## **ENVIRONMENTAL PRODUCT DECLARATION**

as per *ISO 14025* and *EN 15804+A2* 

Owner of the Declaration	Salzgitter AG
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-SMM-20210244-IBB1-EN
Issue date	20.06.2022
Valid to	19.06.2027

### **Mannesmann MSH® Sections**

## Mannesmann Line Pipe GmbH



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#### 1. General Information

#### Salzgitter AG

#### Programme holder

IBU – Institut Bauen und Umwelt e.V. Hegelplatz 1 10117 Berlin Germany

#### Declaration number EPD-SMM-20210244-IBB1-EN

# This declaration is based on the product category rules:

Structural steels, 11.2017 (PCR checked and approved by the SVR)

#### Issue date

20.06.2022

## Valid to 19.06.2027

# Nam Poten

Dipl. Ing. Hans Peters (chairman of Institut Bauen und Umwelt e.V.)

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Dr. Alexander Röder (Managing Director Institut Bauen und Umwelt e.V.))

#### 2. Product

#### 2.1 Product description/Product definition

Mannesmann MSH<sup>®</sup> sections are cold- and hotfinished hollow sections for structural steel which are manufactured from unalloyed structural steels and finegrain steels, e.g. in accordance with:

*EN 10210*, Hot-finished structural hollow sections of non-alloy and fine-grain steels

or

*EN 10219*, Cold-formed welded structural steel hollow sections

#### Product definition:

*(EU) Directive No. 305/2011* (CPR) applies for placing the product on the market in the EU/EFTA (with the exception of Switzerland). The product requires a Declaration of Performance taking consideration of the *EN 10210* or *EN 10219* and CE marking.

#### Mannesmann MSH® Sections

Owner of the declaration

Salzgitter AG Eisenhüttenstraße 99 38239 Salzgitter Germany

#### Declared product / declared unit

The Declaration refers to the production of 1 tonne Mannesmann MSH<sup>®</sup> sections.

#### Scope:

This Environmental Product Declaration refers to Coldand hot-finished Mannesmann MSH<sup>®</sup> sections with circular, square and rectangular cross-sections from the production facilities of

#### Mannesmann Line Pipe GmbH

in Hamm and Siegen (Germany).

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of *EN 15804+A2*. In the following, the standard will be simplified as *EN 15804*.

#### Verification

The standard EN 15804 serves as the core PCR									
Independent verification of the declaration and data									
accor		14025.	2011						
internally x externally									
Wines									

Dr.-Ing. Wolfram Trinius (Independent verifier)

The respective national regulations apply for usage. Application of the products in Germany is subject to the following guidelines:

1. *DIN 18800* to *DIN 18808*: German application standards for steel construction

2. Eurocode 3: (*EN 1993-1-1* to *EN 1993-1-12*): European application standards for steel construction

3. DASt guidelines: supplementary guidelines, published by the Deutscher Ausschuss für Stahlbau (DASt) technical delivery conditions; German version *EN 10025* 

#### 2.2 Application

 $Mannesmann \; MSH^{\circledast} \; sections \; are \; used \; in \; numerous \\ construction \; applications. \; Typical \; examples \; include:$ 

- Industrial buildings and halls
- Bridge construction



- Sports facilities
- Airport terminals and hangars
- Offshore constructions

#### 2.3 Technical Data

The mechanical and technological properties of coldand hot-finished hollow sections are indicated in delivery standards such as Tables A.3 (unalloyed structural steel) and B.3 (fine-grain steel) in *EN 10210* or Table A.3 (unalloyed structural steel) in *EN 10219* and Tables B.4 or B.5 for the treatment conditions of the preliminary material N and M.

The Declaration of Performance shall apply.

#### Technical construction data

Name	Value	Unit
Density	7850	kg/m³
Modulus of elasticity	210000	N/mm <sup>2</sup>
Coefficient of thermal expansion	11,5 - 11,9	10 <sup>-6</sup> K <sup>-1</sup>
Thermal conductivity	35 - 47	W/(mK)
Melting point	1538	°C
Electrical conductivity at 20°C	3,8 - 4,0	Ω-1m-1
Minimum yield strength (for sheet steel)	235 - 460	N/mm <sup>2</sup>
Minimum tensile strength (for sheet steel)	360 - 720	N/mm <sup>2</sup>

#### Product according to CPR with hEN:

The product's performance values correspond with the Declaration of Performance in terms of its essential properties in accordance with

- **EN 10210**:Hot-finished structural hollow sections of non-alloy and fine-grain steels, Part 1: Technical delivery conditions; Part 2: Tolerances, dimensions and sectional properties
- EN 10219:Cold-formed welded structural steel hollow sections, Part 1: Technical delivery conditions (EN 10219); Part 2: Tolerances, dimensions and sectional properties (EN 10219-2)

#### 2.4 Delivery status

e.g. materials in accordance with *EN 10210* and *EN 10219* 

Steel grades:

- S235JRH S460NLH
- S235JRH S460MLH

Ultra high-strength grades as TM or QT variants are available on request.

