

Prolyte General Truss Manual Part 1 of 2

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PART 1 NOT TO BE USED IN ISOLATION - ONLY TO BE USED IN CONJUNCTION WITH APPLICABLE PART 2.

ARTICLE CODE:



READ THIS MANUAL CAREFULLY AND UNDERSTAND ALL OF ITS CONTENTS PRIOR TO ASSEMBLY AND LOADING OF PROLYTE TRUSS.

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Prolyte General Truss Manual

Read this manual carefully and understand all of its contents prior to assembly and loading of Prolyte truss. Prolyte has made every effort to ensure the accuracy of this manual; no liability will be accepted for errors. Prolyte reserves the right to change or alter its products or manuals without prior notice. No part of this manual may be reproduced in any form or by any means without prior written permission.

PROLYTE GROUP - phone +31 (0)594 85 15 15 - fax +31 (0)594 85 15 16 WWW.PROLYTE.COM

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1. PREFACE

Read this manual carefully and understand all of its contents before you assemble and load the truss. Part 2 shall be read in conjunction with Part 1, "General Truss Manual". Part 2 supersedes Part 1 in the case of conflicts. This preface explains how to interpret the symbols and text styles in this manual.

This manual has been written for all users of Prolyte trusses. Please ensure that you read and understand this manual completely before using the trusses. This manual should be accessible to everyone assembling, disassembling, or using the trusses. Save this manual for later use. Prolyte can send you an additional manual on request, or you can download it from the Prolyte website.

This manual has been written for all the users of Prolyte Truss elements. Make sure that you read and understand this manual completely before using the

INDICATES A HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY. THIS SIGNAL WORD IS TO BE LIMITED TO THE MOST EXTREME SITUATIONS.

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INDICATES A HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN MINOR OR MODERATE INJURY.

NOTICE

ADDRESSES PRACTICES NOT RELATED TO PERSONAL INJURY.

SAFETY INSTRUCTIONS

IS USED FOR LISTS OF STEPS, PROCEDURES OR INSTRUCTIONS THAT MIGHT OTHERWISE CLUTTER UP A DANGER, WARNING OR CAUTION NOTIFICATION NOTE THAT EQUIVALENT PHRASES, SUCH AS SAFE OPERATION PROCEDURES OR SAFE SHUT DOWN PROCEDURE, CAN BE USED IN PLACE OF THE WORDS "SAFETY INSTRUCTIONS." Truss elements. This manual should be accessible for everyone assembling, disassembling or using the Truss elements. Save this manual for later use. At request, we can send you an additional manual or you can download it from the Prolyte website. (www.prolyte.com)

For health and safety reasons people assembling, disassembling, transporting and maintaining truss elements should wear adequate Personal Protection Equipment (PPE) like - but not limited to - gloves, sound protection, hard hats and safety shoes. The noise levels during assembly and disassembly can exceed 80dB. Elements weighing 20kg or more shall be carried by at least 2 persons. Artists, performers or people who have to be on the stage or in the vicinity of 50cm shall be instructed and informed about correct use and possible dangers before use.

2. SCOPE

Prolyte trusses are structural elements designed to be repeatedly assembled and disassembled in order to carry loads in temporary or permanent installations. Depending on the application, Prolyte trusses can be considered to be lifting accessories or construction products. If used as lifting accessories, trusses are subject to the European Machinery Directive 2006/42/EC. A declaration of conformity can be found in Appendix C. If trusses are used as construction products in temporary or permanent constructions they are subject to the European Construction Products Directive 305/2011/EC. A declaration of performance can be found in Appendix C.

3. LIMITATIONS OF USE

Truss elements shall always be used within the limits of the structural report. Loading figures mentioned are only valid for static loads. Self-weight is already taken into account. To meet BS, ANSI and CWA standards for truss elements (especially trusses) in repetitive use all loadings shall be multiplied by 0.85. All other structures made of truss elements need dedicated structural reports. Never mix truss elements from different manufacturers.

