of the ZM75 series are characterised by a long service life and low maintenance costs. The Makrofons consist of a brass casing and a sheet steel funnel. Sound is produced by a diaphragm, which is fixed in the casing by two O-rings. The funnel is screwed into the casing. The Makrofon can be additionally fitted with a heating system and a protection grid or mesh. Our Makrofons are available in UIC 644 and TSI EN 15153-2 versions.



Airflows in compressed air horns

The airflow enters the Makrofon casing through the screw-in connection and causes the diaphragm to vibrate. The shape of the funnel amplifies the sound waves produced by the diaphragm.

The ZM75-series // Compressed air-operated signal horns



MAKROFON ZM75/370.1

	FREQUENCY	SOUND PRESSURE LEVEL	SOUND PRESSURE LEVEL	OPERATING PRESSURE	AIR FLOW RATE	WEIGHT
UIC 644	370 Hz ± 10 Hz	134 – 139 dB(A) at 1 m	120 – 125 dB(A) at 5 m	5 – 10 bar	1042.3 l/min – 8 bar	approx. 1.75 kg
TSI EN 15153-2	370 Hz ± 20 Hz	129 – 137 dB(C) at 1 m	101 – 109 dB(C) at 25 m	5 – 10 bar	1042.3 l/min – 8 bar	approx. 1.75 kg



MAKROFON ZM75/660

	FREQUENCY	SOUND PRESSURE LEVEL	SOUND PRESSURE LEVEL	OPERATING PRESSURE	AIR FLOW RATE	WEIGHT
UIC 644	660 Hz ± 15 Hz	134 – 139 dB(A) at 1 m	120 – 125 dB(A) at 5 m	5 – 10 bar	1032.1 l/min – 8 bar	approx. 1.6 kg
TSI EN 15153-2	660 Hz ± 30 Hz	129 – 137 dB(C) at 1 m	101 – 109 dB(C) at 25 m	5 – 10 bar	278 l/min – 8 bar	approx. 1.6 kg



ZÖLLNER Makrofon®
ZM75/660

Fig. above Alstom Transport Deutschland is using ZÖLLNER Makrofonen in the world's first fuel cell-powered, completely emission-free regional train, the Cordia iLint.



Fig. left Our Makrofonen are tested to the highest quality standards in our sound chamber.



MAKROFON ZM75/470

	FREQUENCY	SOUND PRESSURE LEVEL		OPERATING PRESSURE	AIR FLOW RATE	WEIGHT
TSI EN 15153-2	470 Hz ± 25 Hz	129 – 137 dB(C) at 1 m	101 – 109 dB(C) at 25 m	5 – 10 bar	270 l/min – 8 bar	approx. 1.75 kg



MAKROFON ZM75/622

	FREQUENCY	SOUND PRESSURE LEVEL		OPERATING PRESSURE	AIR FLOW RATE	WEIGHT
TSI EN 15153-2	622 Hz ± 30 Hz	129 – 137 dB(C) at 1 m	101 – 109 dB(C) at 25 m	5 – 10 bar	272.4 l/min – 8 bar	approx. 1.65 kg



MAKROFON ZM75/311

	FREQUENCY	SOUND PRESSURE LEVEL		OPERATING PRESSURE	AIR FLOW RATE	WEIGHT
TSI EN 15153-2	311 Hz ± 20 Hz	129 – 137 dB(C) at 1 m	101 – 109 dB(C) at 25 m	5 – 10 bar	1000.7 l/min – 8 bar	approx. 1.85 kg

M75(F) and M125 series

The ZÖLLNER Makrofon[®] of the M75(F) and M125 series are characterised by low maintenance costs and are also available in versions with low sound levels.

The Makrofon consists of a brass casing and a sheet steel funnel. Sound is produced by a diaphragm, which is fixed in the casing by the cover screw and a pressure regulation disk. The Makrofon can be additionally fitted with a heating system and a protection grid or mesh.

Our Makrofon are available in UIC 644 and TSI EN 15153-2 versions.