#### 2.5 Base materials/Ancillary materials

The base material for manufacturing hot-rolled coils as a preliminary material for cold- and hot-finished hollow sections is iron (percentage by mass >= 99.5%).

Other components are carbon, silicon and manganese. Chemical composition varies depending on the type of steel. The detailed percentages by mass are indicated in the *EN 10210* and *EN 10219* product standards. Ancillary materials: Various lubricants depending on the respective rolling process

The product contains substances from the *ECHA* list of candidates of Substances of Very High Concern (SVHC) (dated 17 January 2022) exceeding 0.1 percentage by mass: **no** 

The product contains other CMR substances in categories 1A or 1B which are not on the candidate list, exceeding 0.1 percentage by mass in at least one partial product: **no** 

Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the Ordinance on Biocide Products No. (EU) 528/2012): **no** 

#### 2.6 Manufacture

Hot-rolled strips of suitable width and sheet thickness, wound as coils, represent the preliminary material for manufacturing longitudinal seam-welded steel pipes at Mannesmann Line Pipe. There are two production facilities with identical manufacturing methods located in Siegen and Hamm.

<u>Pipe production (circular hollow sections):</u> The process is broken down into three phases: **forming** the infinitely welded strip as open-seam pipes, **welding** and **annealing** the seam for achieving the requisite structure. The heated strip edges are welded together by pressing. The pipes are rounded and aligned followed by non-destructive testing of the HFI seam. The pipe string is then sawn to the desired length for the requisite round hollow section.

## Processing (hot-finished round, square and rectangular hollow sections):

The cold-finished circular pipes referred to above are heated to >870 °C solid body for manufacturing hot-finished circular hollow sections and for reforming as square and rectangular sections using four inductors. Production speed ranges from 0.5 to 4.0 m/min.

Both sites are certified to *ISO 9001* for product manufacturing and quality assurance.

## 2.7 Environment and health during manufacturing

During the entire manufacturing process, no other health protection measures are required extending beyond the legally specified industrial protection measures for commercial enterprises.

Certification of industrial safety and health protection in accordance with *ISO 45001* is in place for both sites.

Via regular analyses of the environmental impacts and permanent improvement measures and action within the framework of TQM (Total Quality Management), the low environmental impacts attributable to the manufacturing process are continuously minimised.

Both production facilities operated by Mannesmann Line Pipe GmbH are certified to *ISO 14001*.

#### **2.8 Product processing/Installation** Processing recommendations:



#### Hot- and cold-forming:

Hot- and cold-forming are possible without any difficulty. Hot-forming should be carried out in a range of 1050 to 750 °C. Forming with a predominantly upsetting component, e.g. forging, **can** be carried out in the upper temperature range. Forming operations with stretching, on the other hand, **should** be carried out in the lower temperature range. The temperature can decrease to 700 °C for degrees of deformation of less than 5% in the final stage.

This must be followed by cooling down in stationary air. After hot-forming, normalising is necessary if temperatures arose outside the temperature range of 980 to 850 °C during the previous forming process. After stronger cold-forming processes requiring heat treatment in accordance with the respective guidelines (see *AD data sheets*), stress-relief heat treatment is often sufficient unless other acceptance test procedures or other specifications expressly demand normalising.

#### Welding:

The steels can be welded manually or automatically after each of these procedures. At external temperatures below approx. +5 °C and wall thicknesses exceeding 50 mm (for S 355 and higher exceeding 30 mm), preheating a sufficiently wide zone to 80 to 200 °C is recommended. In any case, the surface should be free of condensation. Stress-relief heat treatment (see heat treatment) is not generally necessary and it should only be carried out if demanded by a building regulation or when welded constructions and/or operating conditions commend depletion of the internal welding stresses. Verifiably suitable welding additives must be used for arc welding while alkaline welding additives are preferable for S 355 and higher.

Industrial safety and health protection measures: No health protection measures over and beyond the standard industrial safety measures (e.g. protective gloves) are required during processing/installation of the Mannesmann MSH<sup>®</sup> sections.

#### Environmental protection measures:

No noteworthy environmental pollution is triggered by processing/assembling the products in question. No special measures need to be taken to protect the environment.