Prolyte truss elements described in this manual are not specifically designed for lifting people! Adequate load-reduction and safety precautions, according to local legislation, must be taken into consideration when people are lifted. Truss elements can be used in environmental conditions varying from -20dgr up to +60dgr Celsius. Special attention should be taken if truss elements are exposed to icy conditions or if water might intrude into extrusions and freeze. Chemical reactions with other materials and substances should be considered at all times. Special attention shall be taken when truss elements are used in, or close to, challenging environments where there is a chance the aluminium may be damaged. Direct contact with concrete shall be avoided by means of a sealant.

SAFETY INSTRUCTIONS

ALL BOLTS AND NUTS USED IN THE LINE OF FORCES, SHALL BE FASTENED BY MEANS OF A TORQUE WRENCH. WHEN BOLTS ARE CONNECTED TREADED ALUMINIUM COMPONENTS THE TORQUE SETTING ARE M12 > 25NM, M16 > 50NM.

4. TRANSPORT AND STORAGE

ALWAYS WEAR HARD HATS, SAFETY SHOES, SOUND PROTECTION AND PROTECTIVE GLOVES WHEN MOVING, ASSEMBLING OR DISASSEMBLING TRUSS ELEMENTS

- 1. Treat the truss elements with care. Don't drop them, don't drag them around and don't throw sections on top of each other.
- 2. Prevent damage from sharp edges such as the forks of a forklift.
- Dedicated dollies can be a highly effective means for transportation and storage, while providing the truss elements-sections with some extra protection.
- Vertical transportation or stocking of truss elements can be hazardous for reasons of falling.
- 5. Avoid physical contact with unprotected steel at all times.
- Ensure truss elements cannot move and shake during transport. Due to the softness of aluminium, the abrasive effect of moving or shaking can lead to severe damage.

5. APPROVED ACCESSORIES

A full range of accessories is available. For a complete overview of approved parts please refer to our brochures or www.prolyte.com.

It is of great importance that accessories never damage the structural element under any circumstances. Special attention shall be taken when using clamps and hooks. It might be the case that their inner radius does not meet the outer radius of structural element extrusions. This can lead to severe damage.

6. COATINGS AND SURFACE TREATMENTS

The design shall address any coating or surface finishing techniques used in manufacturing that affect the structural properties and load-bearing capabilities of the truss or tower structures.

Coatings and surface finishes shall only be applied after consultation with the coating or finish manufacturer or other party qualified to evaluate the possible effects of the coating or surface finish on the structural properties and load-bearing capabilities of the module.

The application of powder coating shall use only a low cure process. The heating of truss and tower modules shall only be done in accordance with Table A.3.2 in ASM1-10 (see 3.2.2.1 for full reference.)

Records shall be kept detailing the application of any coating or surface finish with particular attention to processes requiring the application of heat. Chemical removal of coatings and surface finishes shall be carried out only after consulting with the chemical manufacturer to ensure that the chemical will not affect the mechanical properties of the aluminium. Abrasion-blasting shall not be used on aluminium less than or equal to 1/8 inch (3mm) thick.

7. APPROVED SLINGING METHODS

We refer to Part 2 for each specific type of truss element for information regarding the correct slinging method.



SLINGING EQUIPMENT SHALL BE MADE FROM NON-ABRASIVE AND FIRE RETARDANT MATERIAL AT ALL TIMES.

The use of Prolyte "Softsteels" is preferred. Direct contact between a steel wire rope and the truss chord should be avoided because of the abrasive surface of the steel wire rope.

7.1 SUSPENDING/SUPPORTING TRUSSES OUTSIDE NODE POINTS

When using lifting gear it is often not possible to attach these where the diagonals intersect. This can lead to a reduction in the load-bearing capacity of the truss, depending on the position of the suspension points and the number of suspension points per span.

If the truss is not supported in the node point but at the main chord, this chord will be subject to additional forces.

Truss supported at each end of the span, max. 10cm outside the node point:

At the end of the truss the bending moment is almost zero. This means that the main chord is not subject to normal forces. The only load is caused by the lifting bracket.

Resulting load-bearing capacity:

If the lifting bracket is attached 10cm from the node, trusses may be subjected to the following loads:

- Prolyte X30, H30, X40 and H40 series 100% of their load-bearing capacity.
- · Prolyte S-series max. 2000kg per support point.



7.2. MULTIPLE SUPPORTED TRUSSES

If a truss is suspended at more than 2 points, the suspension points in between have to be attached into the node points. If this is not done, the truss may not be loaded to up 100% of its load-bearing capacity. Slinging to all main chords does not change this. The correct load can only be determined by studying each load case individually.