MAKROFON M75F/370.1

	FREQUENCY	SOUND PRESSURE LEVEL	OPERATING PRESSURE	AIR FLOW RATE	WEIGHT	
UIC 644	370 Hz ± 10 Hz	134 – 139 dB(A) at 1 m	120 – 125 dB(A) at 5 m	5 – 10 bar	1072.1 l/min – 8 bar	approx. 1.6 kg
TSI EN 15153-2	370 Hz ± 20 Hz	129 – 137 dB(C) at 1 m	101 – 109 dB(C) at 25 m	5 – 10 bar	628.6 l/min – 8 bar	approx. 1.6 kg



MAKROFON M75F/660

	FREQUENCY	SOUND PRESSURE LEVEL	OPERATING PRESSURE	AIR FLOW RATE	WEIGHT	
UIC 644	660 Hz ± 15 Hz	134 – 139 dB(A) at 1 m	120 – 125 dB(A) at 5 m	5 – 10 bar	1072.4 l/min – 8 bar	approx. 1.45 kg
TSI EN 15153-2	660 Hz ± 30 Hz	129 – 137 dB(C) at 1 m	101 – 109 dB(C) at 25 m	6 – 10 bar	625.5 l/min – 8 bar	approx. 1.45 kg



MAKROFON M125/370

	FREQUENCY	SOUND PRESSURE LEVEL	OPERATING PRESSURE	AIR FLOW RATE	WEIGHT	
UIC 644	370 Hz ± 10 Hz	134 – 139 dB(A) at 1 m	120 – 125 dB(A) at 5 m	5 – 10 bar	726.3 l/min – 8 bar	approx. 4.3 kg
TSI EN 15153-2	370 Hz ± 20 Hz	129 – 137 dB(C) at 1 m	101 – 109 dB(C) at 25 m	5 – 10 bar	393.5 l/min – 8 bar	approx. 4.3 kg