#### Residual material incurred:

Residual material and packaging incurred on the building site must be collected separately. The specifications of local waste authorities must be maintained during processing.

#### 2.9 Packaging

Mannesmann  $MSH^{\odot}$  sections (angular or circular) are bundled using steel bands and/or shipped on wooden beams, secured with wooden wedges (waste code nos.: 150103 packaging made of wood, 150104 packaging made of metal). All packaging can be reused.

#### 2.10 Condition of use

#### Contents in condition of use:

The material composition during the use phase is the same as at the time of production. Mannesmann MSH®

sections are manufactured from non-alloy structural steels and fine-grain structural steels in accordance with *EN 10210* and *EN 10219*. Contents are listed in Table 2.1 in section 2.

#### Corrosion protection:

Detailed information on corrosion protection is available in the technical information sheet entitled "Protecting hollow sections from corrosion" on *Mannesmann Line Pipe*.

#### 2.11 Environment and health during use

General health and environmental aspects There are no health risks for users of Mannesmann MSH<sup>®</sup> sections or for persons manufacturing or processing Mannesmann MSH<sup>®</sup> sections. From an environmental perspective, there are no restrictions governing the use of Mannesmann MSH<sup>®</sup> sections.

#### 2.12 Reference service life

Building product life cycles are dependent on the respective building design, use and maintenance. The use phase for structural hollow sections is not depicted as they involve maintenance-free and generally durable products.

#### 2.13 Extraordinary effects

#### Fire

Mannesmann MSH<sup>®</sup> sections comply with the requirements of construction product class A1 "non-flammable" in accordance with *DIN 4102-1* and *EN 13501*. No smoke gas develops.

#### **Fire Protection**

Name	Value
Building material class	A1

#### Water

The effects of flooding on Mannesmann MSH<sup>®</sup> sections do not lead to any changes in the product or any other negative environmental impact.

#### **Mechanical destruction**

In the event of extraordinary mechanical impact, steel structures display very good characteristics thanks to the high degree of ductility (malleability) of the material. As a general rule, no chips, breaking edges or similar are incurred.

#### 2.14 Re-use phase

Mannesmann MSH<sup>®</sup> sections are 100% recyclable. The Mannesmann MSH<sup>®</sup> sections used in a structure are only partially reused after demolition; the largest share is primarily directed to electro-steel plants as scrap.

#### 2.15 Disposal

As steel is 100% recyclable, this material does not require disposal. Waste code in accordance with the European List of Wastes (EWC), as per the European List of Wastes Ordinance *AVV*: 17 04 05 Iron and steel.

#### 2.16 Further information

Further information on Mannesmann MSH<sup>®</sup> sections is available on *Mannesmann Line Pipe*.

SALZGITTERAG People, Steel and Technology

#### 3. LCA: Calculation rules

#### 3.1 Declared Unit

As a representative of the group of cold- and hotfinished Mannesmann MSH<sup>®</sup> sections, 1 tonne hotfinished Mannesmann MSH<sup>®</sup> section serves as the declared unit.

#### **Declared Unit**

Name	Value	Unit
Declared unit	1	t
Thickness (max. wall thickness)	25,4	mm
Density	7850	kg/m <sup>3</sup>
Conversion factor to 1 kg	0.001	-

#### 3.2 System boundary

Type of EPD: cradle to gate with Modules C1 - C4 and Module D.

The EPD comprises the following life cycle phases:

- Product stage (Modules A1 A3)
- End-of-Life stage (Modules C1 C4)
- Benefits and loads beyond the system boundary (Module D)

Modules A1 - A3 cover both the upstream chain of production and provision of raw materials, auxiliary materials and energy sources, the production of hot strip on the basis of iron ore, as well as its transport to the plants of Mannesmann Line Pipe GmbH, and the energy and material costs there. Waste water treatment is also considered.

For Module C2 (Transport), it is assumed that the steel scrap is transported 100 km by truck for further processing. No other expenses are incurred in Module C, or are already included in the other modules (e.g. recycling in the electric arc furnace and in the converter).

Module D takes consideration of the reuse and recycling potential. Recycling credits are allocated in line with the "theoretically 100% primary furnace route" approach, in accordance with *Worldsteel 2017*.

#### 3.3 Estimates and assumptions

Estimates and assumptions were documented in detail and are based on real production data from hot strip and steel pipe production.

#### 3.4 Cut-off criteria

The end-of-life scenario involves product losses of 3.1%. Landfilling is not considered. Likewise, the manufacture and utilisation of packaging material (steel bands, wooden beams) are not considered. Nor is the use of lubricants taken into consideration.