Support points at multiple supported trusses, 2 forces need to be considered:

A. Because of the own weight and payload on both sides of the support, the truss is subject to bending moments. This results in compression of the bottom chord and tension in the top chords. B. An additional bending moment in the main chord occurs because of the miss nodding of the lifting bracket. An interaction of both forces means that the permissible load-bearing capacity of the support point can only be determined on a case-by-case basis. In general the load should be substantially reduced.





LIFTING BRACKET WLL 1000KG







8. ASSEMBLY INSTRUCTIONS, DOS AND DON'TS

At all times trusses and truss constructions shall be assembled by a competent person or sufficiently instructed personnel under supervision of a competent person. Before assembly, use and disassembly the competent person is responsible for, but not limited to, follow up of all instructions as stated in the applicable truss manuals part 1 and 2, instruction to those assembling the trusses and correct suspension of trusses and loads. It is advisable to demonstrate physically how to assemble and disassemble trusses, how to orientate couplers, which tools to use etc.

A competent person shall check prior to use if all trusses are connected properly before applying loads. The applicable product manual (part 2) gives guidance on best practice for correct use

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- Clean, check and maintain your truss elements on a regular basis, as this will improve ease of assembly and its lifetime.
- Dispose of damaged or deformed truss elements.
- Make a structural calculation for each construction you build.
- Store and transport your truss elements using appropriate dollies.
- Use copper hammers for assembling, as this will reduce damage to the truss elements.
- Attach loads in node points solely. Other positions might be possible but this shall be checked on a case-by-case basis by a structural engineer.
- Check if loads are attached properly to the truss elements before lifting.
- Check all connections before lifting.

DON'T

- Mix H and X version of truss elements in one construction.
- Mix truss elements from different suppliers in one construction.
- Exceed the maximum loading and given structural data.
- Drill holes in truss elements.
- Use damaged Truss elements.

- Climb on Truss elements while attaching yourself to a structural element without taking specific measures to bear loads caused by fall arrest equipment.
- Attach loads on the Truss elements diagonals and end braces.





9. LEGISLATION

	USE
IGVW SQP1	Code of practice for event technology- Provision and Use of Truss Systems / Germany
BGV C1 / GUV 6.15	Staging and Production Facilities for the Entertainment Industry / Germany
BS 7906-2	Code of practice for use of aluminium and steel trusses and towers / England
LOLER	Safe use of lifting equipment, lifting operations and lifting equipment regulations / England
TISE	The Institution of Structural Engineers, Temporary Demountable structures, guidance on use, procurement and design / England
NPR 8020-10	Entertainment-rigging-design factors of safety / Netherlands

	MANUFACTURING
ANSI E1.2-2006	Entertainment Technology: Design, Manufacture and Use of Aluminium Trusses and Towers
CWA 15902-2	Lifting and Load-bearing Equipment for Stages and other Production Areas within the Entertainment Industry - Part 2: Specifications for design, manufacture and for use of aluminium and steel trusses and towers
BS 7905-2	Specification for design and manufacture of aluminium and steel trusses and towers
BS 8118	Structural use of Aluminium part 1 code of practice for design
DIN 1055 (all parts)	Design loads on buildings - all parts
DIN 4113-All parts	Aluminium constructions under predominantly static loading; static analysis and structural design
EN 10002-1	Metallic materials – Tensile testing – Part 1: Method of testing at ambient temperature
EN 10067:1997	Hot rolled bulb flats, Dimensions and tolerances on shape, dimensions and mass
EN 1990	Eurocode 0 Basis of structural design
EN 1991 all parts	Eurocode 1 Actions on structures
EN 1993 all parts	Eurocode 3 Design on steel structures

