MEG4 COMPLIANCE
CUSTOMER INFORMATION

AUGUST 2024

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INTRODUCTION

The regulatory environment for the oil and gas industry is rapidly evolving, with a significant emphasis being placed on product performance validation and certification that will promote equipment compatibility and improved safe usage of vessel mooring lines. With the release of the MEG4 by OCIMF, vessel operators must look to their mooring equipment suppliers to provide products that have undergone performance indicator testing. This info packet provides detail related to Samson's approach to certification and interpretation of performance indicator values.

MEG4 PROCUREMENT FRAMEWORK

The guidance in MEG4 is the result of an extended cross-industry working group that reviewed current technology and best practices as well as the findings from the MAIB report summarizing findings of the investigation into the parted mooring line on the LNG carrier Zarga. The *Zarga* incident highlighted the need across the industry for improved guidance on selecting mooring lines that are appropriate for the intended service; this meant reviewing performance considerations beyond just the minimum breaking strength of the line as well as clarifying the relationship of ratings and strengths for all of the mooring system components. This resulted in a framework which introduces more robust performance testing to be performed by the manufacturer, reported via standardized certificates and endorsed by a third-party validation process to help improve product comparisons and selection for users.

CERTIFICATES

As part of alignment with MEG4, Samson followed a base design review process with a 3rd party inspector (ABS – American Bureau of Shipping) to verify that products are described in accordance with the new guidelines. Included in the review was examination of Samson's manufacturing process and the product's performance indicators (detailed within section B8.1 in MEG4 Appendix B).

BASE DESIGN CERTIFICATES

During the base design review process for each product, Samson provided product design documentation and a compilation of test results to the 3rd party inspector for review and approval. Samson also developed a base design Inspection Test Plan (ITP) specific to each product, that identifies all significant manufacturing and testing steps with Hold, Witness, and Monitor (H/W/M) points for both the manufacturer's own quality assurance staff and the independent inspector. This review by the inspector is performed every 5 years and is documented with an endorsed (or stamped) base design certificate (per product family).

SAMSON BASE DESIGN CERTIFIED PRODUCTS	
MAINLINES	**TAILS**
AmSteel®-X	RP-12 Nylon™
EverSteel™-X	HTP-12™
Turbo-RC™	MP-1™
AmSteel®-Blue	NyloMoor™-8
SureSteel™	
Ultra Blue-8™	
SureShield-EPX™	
AmSteel®-Eco	

The new certificate format includes a listing of performance indicators which apply to the specified size range. The corresponding testing scope to identify these indicators ensures that the critical properties laid out in MEG4 have been validated within the relevant scale as certified. The certificates also list expiration date, manufacturer information, and base design testing information, with the corresponding third party stamp of certification, as laid out in MEG4 Appendices. Test method details associated with the evaluated performance indicators are included in the third party Product Design Assessment (PDA) provided by ABS for each of Samson's certified products. These certificates are available on the ABS Eagle website (www.eagle.org) and an example PDA for *AmSteel-X* is included in Appendix 4.

Not all of Samson products used in Mooring will have endorsed base design certificates. Nevertheless, an unendorsed product may still be provided and used for mooring. Documentation specifics for these products will vary depending on the relevant experience and testing which has been performed. While performance indicator data listed in MEG4 may not be available for these unendorsed product requests, the available information can be provided in a compatible certificate format to clearly indicate the critical specifications identified during product selection and comparison.

PRODUCT-SUPPLY CERTIFICATES

With every order, **a product-supply certificate** is to be provided by the manufacturer. This certificate includes product descriptions, detailed product specifications, performance indicators, order details, and assembly descriptions. These certificates do not require 3rd party endorsement as the product family is already endorsed via the base design certificate. Examples of both Samson certificate types are provided in Appendix 2 and Appendix 3.

PROJECT-SPECIFIC DOCUMENTATION

In some instances (primarily for project-specific supplies), a project supply ITP may be requested by the vessel owner or operator. This plan may hold additional steps to describe the quality assurance measures, records, and checks specific to that project manufacture. Where the involvement of an independent inspector for project supplies is required, the end user / purchaser must specify this test witnessing requirement as part of the procurement process.

Other documents that might be required for project-specific supplies such as operation, line maintenance, testing and inspection procedures, quality manual, and discard criteria are provided in the Samson Mooring Manual or available upon request.

PERFORMANCE INDICATORS

To improve the consistency of comparing product performance and decrease the chances of products being selected that are not well suited for mooring operations, MEG4 introduces a range of performance metrics that allow users to understand performance beyond break strength. The standardization of how these tests are conducted, and results reported, should improve operators' understanding of key parameters. Additional information can be found at *www.ocimf.org.*

MEG4 Section 5 and Appendix B outline a series of "performance indicators" that are intended to help users understand product performance characteristics beyond the tensile strength. These include fatigue/endurance properties, impacts of bending on rope strength, linear density, axial compression resistance and the impacts of temperature on yarn strength.