In their entirety, these unconsidered flows significantly comply with the cut-off criterion of max. 5% of energy and mass expenditure while also adhering to the criterion of 1% in relation to individual processes, *PCR*, *Part A* + *A*2.

#### 3.5 Background data

The LCA results of the declared product are based on modelling in the *GaBi ts* software environment.

Modelling is based on primary production data for the production of hot strip and the energy and media consumption values for an entire year.

This has been supplemented by secondary data from the GaBi database. The respective documentation can be viewed online.

#### 3.6 Data quality

All primary data on steel/hot strip production and pipe production refers to the financial year 2018. The annual volumes have been examined for representativity in relation to previous financial years.

The current GaBi database (GaBi version 10.5.1.124, database 2021.2) was used for background data sets.

The assessment model of the "Product Environmental Footprint (PEF)" approach (see *PEF*) of the EC Joint Research Centre 2012 was used to assess the quality of the primary and secondary data in this EPD. Accordingly, the overall data quality can be rated as "very good".

#### 3.7 Period under review

The period under review is fiscal 2018. The volumes of hot-finished Mannesmann MSH<sup>®</sup> sections produced in 2018 serve as averages for the Declaration.

#### 3.8 Allocation

The methodology used for the co-products in the "coking plant" and "power plant" processes of primary steel production was physical allocation based on calorific value. For the other co-products, a partitioning approach based on the product energy content was used according to the recommendation of *Worldsteel 2014*.

The use of steel scrap for the production of hot strip in Module A1 is considered unencumbered. However, a large percentage of scrap requirements is already covered by the cutting losses incurred during pipe production.

The remaining residual quantity is fed into Module A1 before the End-of-Life scenario is considered and deducted from the "scrap for recycling" material flow. The difference is the net scrap quantity that is transferred to the recycling process; please refer to *Helmus*. Recycling credits are allocated in line with the "theoretically 100% primary furnace route" approach, *Worldsteel 2014*.

If reused, this material flow is credited to pipe production (Modules A1-A3).

#### 3.9 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account.

The background database used involves the *GaBi* data base, version 2021.2.



#### 4. LCA: Scenarios and additional technical information

Characteristic product properties Information on biogenic Carbon

#### End of life (C1 - C4)

Name	Value	Unit
Collected separately	969	kg
Reuse	53	kg
Recycling (net flow steel scrap)	914	kg