EN 1999 all parts	Eurocode 9 Design of Aluminium structures
EN 1090-1	Requirements for conformity assesment of structural components
EN 1090-3	Execution of steel and aluminium structures-part 3 technical rules for execution of aluminium structures
EN 30042:1994	Arc welded joints in aluminium and its weldable alloys - Guidance on quality levels for imperfections.
EN ISO 3834-1 & 3	Quality requirements for welding - Fusion welding of metallic materials - Part 1: Guidelines for selection and use Part 3: Standard quality requirements
EN 754 (all parts)	Aluminium and aluminium alloys - Cold drawn rod/bar and tube
EN 755 (all parts)	Aluminium and aluminium alloys - Extruded rod/bar, tube and profiles
EN 515:1993	Aluminium and aluminium alloys - Wrought products - Temper designations
EN 573 (all parts)	Aluminium and aluminium alloys - Chemical composition and form of wrought products
EN 10204:2004	Metallic products - Types of inspection documents
2006/42/EC	European Machine Directive
305/2011/EC	European Construction Product Directive

10. INSPECTION

Prolyte encourages careful documented inspection by a competent person at least once a year and possibly more often if the circumstances or intensity of use requires so. If the truss elements are used as lifting equipment, the inspection interval should be according to the machine directive (EC 2006/42) and local legislation for inspection. If the structural elements are used as permanent loadbearing elements in permanent buildings they are subject to the EU construction product directive (EC 305/2011), the inspection interval should be according to the building code and local legislation for inspection.

PROLYTE TRUSS ELEMENTS SHALL BE CHECKED AND INSPECTED VISUALLY FOR DAMAGE OR ANY OTHER ASPECT, THAT MIGHT NEGATIVELY AFFECT THE SAFETY OF THE TRUSS ELEMENTS, PRIOR TO EACH TIME OF USE.

Table 1

	INSPECTION LE	INSPECTION LEVEL			ITEMS TO BE INSPECTED						
Part	Initial Chapter	Regular Chapter	Periodic Chapter	Chords	Diagonals	Connectors	Welds	Fasteners	Geometry	ID-TAG	
Missing parts											
Dents		\checkmark	\checkmark	\checkmark							
Bends		\checkmark		\checkmark							
Holes (1)	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark	\checkmark			
Incorrect repair	\checkmark	\checkmark	\checkmark	\checkmark			\checkmark	\checkmark			
Abrasion	\checkmark	\checkmark	\checkmark	\checkmark			\checkmark				
Corrosion			\checkmark								
Missing members	\checkmark	\checkmark	\checkmark	\checkmark		\checkmark		\checkmark			
Flatness (2)		\checkmark	\checkmark			\checkmark					
Deformation		\checkmark	\checkmark			\checkmark		\checkmark			
Excessive wear		\checkmark	\checkmark			\checkmark		\checkmark			
Cracks		\checkmark					√				
Correct grading (3)	\checkmark	\checkmark	\checkmark					\checkmark			
Twisting	\checkmark	\checkmark	\checkmark						\checkmark		
Squareness		\checkmark	\checkmark						\checkmark		
Bending									\checkmark		
Camber											

(1) not to be part of the construction (2) particular for trusses with connecting plates (3) Minimum 8.8 grade

10.1 GENERAL

Responsibility and liability for the safe use of truss elements lies predominantly with the user. The open heel in the bracing welds in the 30er and 40er series part of the design and TüV approved.

10.2 INSPECTION

Inspect the truss elements, rigging wear and accessories for visual wear or damage of any kind before assembling or using the truss elements at any time! For inspection criteria see table 1.



USING DAMAGED OR WORN STRUCTURAL ELEMENTS, COUPLER PARTS, RIGGING WEAR AND ACCESSORIES CAN RESULT IN DEATH!

10.3 INSPECTION LEVELS

Initial inspections

When first acquired, whether they are new or used, structural elements should be inspected in accordance with Table 1, and a record of the inspection maintained.

Regular inspections

Regular visual inspections should be carried out in accordance with Table 1. Regular inspections should be performed by a competent person and should be carried out prior to each incident of use.

Periodic inspections

Periodic visual inspections should be carried out in accordance with Table 1 and a record of the inspections maintained. Periodic inspections should be performed by a competent person and should be conducted at least once each year or in accordance with an inspection routine established by a qualified person.

Truss elements which are subject to any accident must be inspected according to the requirements per periodic inspection and in accordance with table 1. not to be part of the construction (2) particular for trusses with connecting plates (3) Minimum 8.8 grade

10.4 INSPECTION FREQUENCY

Truss elements in regular service should be subjected to regular and periodic inspections.