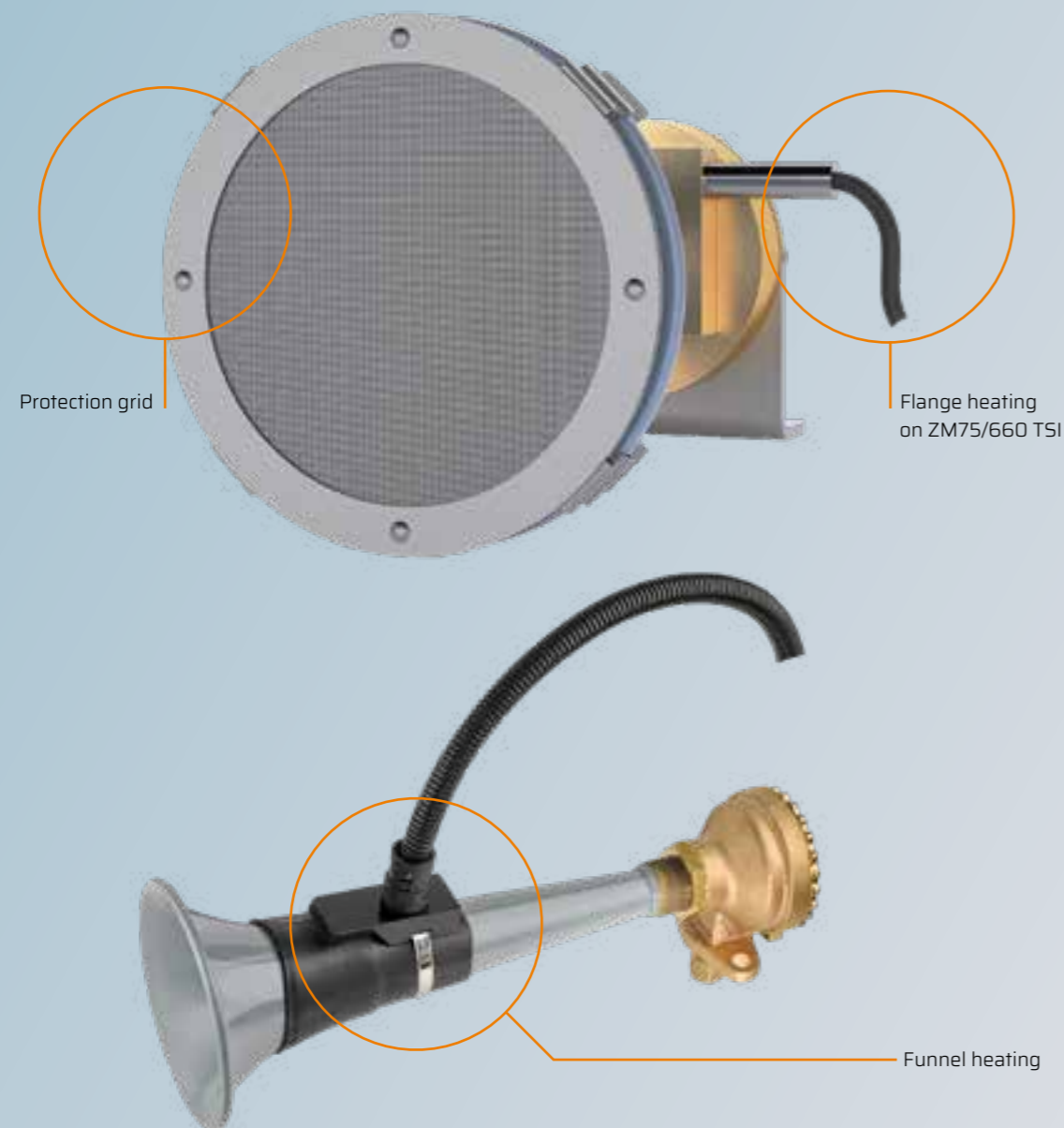
MAKROFON M75/660

	FREQUENCY	SOUND PRESSURE LEVEL	OPERATING PRESSURE	AIR FLOW RATE	WEIGHT	
UIC 644	660 Hz ± 15 Hz	134 – 139 dB(A) at 1 m	120 – 125 dB(A) at 5 m	5 – 10 bar	714.8 l/min – 8 bar	approx. 1.15 kg
TSI EN 15153-2	660 Hz ± 30 Hz	129 – 137 dB(C) at 1 m	101 – 109 dB(C) at 25 m	5 – 10 bar	583.8 l/min – 8 bar	approx. 1.15 kg

Accessories // Different environmental influences require solutions and measures that are tailored to the respective situation

Heating

In particular, wintry conditions necessitate a flexible system to ensure the functionality of the Makrofon. Our heating systems are suitable for retrofitting on all ZÖLLNER Makrofon and can be switched on via an external thermostat:



Protection grids and meshes

To provide protection against external influences, such as chippings, dust, snow, hail and birds, we offer you our optional protection meshes and protection grids for any installation situation:

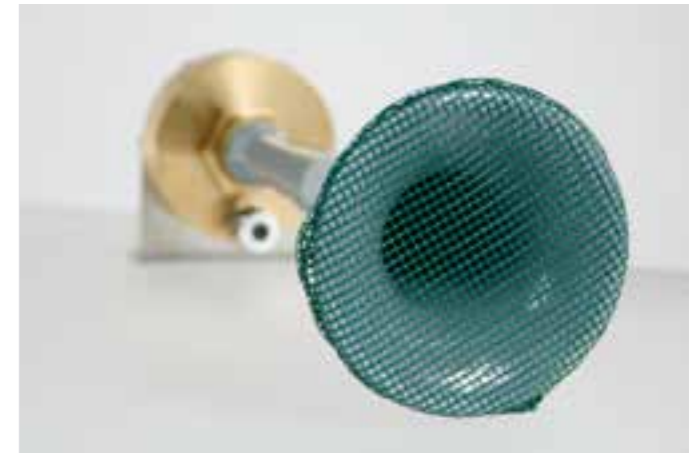


Fig. 01 Fine meshed protection grid with screw clip; front and side view

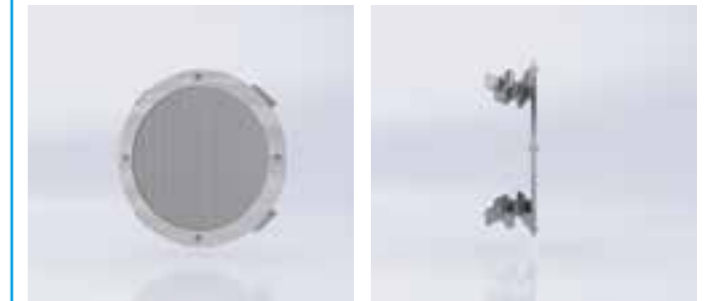


Fig. 02 Fine-meshed protection grid without screw clip; front and side view

Sound insulation

TSI Noise stipulates that a sound level of 95 dB(A) may not be exceeded within the driver's cab when the Makrofon is actuated. In compliance with UIC 644 and EN 15153-2, the ZÖLLNER sound insulation offers maximum protection for the train driver.