Reuse, recovery and recycling potential (D), relevant scenario information

Name	Value	Unit
Collection Rate	96,9	%
Recycling	91,6	%
Reuse	5,3	%
Loss	3,1	%



#### 5. LCA: Results

## DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; ND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

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RESU tonne	Ren Renewable Total u Non-ren Total use	OF TH nesma evable p primary use of rer enewable newab	ELCA ann Ma Indic primary en energy re ewable p primary en enewable of secon enewable	A - IND SH® s ator ergy as a sources a rimary en energy as nergy as r primary dary mate e seconda	ICATO ections as material ergy resou s energy can naterial utili energy resource rial ary fuels	er utilizatio rces rrier zation ources	o DES	Unit MJ MJ MJ MJ MJ MJ MJ MJ MJ MJ MJ	E RES 2.20E+: 0.00E+: 2.45E+: 0.00E+: 2.45E+: 1.88E+: 0.00E+:	OURO 3 0.0 3 0.0 3 0.1 4 0.0 0 0.0 4 0.1 2 0.1 0 0.0	<b>C1</b> 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0	E accor 5.20E+ 0.00E+ 5.20E+ 9.06E+ 9.06E+ 9.06E+ 0.00E+ 0.00E+	D         O.	C3 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0	15804- C4 0.00E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+	A2: 1 D 0 1.55E+3 0 0.00E+0 0 1.55E+3 0 -1.34E+4 0 0.00E+0 0 -1.34E+4 0 9.14E+2 0 0.00E+0
RESU	A Construction of the second s	OF TH nesma ewable p primary use of rer enewable pe of non-r Use of ro Use of r	E LCA ann MS Indic Drimary en energy re aewable p e primary en enewable o f secon enewable o f secon enewable	A - IND SH® s ator ergy as e sources a rimary en energy as r energy as r primary dary mate e seconda ble seconda	ICATO ections energy carri as material ergy resou s energy cas naterial utili energy reso erial any fuels dary fuels	er utilization rces rrier zation ources		Unit [MJ] [MJ] [MJ] [MJ] [MJ] [MJ] [MJ] [MJ]	E RES A1-A3 2.20E+: 0.00E+ 2.20E+: 2.45E+: 0.00E+: 1.88E+: 0.00E+: 0.00E+: 4.27E+: 0.00E+:	OURO 3 0.0 3 0.0 3 0.0 4 0.0 2 0.0 0 0.0 0 0 0.0 0 0.0	C1 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0	E accor 5.20E+ 0.00E+ 5.20E+ 9.06E+ 9.06E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+	D         O.	C3 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0	15804- C4 0.00E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+	A2: 1 D 0 1.55E+3 0 0.00E+0 0 1.55E+3 0 -1.34E+4 0 0.00E+0 0 -1.34E+4 0 9.14E+2 0 0.00E+0 0 0.00E+0 0 0.00E+0 0 0.00E+0 0 0.00E+0
RESU	A Construction of the second s	OF TH nesma ewable p primary use of rer enewable pe of non-r Use Use of no Jse of no Use of no	E LCA ann Ma Indic orimary en energy re everable p e primary en enewable o f secon enewable n-renewable n-renewable	- IND SH® s ator ergy as e sources a rimary en energy as pergy as n primary dary mate dary mate dary mate ble second fresh wate	ICATO ections anergy carri- as material ergy resous s energy cas- naterial utili energy res- erial any fuels dary fuels er	er utilization rces rrier zation burces		Unit [M] [M] [M] [M] [M] [M] [M] [M] [M] [M]	E RES A1-A3 2.20E+ 0.00E+ 2.20E+ 2.45E+ 0.00E+ 2.45E+ 1.88E+ 0.00E+ 4.79E+ 0.00E+	OURO 3 0.0 3 0.0 4 0.0 2 0.0 0 0.0 4 0.1 2 0.0 0 0	C1 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0	E accor 520E+ 9.06E+ 9.06E+ 9.06E+ 9.06E+ 0.00E+ 0.00E+ 0.00E+ 5.95E-	D         0.	C3 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0	15804- C4 0.00E+ 0.	A2: 1 D 0 1.55E+3 0 0.00E+0 0 1.55E+3 0 -1.34E+4 0 0.00E+0 0 -1.34E+4 0 9.14E+2 0 0.00E+0 0 0.00E+0 0 -5.66E-1 0 0.2