Permanent installations, stationary

Periodic inspections should be carried out on all truss elements that are permanently installed in a stationary (not moving) configuration. The frequency of inspections should be determined based on the prevalent conditions.

Permanent installations, moving

Periodic inspections should be carried out every three months, or in accordance with an inspection routine established by a qualified person, on all truss elements that are installed in a permanent configuration where movement of the truss elements system is an integral part of use.

Records

Records of initial inspections and periodic inspections should be kept by the owner for each truss elements and should be signed and dated by the person carrying out the inspections.

11. MAINTENANCE AND DISCARD CRITERIA

11.1 INTRODUCTION

In addition to the normal requirements with regard to due care in utilization, professional assembly, dismantling, transport and storage of truss elements, regular inspections are vital. A careful visual check of the individual elements before each use, independent of the respective field of utilization, shall be performed.

Regular tests of the truss elements should be carried out at least once a year by a competent person and documented in written form. If the truss elements are used intensively, regular inspections should be performed at shorter intervals. If deficiencies are noted during an inspection of truss elements that preclude further safe use, the truss elements must be taken out of service and scrapped. Identification

of the deficiency cannot be considered sufficient in most cases. Disposal via the manufacturer/supplier or a metal recycling company is the only safe way of protecting others from risks generated by defective material. The criteria given here by PROLYTE for the disposal of truss elements shall be incorporated fully into the inspection.

11.2 DISCARD AND REJECTION CRITERIA

Truss elements are considered to be rejected from service if they display one or more of the criteria outlined in this manual. In case of doubt the manufacturer/supplier or an expert should be consulted.

WARNING

GENERAL

- Although aluminium may not develop corrosion the way many steel alloys do, nevertheless ambient influences can have a corrosive impact on aluminium.
- Care should be taken with structures that are placed outdoors for a long time; in particular in areas with a high level of industrial pollution, near salt water, near tram lines, near swimming pools. Truss elements should be checked individually prior to each use to ascertain if the potential pollutant has had a corrosive effect.
- If any part of a truss element shows significant visible damage or is suspected of containing a damaged element (visible or not), the truss element should be taken out of service and marked accordingly. A qualified person should carry out an assessment of the truss element.
- Repairs should be undertaken by either the manufacturer or a suitably qualified person approved by the manufacturer.
- Regularly smooth the surface of coupling parts with fine sandpaper.
- Keep them slightly lubricated with silicone oil, spray or similar lubrication. Any lubricant used should not be "sticky", in order to preventing the gathering of dirt, dust or small parts of debris.
- Prevent the drying of spray-painted coupler components when in position, this has a negative effect on the precise fit.
- Remove any kind of debris from truss elements and their components.

Do not use any abrasive methods other than Scotch-Brite or sandpaper grain 240 or higher.

- Welds which have cracks or other irregularities.
- The incomplete welding seams around the diagonal braces are production-related and their stability has been proved (TÜV approved).
- Missing identification (name of the manufacturer, truss elements type and date of production).
- Lasting (3D) deformation of the truss elements by rotation, bending or torsion or other deformation with resultant deviation from the original shape.
- Reduction of the raised level of the welding seam by mechanical wear by more than 10%.
- Excessive corrosion whereby the total cross-sectional area of the truss elements is reduced by more than 10%.

DAMAGED OR WORN MATERIAL SHALL BE CLEARLY MARKED AND TAKEN OUT OF SERVICE IMMEDITAELY.

11.3 MAIN CHORDS

If one or more of the main extrusions breaks or shows cracks, or if one or more of the main extrusions is rolled by more than 10% of their respective diameter from the original centre line then the Truss elements is unfit for further use. The same applies if

the ends of the main chord of a Truss elements are rolled in the area around connector, connecting the Truss elements to another element only possible by exerting considerable force. Further signs of a discard condition are:

- Scratches, cuts or signs of attrition on the surface of the main extrusions that reduce the cross-sectional area of the tube by more than 10%.
- Scratches, cuts or indentations in the main tube to a depth of more than 1mm and a length of more than 10mm, irrespective in which direction.
- Holes which appear after the Truss elements is brought into use.
- The remaining (plastic) deformation of the main chord to an oval shape or indentation of the tube by more than 10%.