Fig. 03/04 The sound insulation is pushed in, for example, via a connecting socket on the side of the vehicle. In this way, the Makrofon is kept facing forwards and is additionally fitted to the Makrofon cover using rubber-metal mounts. The sound insulation reduces the sound pressure level in the driver's cabin by ensuring that the sound only propagates forwards.

Fig. 05 An optimal installation reduces the structure-borne and airborne sound within the vehicle.

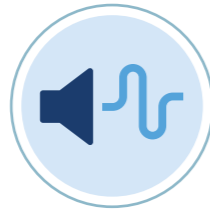
The advantage of ZÖLLNER // Individual solutions

Besides normative requirements, certain projects require individual solutions, especially when customer requirements are at the forefront. For example:



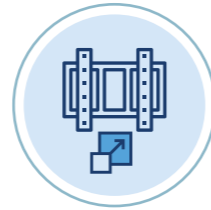
Alternative frequencies

Among other things, we will gladly offer you a range of frequencies: e.g. 404, 570, 808 or even triads.



Sound pressure level

Reduced sound levels are no problem for our M75F series. We fulfil the requirements of UK standards (GMRT) and Australian standards (AS), among others.



Bracket modification

We cover special installation situations with our different designs. Individual mounting brackets that are tailored to your needs are also possible in such cases.



Fig. 01 Example of a standard Makrofon mounting bracket



Fig. 02 Example of an alternative mounting bracket



Fig. 03 An example of a mounting bracket that enables different horns to be installed



Are you looking for an individual solution?

Tell us about your project at rollingstock@zoellner.de



Fig. 04 Example colour // RAL 7015



Fig. 05 Example colour // P165 Gris orange



Fig. 06 Example colour // RAL 7000



Colour selection

Our signal horns should also blend harmoniously into the overall appearance of your vehicle. For this reason, we give you the option to select various RAL tones and colour requirements for the funnels of our Makrofon.

Our funnels are produced in RAL 7000 as standard.

See Figs. 04-06 above for some example colour variations.

The following are also popular among our customers:



RAL 7000 (standard)



RAL 7015

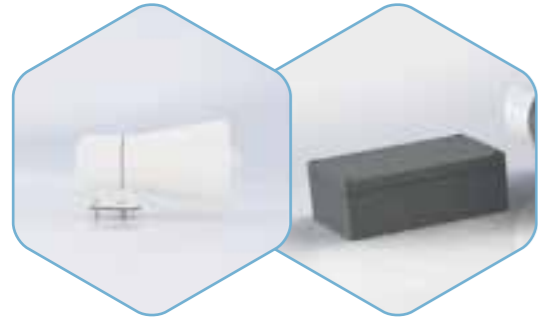


RAL 7021



RAL 9005

Electrical Makrofons // ZETFON series



With our electrical Makrofons we offer you solutions that are independent of compressed air. The electrically operated Makrofons consist of the ZETFON 70s (speaker) and the control and amplifier unit. Optionally, a second ZETFON 70s can also be connected to a suitable control and amplifier unit.