RESU tonne Re Re RESU	JLTS ( Man Renewable Total u Non-ren Total use U JLTS ( ne Ma	OF TH nesma ewable p primary use of rer enewable ewable p e of non-r Use of no Use of no Use of no Use of no Use of no	E LCA ann M Indic orimary en energy re ewable p primary or enewable or factor of secon enewable of secon enewable se of net E LCA mann	- IND SH® s ator eregy as e sources a rimary en energy as r eregy	ICATO ections energy carri as material ergy resou s energy caso energy resou s energy resou rial any fuels dary fuels dary fuels er STE C sectio	er utilizatio rces rrier zation ources ATE(	O DES	Unit [M.] [M.] [M.] [M.] [M.] [M.] [M.] [M.]	E RES A1-A3 2.20E+ 0.00E+ 2.45E+ 0.00E+ 2.45E+ 1.88E+ 0.00E+ 4.79E+ D OUT	OURO 3 0.0 3 0.0 3 0.1 4 0.0 2 0.0 0 0.0 4 0.0 2 0.0 0 0	C1 00E+0	E accor C2 5.20E+ 0.00E+ 9.06E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+ S.95E- S accor	oding f           0         0.           0         0.           0         0.           1         0.           0         0.           1         0.           0         0.           1         0.           0         0.           1         0.           0         0.           0         0.           0         0.           0         0.           0         0.           0         0.           0         0.           0         0.           0         0.           0         0.           0         0.           0         0.           0         0.	C3 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0	15804- C4 0.00E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+ 15804+	A2: 1 0 1.55E+3 0 0.00E+0 0 1.55E+3 0 -1.34E+4 0 0.00E+0 0 -1.34E+4 0 9.14E+2 0 0.00E+0 0 0.00E+0 0 -5.66E-1 A2:
RESU Re RESU 1 ton	JLTS ( Man Ren enewable Total use Non-ren Total use ULTS ( ne Ma	OF TH nesma eremewable p primary use of rer enewable p e of non-r Use of no Use of no Use of no Use of no Use of no	E LCA ann Ma Indic Drimary en energy re ewable p e primary en enewable of secon enewable of secon enem	- IND SH® s ator energy as esources a rimary en energy as energy as energy as energy as primary dary mate a seconda ble secon fresh wate MSH® ator	ICATO ections as material as material eregy resou s energy can material utili energy resources and any fuels dary fuels ar STE C sectio	er utilization roes zation ources		Unit [MJ] [MJ] [MJ] [MJ] [MJ] [MJ] [MJ] [MJ]	E RES A1-A3 2.20E+: 0.00E+: 2.20E+: 2.45E+: 0.00E+: 1.88E+: 0.00E+: 4.79E+: D OUTI A1-A3	OURO 3 0.0 3 0.0 4 0.0 2 0.0 2 0.0 0 0.0 0 0.0 PUT F	C1 00E+0	E accor 5.20E+ 0.00E+ 5.20E+ 9.06E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+ 5.95E< S accor C2	o     0.       0     0.       0     0.       0     0.       1     0.       0     0.       1     0.       0     0.       0     0.       0     0.       3     0.	C3 00E+0 000	15804- C4 0.00E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+ 0.00E+ 15804+ C4	A2: 1 D 0 1.55E+3 0 0.00E+0 0 -1.34E+4 0 0.00E+0 0 -1.34E+4 0 9.14E+2 0 0.00E+0 0 0 0.00E+0 0
RESU Results	JLTS ( Man Renewable Total u Non-ren Total use	OF TH nesma evable p e primary use of rer use of non-r Use of non-r Us	E LCA ann Ma Indic Drimary er energy re ewable p primary er enewable o f secon enewable o f secon enewable n-renewable o f secon renewable n-renewable <b>i E LCA</b> mann I Indic ardous wa	IND SH® s ator lergy as e sources a rimary en- energy as lergy a	ICATO ections energy carri- as material ergy resous senergy resous energy resous energy resous anaterial utilite energy reso erial any fuels er STE C section	er utilization roces zation ources		Unit MJ MJ MJ MJ MJ MJ MJ MJ MJ MJ MJ MJ MJ	E RES A1-A3 2.20E+ 0.00E+ 2.45E+ 0.00E+ 2.45E+ 1.88E+ 0.00E+ 4.79E+ D OUT A1-A3 2.34E+	OURC 3 0.0 0 0.0 3 0.0 4 0.0 0 0.0 4 0.0 2 0.0 0 0.0 PUT F 0 0.0	C1 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 C1 00E+0	E accor 520E+ 0.00E+ 9.06E+ 9.06E+ 9.06E+ 0.00E+ 0.00E+ 0.00E+ 5.95E< S accor C2 4.78E	0     0.       0     0.       0     0.       0     0.       1     0.       0     0.       1     0.       0     0.       1     0.       0     0.       1     0.       0     0.       1     0.       0     0.       1     0.       0     0.       0     0.       0     0.       0     0.       0     0.	C3           00E+0	15804- 0.00E+	A2: 1 D 0 1.55E+3 0 0.00E+0 0 1.55E+3 0 -1.34E+4 0 0.00E+0 0 -1.34E+4 0 9.14E+2 0 0.00E+0 0 -0.00E+0 0 0.00E+0 0 -5.66E-1 A2: D 0 -1.25E-1
