INDIRES

Information Driven Incident Response

User Manual
Composite Material Prop

17th November 2020

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1 Intended Audience

An output of the INDIRES project is user documentation for each of the products produced during the project. However, the status of the various products differs and, for this reason, the intended audience for the *User Documentation* will be different for each product. It is necessary, therefore, to indicate the type of user who will benefit from this particular *User Document*.

The composite material props described here were fully prototyped and tested in a mine environment. As such, the information provided in this *User Document* is intended to be utilised by end users – mine operators and rescue organisations – who have a need for these props. Such users can consider the instructions on how to use and maintain the props as definitive.

End users who want to know more, and perhaps to discuss possible collaborative opportunities, are referred to *Section 12*.

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2 Introduction

The composite prop is designed for supporting excavations in underground mining facilities. The prop is used mainly in conditions with no tremors, or with only a small number of tremors .Its purpose is to maintain the safety and size of such excavations necessary for mining and rescue operations involving people, machinery, and equipment. It differs from conventional props in being made of a composite material for reduced weight and, therefore, ease of transport, especially during a rescue situation.

The prop can also be used to perform other supplementary tasks during underground work related to the operation, transport, and repair of machines and equipment in compliance with the approved workplace instructions.

Depending on the dimensions of the excavation and the thickness of the deposit, the appropriate dimensions of composite props can be selected.

The composite prop provides protection for the working area by supporting the roof with a maximum load bearing capacity of 200kN (20 tonnes).

Figure 1 – View of the Composite Material Prop

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3 Range of Applications

The composite prop is a piece of individual supporting equipment designed for:

- carrying out rescue work,
- direct and indirect roof support,
- support for rock rubble when, for example, a rescue passage is being made.

The trapezoidal thread installed on upper part of the prop is designed to perform the following tasks:

- extending the prop to an appropriate length, depending on the height of the excavation,
- installing the prop with initial load-bearing capacity,
- supporting the roof with working load-bearing capacity,
- sliding down the prop to enable its dismantling and removal from the excavation.

The composite prop has the following features:

- immediate load-bearing work parameters,
- constant load-bearing capacity,
- anti-corrosion properties,
- it can be used at any location,
- the construction of the prop enables its use in all conditions, including potentially explosive atmospheres,
- fast ejection of the upper prop,
- low resistance to movement allows for quick sliding down (dismantling) of the prop,
- possibility of remote dismantling, e.g. with a cord or chain,
- low weight.

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4 Technical Description

The composite prop, as shown in *Figure 2*, comprises the following components:

1. Inner tube:
    a) steel crown head (*Figure 2-1*) welded to trapezoidal thread (*Figure 2-2*),
    b) steel bolt for fixing the height of the prop(*Figure 2-5*),
    c) composite pipe of the inner tube(*Figure 2-3*),
    d) height (extension) adjustment holes in the inner tube (*Figure 2-4*).

2. Outer tube:
    a) steel ring (*Figure 2-6*),
    b) composite pipe of the Outer tube (*Figure 2-7*),
    c) foot plate (*Figure 2-8*),