ZETFON 50/660

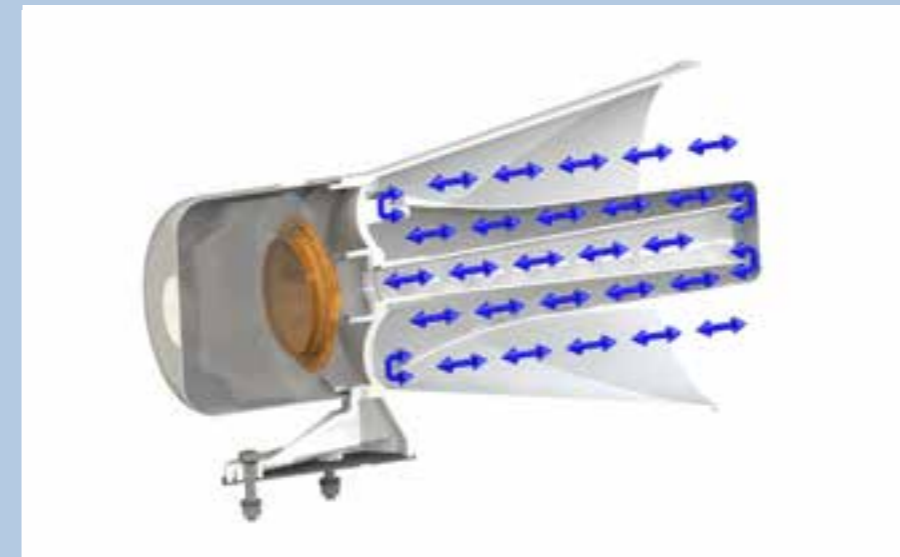
	FREQUENCY	SOUND PRESSURE LEVEL		VOLTAGE	MAX. POWER CONSUMPTION	WEIGHT
Requirement in dB(A)	660 Hz ± 15 Hz	approx. 124 dB(A) at 1 m	approx. 110 dB(A) at 5 m	24 V DC	max. 200 W	approx. 6.6 kg
Requirement in dB(C)	660 Hz ± 15 Hz	approx. 123 dB(C) at 1 m	approx. 95 dB(C) at 25 m	24 V DC	max. 200 W	approx. 6.6 kg

ZETFON 2/50/660

	FREQUENCY	SOUND PRESSURE LEVEL		VOLTAGE	MAX. POWER CONSUMPTION	WEIGHT
Requirement in dB(A)	660 Hz ± 15 Hz	130 – 132 dB(A) at 1 m	122 – 124 dB(A) at 3 m	24 V DC	max. 200 W	approx. 10.1 kg
Requirement in dB(C)	660 Hz ± 15 Hz	129 – 131 dB(C) at 1 m	121 – 123 dB(C) at 3 m	24 V DC	max. 200 W	approx. 10.1 kg

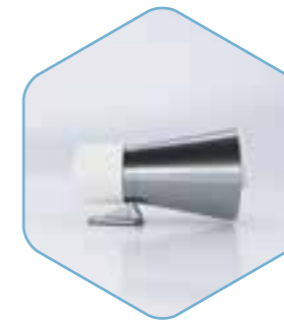
ZETFON 120/330K

	FREQUENCY	SOUND PRESSURE LEVEL		VOLTAGE	MAX. POWER CONSUMPTION	WEIGHT
Requirement in dB(A)	330 Hz ± 15 Hz	122 – 124 dB(A) at 1 m	117 – 119 dB(A) at 2 m	24 V DC	max. 120 W	approx. 10.1 kg
Requirement in dB(C)	330 Hz ± 15 Hz	121 – 123 dB(C) at 1 m	116 – 118 dB(C) at 2 m	24 V DC	max. 120 W	approx. 10.1 kg



Airflows in electrically operated signal horns

Sound waves are produced by an alternating electrical signal in the pressure chamber driver. The folded funnel amplifies the sound waves produced by the diaphragm.

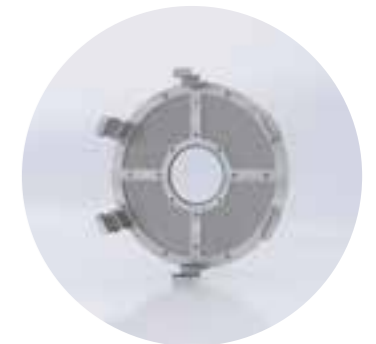
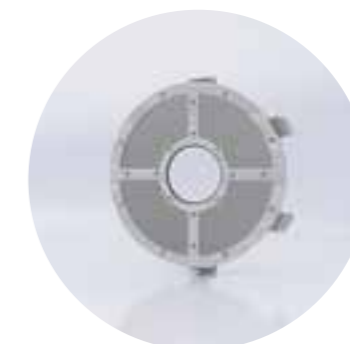