RESU Resu RESU	JLTS ( Man Renewable Total u Non-ren Total use	OF TH nesma pewable p p primary use of rer use of non-r use of non-r u	E LCA ann Ma Indic Drimary ere energy re ewable p e primary er enewable of secon enewable of secon enewable n-renewable se of net 1 IE LCA mann I Indic ardous wa azardous wa	- IND SH® s ator ergy as e sources a rimary en energy as energy as ergy as erg	ICATO ections energy carri- as material ergy resous energy	er utilizatic rces mrier zation ources		Unit MJ MJ MJ MJ MJ MJ MJ MJ MJ MJ MJ MJ MJ	E RES A1-A3 2.20E+ 0.00E+ 2.45E+ 1.88E+ 0.00E+ 4.79E+ D OUT A1-A3 2.34E+ 2.63E+ 2.34E+ 2.34E+ 2.63E+ 0.00E+ 0.	OURO 3 0.0 3 0.0 3 0.1 4 0.1 2 0.1 2 0.1 0 0.0 0 0.1 0 0	EUS C1 00E+0	E accor 520E+ 0.00E+ 520E+ 9.06E+ 9.06E+ 0.00E+	0     0.       0     0.       0     0.       0     0.       1     0.       0     0.       1     0.       0     0.       1     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.	C3 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0	15804- 0.00E+	A2: 1 D 0 1.55E+3 0 0.00E+0 0 1.55E+3 0 -1.34E+4 0 0.00E+0 0 -1.34E+4 0 9.14E+2 0 0.00E+0 0 -5.66E-1 A2: D 0 -1.25E-1 0 -2.42E+1 0 -2.42E+1 0 -2.42E+1
RESL Re RESL 1 ton	JLTS ( Man Renewable Total u Non-ren Total use	OF TH nesma perveable p primary use of rer enewable perveable perveable perveable use of non- use Use of non- use Use of non- the use of non-the use of non-th	E LCA ann Ma Indic Drimary en energy re ewable p e primary er enewable of secon enewable of secon enewable of secon enewable n-renewable se of neti E LCA nann I E LCA nann I Indic ardous wa azardous wa oactive w	- IND SH® s ator ergy as e sources a rimary en energy as r eprimary dary mate e seconda ble secon fresh wate MSH® aste dispo waste disp aste disp s for re-u	ICATO ections energy carri- as material ergy resou- s energy case naterial utili energy resou- rial any fuels dary fuels er STE C section posed posed posed posed posed posed	er utilizatic rces rrier zation ns	O DES on in	Unit [MJ] [MJ] [MJ] [MJ] [MJ] [MJ] [MJ] [MJ]	E RES A1-A3 2.20E+ 0.00E+ 2.45E+ 0.00E+ 2.45E+ 1.88E+ 0.00E+ 0.00E+ 4.79E+ D OUTI A1-A3 2.34E+ 2.89E+ 2.67E- 0.00E+	OURO 3 0.0 3 0.1 3 0.1 4 0.0 2 0.1 4 0.1 2 0.1 0 0.0 0 0.0 0 0.1 0 0	C1 00E+0	E accor C2 5.20E+ 0.00E+ 9.06E+ 0.00E+ 9.06E+ 0.00E+ 0	o     0.       0     0.       0     0.       0     0.       1     0.       0     0.       1     0.       0     0.       1     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.       0     0.	C3 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0	15804- 0.00E+	A2: 1 D 0 1.55E+3 0 0.00E+0 0 1.55E+3 0 -1.34E+4 0 0.00E+0 0 -1.34E+4 0 0.00E+0 0 -1.34E+4 0 0.00E+0 0 0.00E+0 0 -1.25E-1 0 -2.42E+1 0 1.84E-1 0 0.00E+0
RESU Results	JLTS ( Man Renewable Total u Non-ren Total use U JLTS ( ne Ma	OF TH nesma ewable p primary use of rer enewable newable pe of non-turned use of non	E LCA ann Ma Indic Drimary en energy re ewable p e primary en enewable o f secon enewable o f secon enewable n-ren	IND SH® s ator argy as e sources a rimary en energy as n energy as n e	ICATO ections energy carri- as material ergy resou- senergy resou- naterial utili energy resou- rial ary fuels dary fuels er STE C section seed posed posed see g	er utilizatic rces rrier zation Durces	O DES	Unit [MJ] [MJ] [MJ] [MJ] [MJ] [MJ] [MJ] [MJ]	E RES A1-A3 2.20E+ 0.00E+ 2.45E+ 0.00E+ 2.45E+ 1.88E+ 0.00E+ 1.88E+ 0.00E+ 4.79E+ D OUT A1-A3 2.34E+ 2.89E+ 2.67E- 0.00E+ 1.89E+ 1.89E+	OURO 3 0.0 3 0.1 3 0.1 4 0.0 0 0.1 4 0.0 0 0	C1 00E+0	E accor C2 5.20E+ 0.00E+ 9.06E+ 0.00E+ 0	ading 1       ading 2       ading 5       ading 5	C3 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 00E+0 16E+2	15804- 0.00E+	A2: 1 D 0 1.55E+3 0 0.00E+0 0 1.55E+3 0 -1.34E+4 0 0.00E+0 0 -1.34E+4 0 0.00E+0 0 -1.24E+1 0 -2.42E+1 0 1.84E-1 0 0.00E+0 0
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#### 6. LCA: Interpretation