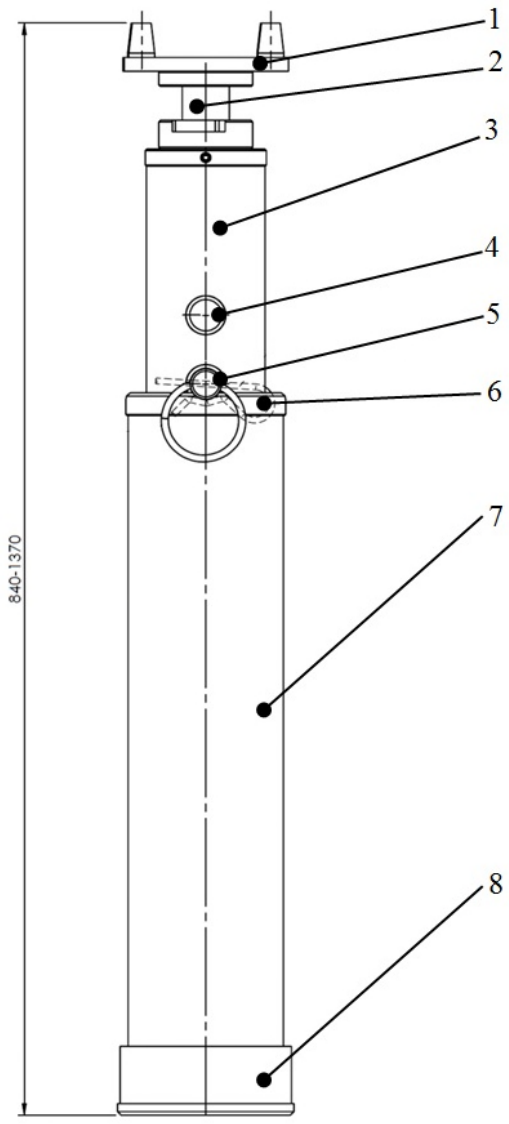

Figure 2 – Components of the Composite Material Prop

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5 Handling

The work cycle of the composite prop can be divided as follows:

1. mounting and installation,
2. supporting the roof,
3. dismantling.

These processes are described in the following sections.

5.1 Mounting and Installation

1. Place the prop perpendicularly to the roof on a prepared floor.
2. Place the outer tube under the canopy so that the steel crown head is within the canopy's boundary to prevent movement.
3. Jam the prop by placing a steel bolt (*Figure 2-5*) in the hole adjusting the position height of the inner tube (*Figure 2-4*).
4. Secure the steel bolt with a cotter pin to prevent it from falling out of the hole.
5. Set the initial load-bearing capacity of the prop with the trapezoidal thread and a nut, adjusting the level that the steel crown head (*Figure 2-1*) is pressed to the canopy.
6. Secure the prop to prevent tipping over.

The mounted prop shall be positioned in such a way that it can be easily slid down.

Note: In order to check the appropriate support, the support of props mounted in the excavation shall be tested at regular intervals.

5.2 Supporting the Roof

The prop works with the roof to maintain constant working support as shown by the graph of operational characteristics in *Figure 3*.