Figure 16. Bending of the main chords.



11.4 BRACES

If one or more diagonal braces, end braces or cross braces is broken or no longer exists, the truss element is not usable. The same applies for braces rolled by more than 10° of their diameter from the centre line. Further signs of a discard condition are:

- Scratches, cuts or signs of wear on the surface of the braces that reduce the cross-sectional area of the braces by more than 10%.
- Scratches, cuts or indentations in the braces to a depth of more than 0.5mm and a length of more than10 mm, irrespective in which direction.
- Holes which appear after the truss element is brought into use.
- The remaining (plastic) deformation of a brace to an oval shape or indentation of the brace tube by more than 10%.



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Figure 17. Bending of the braces.

11.5 CONNECTORS

Signs of a discard condition are:

- Cracked or partially broken welding seams between the main tube and the connector.
- Oval signs of wear in the drill holes greater than 10%.
- Rotational displacement for the drill holes for the bolt holes in a CCS connector or between two adjoining connectors by more than 2°.
- Deflection of the main chord ends with connector by more than 5° which makes connecting two truss elements during assembly more difficult.
- Signs of wear on the connector that reduce the cross-sectional area by more than 10%.
- Deformation or distortion in the main chord area next to the welds of the connector.
- Overloading by excessive force causes buckling.
- Overloading through excessive tensile force can cause diminution of the main tube next to the welds.
- Each scratch, cut or hammer stroke indentation on the connector to a depth of more than 2mm
- and that is longer than 10mm, independent of the direction.
- Excessive corrosion in the connector.

For systems that have remained assembled for more than one year indoors, or for 2 months outdoors, new, galvanized bolts should be used, or stainless steel, in order to prevent possible dangers by galvanic corrosion.



Figure 18. Oval-shaped holes.

11.5 PINS

Pins undergo wear when inserted and removed frequently, in particular by hammer strokes. They can be regarded as consumer goods. Pressure areas and deformations in the bolts are indications of a massive overload. If a bolt shows such a change, it may no longer be used. Further signs of a discard condition:

- Cuts, indentations, scratches and other damages on the smooth surface of the pin.
- Burrs, mushroom heads and other protruding, sharp or pointed edges at the narrower end of the pin.
- Deformation through hammering which causes
- wear on the cross-hole or damage to a screw thread.
- Attrition of the zinc coating on any part of the bolt, causing this to corrode.
- No self-locking nuts may be used if the nylon safety mechanism is clearly damaged by wear.



Design (ASD) standard, caution should be taken when comparing data or using data in the calculations of structures based on Load Resistance Factor Design (LRFD) standards, such as Eurocodes and British Standards.



NEVER MIX STRUCTURAL DATA FROM DIFFERENT STANDARDS WITHOUT KNOWING THEIR RESPECTIVE SAFETY PRINCIPLE

Trusses and structures from assembled trusses shall always be checked on their structural stability and strength by a chartered engineer. The provided technical specifications shall never be exceeded.



NEVER EXCEED THE STATED TECHNICAL SPECIFICATIONS OF A TRUSS

Figure 19. Damaged spigot pins.

NEVER RE-SINC PLATE STEEL PINS AS THEY ARE MADE OF HIGH GRADE STEEL. HYDROGYNE EMBRITTLEMENT MIGHT OCCUR

12 SAFETY

In case of an accident or malfunction, the trusses shall be marked, taken out of service and offered for inspection to a qualified person in order to establish their structural integrity for re-use. The trusses shall be identified accordingly and records of identification numbers and photographs shall be taken. It is strongly advisable to retain photographs of the situation for your records. Examples of accidents or malfunction include:

- Truss is dropped to floor from height
- Truss is lifted with missing pins in joints which might cause overloading
- Truss was subject to shock loads
- Truss was torqued during e.g. lifting

DO NOT USE DAMAGED OR MALFUNCTIONING PARTS

The Prolyte data published prior to April 2014 is based on calculations according to the German DIN 4113 standard. As this is an Allowable Strength









 Leek, Netherlands
 Wakefield, England
 Emsdetten, Germany

 info@prolyte.com
 info@prolyte.co.uk
 info@prolyte.eu

Prolyte Products RO SRL Slatina, Romania