The results of the environmental impact show that practically the "entire greenhouse gas emissions (**GWP total**)" of Modules A1 - A3 come from fossil sources (cf. indicator **GWP fossil**).

As expected, the more detailed analysis shows that hot strip production (Module A1) has the greatest influence on GWP total or GWP fossil, accounting for almost 94%. Here, the fossil carbon input in the blast furnace process is particularly noteworthy, leading to direct, process-related  $CO_2$  emissions and to further indirect emissions in the power plant process. Within Module A1, approx. 70% of greenhouse gas emissions come from the direct plant emissions and the remainder from the emissions of the preliminary processes for the production and provision of the raw materials such as the coal, iron ore carriers and lime. In Module A3 ("Pipe production"), the majority of greenhouse gas emissions are accounted for by upstream emissions in the production of electricity.

In contrast, the absolute shares of the "greenhouse potentials from biogenic sources (**GWP biogenic**)" and from "landscape use and landscape use change (**GWP luluc**)" have only a negligible share of the total greenhouse potential. As expected, the contributions in Modules A1 and A3 come exclusively from the upstream processes, and here primarily from the electricity mix used or the raw material supplies.

For the "Water depletion potential (user) (**WEP**)", the chains of electricity generation to cover the electricity demand in Module A3 are decisive.

The other core indicators of environmental impacts are predominantly determined by steel and hot strip production in Module A1. The "Potential for stratospheric ozone depletion (**ODP**)" should be emphasised. The ODP is almost exclusively caused by the use of methanol in wastewater treatment in Module A1, as halogenated hydrocarbons are emitted during the production of methanol.

For the remaining impact indicators, the provision of raw materials for steel production (Module A1) also has the greatest influence on the absolute size of the environmental indicators. As expected, the largest contributions are made by the provision of iron ore carriers, coal and lime, i.e. those input materials that are used in the largest quantities (see Table 7). In addition, the impact indicators describing the acidification potential (**AP**), the eutrophication potential (**EP freshwater, EP marine, EP terrestrial**) and the ozone creation potential (**POCP**) are increased by the direct NO<sub>x</sub> and SO<sub>2</sub> emissions of the sintering plant and the power plant.

The credits from the reuse and recycling of steel scrap in Module D result from the selected recycling approach of avoided primary steel production and the associated avoidance of emissions from this process route. The positive share of the impact indicator **GWP biogenic** of Module D comes from the biogenic shares of the German electricity mixes used.

In contrast to fossil-based primary steel production recycling by means of the electric arc process is mainly based on electricity. This is largely made up of



renewable energies. For this reason, "Module D" leads to an increase rather than a decrease in the use of renewable energy, while at the same time reducing the use of fossil energy, as can be seen from the indicators **PERE** and **PENRE**.

In summary, almost every LCA indicator is determined by the steel production process in

#### 7. Requisite evidence

This EPD concerns semi-finished products made from structural steel. Further processing depends on the respective application. Accordingly, further documentation is not of relevance here. Module A1. Only electricity generation and its upstream chains have a significant overall impact on the pipe manufacturing process (Module A3). For Mannesmann Line Pipe, material efficiency is therefore the biggest lever in this and most categories.

#### 7.1 Weathering

Components manufactured from Mannesmann MSH<sup>®</sup> sections are not generally exposed to weathering without protection. Corrosion protection systems are selected in accordance with the respective application and site.

#### 8. References

#### Standards

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#### DIN 18808

DIN 18808:1984-10, Steel structures; Supporting structures made of hollow sections under predominantly static loads

#### EN 1993-1-1

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#### EN 10025

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#### EN 10210

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#### EN 10219

DIN EN 10219-1:2006-07, Cold-finished welded hollow sections for steel construction using unalloyed structural steels and fine-grain steels – Part 1: General technical delivery conditions; German version EN

#### 10219-1:2006

#### EN 10219-2

DIN EN 10219-1:2006-07, Cold-finished welded hollow sections for steel construction – Part 2: Tolerances, dimensions and sectional properties

#### EN 13501

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#### EN 15804

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#### ISO 14025

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#### ISO 45001

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#### AVV

Ordinance on the list of wastes (Directive governing the European Waste Index): 10 December 2001 (Federal Law Gazette No. I S. 337s9), last amended: 4



July 2020

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#### PCR, Part B

Steel pipes for pressure applications; Product category guidelines for building-related products and services Part B: Requirements on the EPD for steel pipes for pressure applications, version 1.0, Berlin: Institut Bauen und Umwelt e.V. (pub.), www.ibu-epd.com, 2016-05

#### PEF

EC Joint Research Centre, Product Environmental Footprint (PEF) Guide, consolidated version, Ispra, Italy, 2012

#### (EU) Directive No. 305/2011/

(EU) Directive No. 305/2011 of the European Parliament and Council of 9 March 2011 establishing harmonised conditions for marketing construction products and replacing Council Guideline 89/106/EEC

#### Other literature

#### **ECHA**

https://echa.europa.eu/de/candidate-list-table

#### GaBi ts

GaBi version 10.5.1.124; database used: 2021.2 GaBi ts data set documentation for the software system and databases, LBP, University of Stuttgart and thinkstep, Leinfelden-Echterdingen, 2021 (http://documentation.gabi-software.com/)

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#### Mannesmann Line Pipe

www.mannesmann-linepipe.com

#### SZFG

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#### World steel 2014

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#### World steel 2017

World Steel Association, Life Cycle Inventory Methodology Report, Brussels, Belgium, 2017, ISBN 978-2-930069-89-0

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