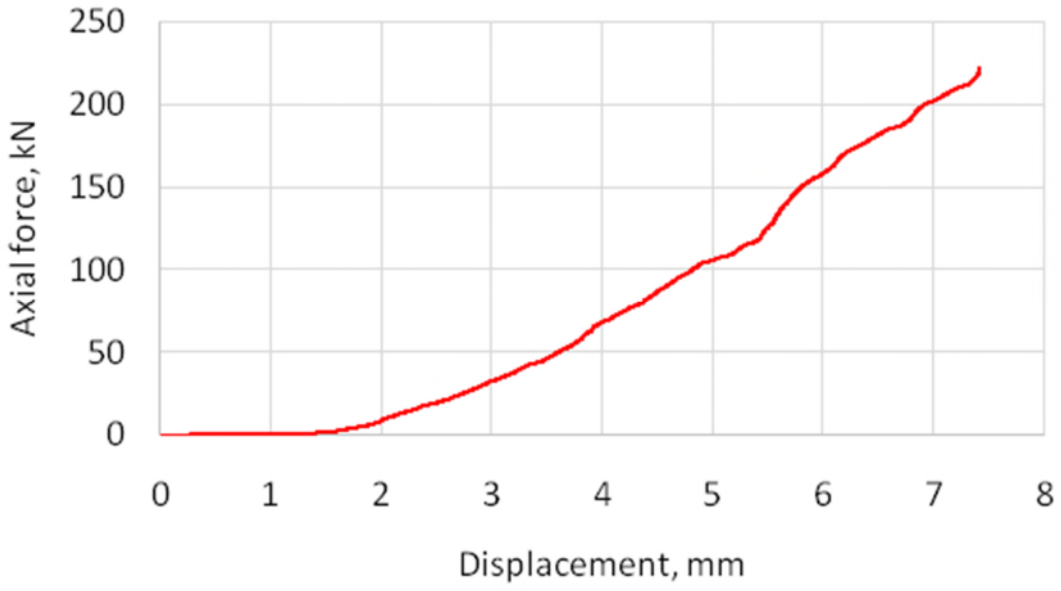

Figure 3 – Operational Characteristics of the Prop

5.3 Dismantling

1. Reduce the load-bearing capacity of the prop with a trapezoidal thread and a nut to adjust the position of the steel crown head.
2. Remove the bolt after removing the cotter pin.

Note: The prop during sliding-down must be properly secured against falling over in the direction of the person carrying out the procedure. The knockout of the steel bolt may cause the upper prop to slide suddenly towards the bottom of the excavation.

6 Symptoms of Operational Deficiencies

6.1 Low Load-bearing Capacity

This may be caused by damage to the composite material of the inner tube, poor preparation of the substrate (floor base) under the foot of the prop, or no adjustment of the crown head extension with the nut and trapezoidal thread.

6.2 Buckling of Inner Tube

This may be caused by high pressure, or exceeding the permissible constant working support of the prop.

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7 Maintenance

The supervisory staff of the mining facility who are familiar with the construction, operating principle, and technical requirements, are obliged to inspect the props in operation on an ongoing basis, removing any damaged props from service. The props shall be subjected to a technical inspection during the period of transporting them from a selected location to a new one.

The following range of repairs are allowed to be performed in workshops in mining facilities:

- replacement of inner tube, brackets, and steel crown heads obtained directly from the manufacturer,
- replacement of the crown head, nut, and steel bolts in the inner tube holes.

Note: All other repairs should be done only by the manufacturer of the props.

It is forbidden to make any repairs to the inner and outer tube, and if the mining company has its own numbering system it is forbidden to hardface the surface of the composite props.

After repairs and maintenance, the props shall be subjected to load-bearing tests.

A prop is considered to be in good condition if it has a positive test result and a working resistance of 200kN ± 2%. Props that do not meet the support requirements shall be scrapped.

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8 Period of Use

The service life of the props depends on geological and mining conditions, in particular the pressure of the rock mass, the frequency of development, the pressure exerted on the prop structure.

The approval of the props for further use is determined by the positive results obtained during periodic inspection and strength (load-bearing) tests.

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9 Hazard Identification

9.1 Introduction

The prop described in this document was constructed in compliance with the current regulations in order to guarantee safety during handling and operation. It is not possible, however, to predict all possible special cases and emergencies that may occur during the use of the props. Some hazards cannot be prevented by any design solution. Following the general guidelines and principles provided in this document in such cases will prevent accidents and hazards.

All persons performing any work related to the props should be familiar with the contents of this Operation and Maintenance Manual. Any work related to the casing shall be preceded by consultation with the appropriate supervisor in order to obtain detailed instructions regarding such work.

The use of the prop that is not included in its scope of application can lead to severe or fatal accidents.

Safe handling requires special training, knowledge, and experience. The prop may only be operated by authorized persons with appropriate qualifications. Improper or careless handling can lead to serious or fatal accidents involving the operator or other persons.

Any changes to the structure made by the user, which have not been approved by the manufacturer, the use of self-manufactured or not meeting the technical conditions of the manufacturer of spare parts may result in danger, loss of warranty and certification, and approval.

During normal operation, it shall be remembered that operators of the props are responsible for damage and accidents caused by their improper conduct as a result of failure to follow the working principles set out in the instructions and training courses for the props.

Failure to comply with the work procedures and instructions of supervisors may lead to an accident or damage to the prop components.