ELECTRICAL MAKROFON EM660/370 TSI

	FREQUENCY	SOUND PRESSURE LEVEL		VOLTAGE	MAX. POWER CONSUMPTION	WEIGHT
TSI EN 15153-2	660 Hz ± 30 Hz 370 Hz ± 20 Hz	101 – 109 dB (C) at 25 m set to approx. 130.5 dB(C) at 1 m	91 – 101 dB (A) at 7 m set to approx. 116 dB(A) at 1 m	24 V DC	approx. 400 W 13 A (660 Hz) 15 A (370 Hz)	approx. 7.1 kg

Accessories for electrical Makrofons

Protection grids reliably protect the funnels against external influences, such as chippings, dust, snow, etc.





Light rail applications

Urban rail vehicles, underground railways, tramways and light railways are subject to special functional and technical requirements. For the European area of application, these are described in EN 15153-4, for example. To this end, as well as to meet the most varied requirements in European countries outside Germany, we offer appropriate solutions:



Fig. Example of a ZET FON on a high-output track renewal train

Applications in railbound construction and maintenance vehicles

Signal horns according to EN 14033-1 / EN 15153-2

Vehicles used in the construction, maintenance and inspection of tracks and structures, etc., are subject to special safety-related and technical requirements and must be able to withstand extreme conditions. Our compressed air-operated standard horns as well as our electrical Makrofonen are also used in this area. For example:

- » M75F/370.1 TSI Rev.01
- » M75F/660 TSI Rev.01
- » ZM75/370.1 TSI Rev.01
- » ZM75/660 TSI Rev.01
- » ZET FON 50/660
- » ZET FON 2/50/660
- » EM660/370 TSI



	FREQUENCY	SOUND PRESSURE LEVEL		OPERATING PRESSURE	AIR FLOW RATE	WEIGHT
M75F/380	380 Hz ± 10 Hz	126 – 131 dB(A) at 1 m	96 – 101 dB(A) at 30 m	5 – 9 bar	360 l/min – 8 bar	approx. 1.8 kg
M75F/408	408 Hz ± 10 Hz	134 – 139 dB(A) at 1 m	120 – 125 dB(A) at 5 m	6 – 10 bar	1219.6 l/min – 8 bar	approx. 1.25 kg
M75F/350/408	350 Hz ± 10 Hz 408 Hz ± 10 Hz	118 – 122 dB(A) at 1 m	101 – 105 dB(A) at 7 m	4 – 10 bar	567.2 l/min – 8 bar	approx. 3.5 kg

Our partners rely on ZÖLLNER

An essential part of the cooperation with our customers is to work together in a spirit of partnership – this is the prerequisite for a long-lasting, trusting customer relationship. Customers all around the world rely on ZÖLLNER quality.

ALSTOM

pesa

vossloh
Locomotives

Plasser & Theurer

TOSHIBA

SBB CFF

STADLER

SIEMENS

CAF

...



Our quality promise

Acoustic warning devices – signal horns



ZÖLLNER has been producing compressed air-operated signal horns for rail vehicles for over 75 years. Thanks to this long-standing experience, we have gained an edge in terms of knowledge that makes us a reliable partner of vehicle manufacturers.

Our current product portfolio for rail vehicles includes a wide selection of signal horns with different frequencies. For us, it is particularly important to meet the increasing requirements in terms of materials (REACH, ROHS EN 45545 etc.), documentation and safety.

Developing individual solutions and modifying products together with our customers and partners is one of our passions.

We focus on professional advice from the outset

We use our know-how to realise the individual wishes of our customers and focus on developing the ideal device solution in order to underscore your and our claim to sustainable mobility.

Your ZÖLLNER team



Fig. A look inside our workshop: assembly of Makrofonen of the ZM75 series. Only perfectly manufactured signal horns receive the ZÖLLNER inspection stamp.



Customer-specific solutions

Project-related developments and adaptations to suit your requirements



Future-oriented, sustainable design

Products and components with long lifecycles and preventive obsolescence management



Impressum/Imprint

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