9.2 Hazard During Mounting, Operation and Dismantling of the Prop

In order to avoid accidents and damage to the prop, it is necessary to remember the following points:

- Use appropriate and efficient tools.
- After positioning the props, they shall be immediately expanded and the steel bolt must be inserted and properly secured with the cotter pin.
- A steel bolt of the inner tube that has been incorrectly inserted and secured against slipping out can cause the prop to slide down.
- Do not stay under the roof supported by a prop with a steel bolt not inserted in the inner tube of the prop.
- During mounting, the prop shall be positioned in such a way that it can be conveniently and safely dismantled.
- Do not stay in areas that are not protected against the fall of roof rocks.
- Do not stay under the developed canopies during sliding-down of the props.

All work related to the construction, dismantling, transport, and transfer of props should be carried out by persons trained in the safe execution of these works. This work must be carried out in compliance with the Technical Design and the manuals approved by the Mine Management.

10 Handling and Eligibility for Repairs

10.1 Technical Review

A technical review is to determine whether the prop is suitable for further operation. A technical review indicates whether the prop is suitable for further use, technical testing, or scrapping.

The persons carrying out the technical assessment shall:

- have a good knowledge of the construction and operation of the prop,
- be familiar with the principles of cooperation between the prop and the canopies,
- hold the documentation of basic components or repair documentation of the prop.

A technical review consists in a visual assessment without dismantling the prop in relation to the technical requirements.

10.2 Technical Tests

Technical tests are aimed to determine whether the components of the prop are suitable for repair within the specified technical requirements.

Technical tests indicate whether the components of the prop are suitable for repair or scrapping. The following components of the prop are subject to technical tests:

- inner tube with the head,
- outer tube.

The components to be evaluated shall be thoroughly cleaned, especially the lock connecting the upper prop to the lower prop.

The verification of technical requirements shall be carried out on a prepared prop adjusted to take the required measurements and check the condition of individual components and parts.

10.3 Technical Requirements

Assessment of the degree of wear of the prop or its components shall be carried out as part of the technical inspection and testing, which shall consist of external visual inspection and measurement of the specified values:

10.3.1 Inner Tube with the Head

- Allowable bend of the inner tube from a straight line up to 10mm along its entire length. The inner tube with bends greater than permitted values shall be repaired or scrapped.
- Up to 2mm dents are allowed on the outer surface of the pipe of the inner tube. The inner tube with dents greater than permitted values shall be repaired or scrapped.
- Cracked joint between the crown head.
- Deformations and fractures of the heads allowing the canopies to fall out.

- Corrosion defects of no more than 10%. Given the nature of the work of the external surface of the inner tube, the surface defects are no more than 10%.
- Corrosion defects of welds no more than 10% below the work tolerance.
- Condition of the external surface coating of the prop.
- Damage or wear of fasteners.

10.3.2 Outer Tube with a Lock

- Allowable bend of the outer tube from a straight line up to 10mm along its entire length. The outer tube with bends greater than permitted shall be scrapped.
- Up to 3 mm dents and ovalisation of the outer tube are permissible. Props with any dents or ovalisations that exceed the permitted levels shall be repaired or scrapped.
- Cracked joints between the footplate and the ring.
- Damaged foot plate.
- Lock (steel bolt in holes of the inner tube) – it should be assumed that damage to the lock forces the complete replacement of the lock.
- Missing or damaged bolts must be replaced with new ones,
- Corrosion defects of no more than 10%.
- Corrosion defects of welds no more than 10% below the work tolerance.

11 Parts Catalogue

11.1 Composite Material Prop

The prop with a crown head welded to a trapezoidal screw, length of the prop H=840mm– 1.370mm.

Item	Name	pcs	Weight [kg]	Material
1	Crown head	1	2.5	C4/S235JR
2	TR40 L150 Trapezoidal thread	1	1.46	C45
3	Nut	1	1.4	C15
4	Top ring Ø 103	1	0.78	S235JR
5	Composite pipe Ø 100	1	4.4	Glass/polyester composite
6	Flat bar	2	1.87	S235JR
7	Bolt	1	0.75	40HM
8	Ring Ø 136	1	1.25	40HM
9	Composite pipe Ø 130	1	3.76	Glass/polyester composite
10	Bottom ring Ø 103	1	0.72	S235JR
11	Foot	1	2.28	S235JR
12	Bolt handle	1	0.04	S235JR
13	DIN 11021 type E cotter pin of the bolt	1	0.03	S235JR
14	ISO 4028 M8x20 hexagon socket head screw with a cylindrical pin	1	0.001	45H

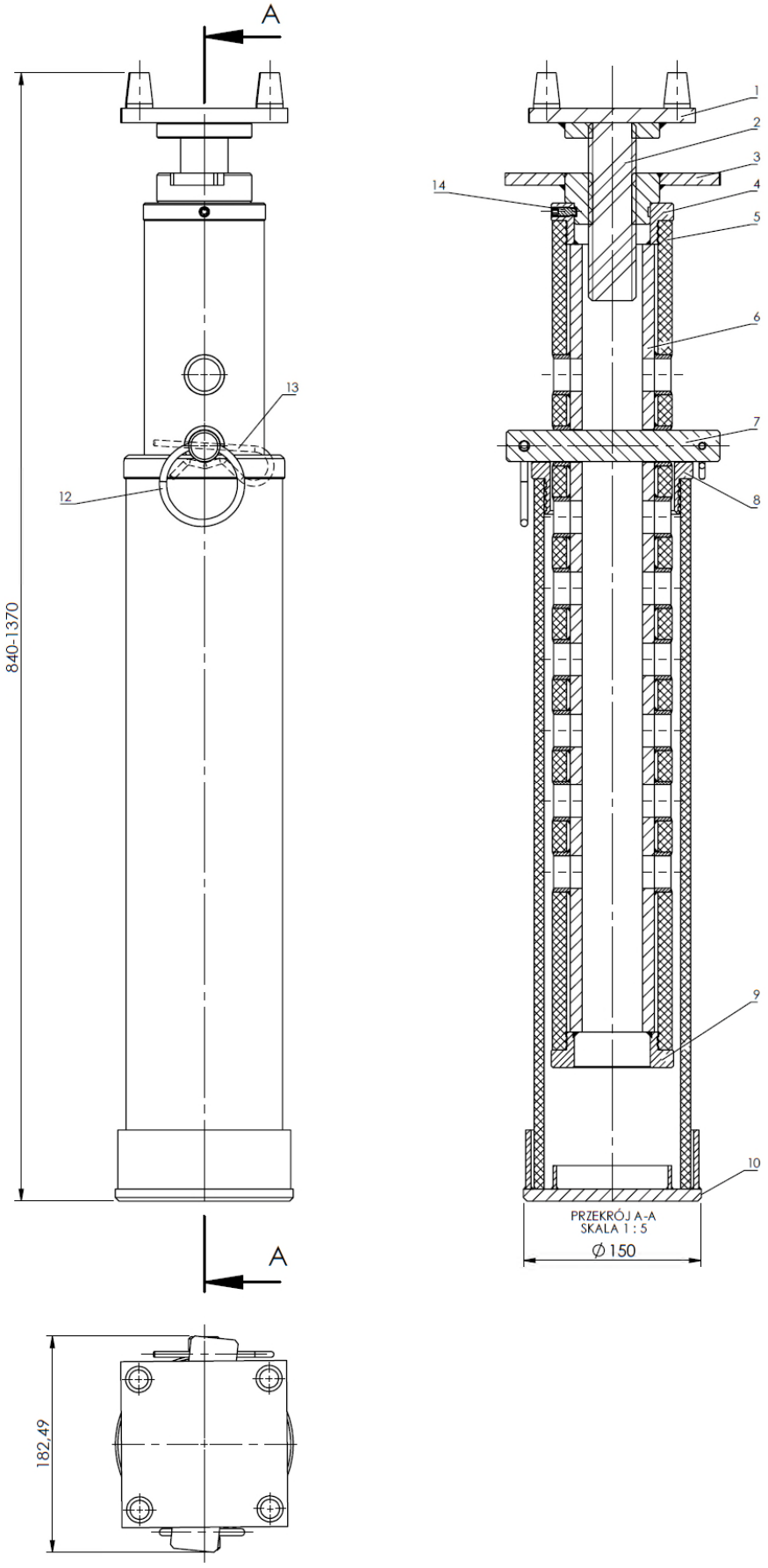

Figure 4 – Composite Material Prop Parts

11.2 Parts Approved for Repairs in a Mining Facility Workshop)

Item on the figure	pcs	Subassembly or part name	Weight [kg]
1	1	Crown head	2.5
7	1	Bolt	0.75
3	1	Nut	1.4

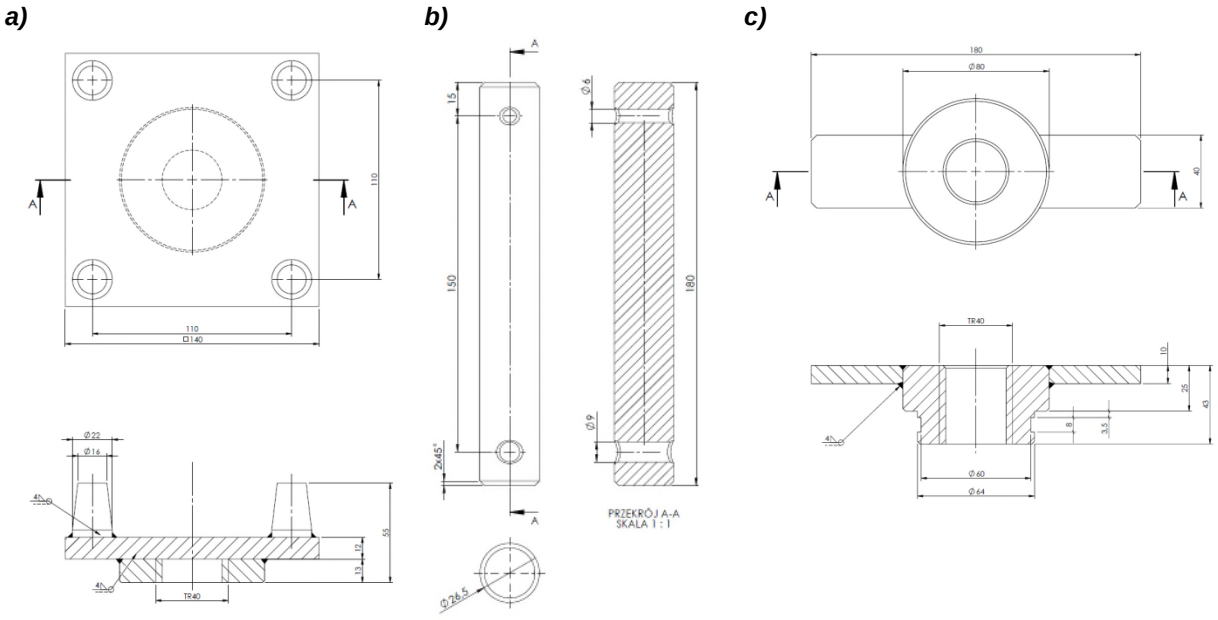

Figure 5 –Spare Parts Approved for Repairs in Workshops of Mining Facilities a – crown head, b – steel bolt, c – nut

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12 Further Information

Further information about the composite prop is available from the Central Mining Institute (GIG), plac Gwarków 1, 40-166 Katowice, Poland, https://www.gig.eu.

Please contact: WojciechMasnywmasny@gig.eu or Aleksander Wrana awrana@gig.eu