PERFORMANCE INDICATOR	SAMSON MAINLINES	SAMSON TAILS
Nominal Diameter	**24 – 60 mm**	**40 – 110 mm**
WHAT IT MEANS TO YOU *Nominal dimension related to the diameter of the circular cross section of the rope and used for reference purposes.*		
Line Design Break Force (LDBF) / Tail Design Break Force (TDBF)	**39 – 250 mt**	**46 – 194 mt**
WHAT IT MEANS TO YOU *The tensile force rating that can be sustained by a product sample without rupture when tested with terminations and in laboratory conditions. A greater LDBF / TDBF for a given diameter or LLD does not necessarily indicate a superior product. The force at which a line breaks in service may be lower than the LDBF / TDBF, due to the influence of geometry (D/d), temperature, loading rates and amplitudes, and line wear over time.*		
Line Linear Density (LLD)	**0.320 – 1.99 kg/m**	**1.38 – 6.46 kg/m**
WHAT IT MEANS TO YOU *The linear mass of the entire line structure (LLD) including any coatings measured at reference tension. A higher LD value results in reduced material stress for a fixed design break force.*		
Load Bearing Linear Density (LBLD)	**0.242 – 1.99 kg/m**	**1.38 – 6.46 kg/m**
WHAT IT MEANS TO YOU *The linear mass of the load bearing structure of the line (LBLD) including any coatings measured at reference tension. A higher LBLD value results in reduced material stress for a fixed design break force. For jacketed lines, the LLD is greater than the LBLD as it includes material mass of jackets which is non-load bearing.*		
Line Tenacity	**126 – 164 mt/kg/m**	**26.3 – 33.4 mt/kg/m**
WHAT IT MEANS TO YOU *Line Tenacity represents material stress at the LDBF / TDBF. For a given line size and material type, a line of lower Line Tenacity offers increased resistance to the majority of fatigue and wear modes. Line Tenacity of different material types should not be compared.*		
Average Immediate Strain @ 10%	**0.10 – 0.38 mm/mm**	**0.38 – 2.2 mm/mm**
Average Immediate Strain @ 50%	**0.6 – 1.4 mm/mm**	**2.1 – 5.7 mm/mm**
WHAT IT MEANS TO YOU *The percentage elongation of the mooring line when exposed to a stated percentage of LDBF / TDBF. Elongation is affected by material content, material type, and line structure. The elongation of the mooring line with act in combination with the elongation of the mooring tail to control peak and mean tensions in the mooring system. Users should ensure that the elongation of the mooring line matches the elongation properties used in any mooring analysis*		

PERFORMANCE INDICATOR	SAMSON MAINLINES	SAMSON TAILS
Average Angled Break Force D/d 5	**190 – 212 % of Average NSBF**	**N/A**
Average Angled Break Force D/d 10	**194 – 233 % of Average NSBF**	**N/A**
WHAT IT MEANS TO YOU *Angled Break Force indicates the instantaneous loss of break force caused by a line passing 180° around mooring hardware of the stated D/d ratios. The effect on line life of lines passing over mooring equipment is not assessed by Angled Break Force.*		
Average Angled Endurance D/d 5	**85 – 111 % of Average NSBF**	**N/A**
Average Angled Endurance D/d 10	**100 – 116 % of Average NSBF**	**N/A**
WHAT IT MEANS TO YOU *Angled Endurance indicates the reduction in the New Straight Break Force of a line after 17,000 tension cycles to the line WLL for a section of line passing 180° around equipment of the stated D/d ratios. Angled Endurance resistance is influenced by line design, material choice, coating choice, average load, load range, load rate, ambient temperature, past exposure to both Tension-Tension and Angled Endurance degradation modes and ship geometry.*		
Axial Compression Resistance	**89 – 117 % of Average NSBF**	**N/A**
WHAT IT MEANS TO YOU *Axial Compression Resistance represents the ability of the line to withstand compressive forces generated by low mean load cyclic loading. Jacketed lines are at higher risk from the effects of this load response, due to the restrictive nature of the jacket and the difficulty of in service inspections. Users of jacketed lines should verify the long-term influence of compression fatigue through staged retirement and inspection and testing of retired lines.*		
Material Breaking Force @ -20°C	**111 % of 20°C BF**	**N/A**
Material Breaking Force @ 80°C	**78 % of 20°C BF**	**N/A**
WHAT IT MEANS TO YOU *This performance indicator provides the ratio of material break force at ambient conditions (20°C) to material break force at varied temperature. Both a line's instantaneous and long-term performance may be affected by extreme temperatures and the line temperature may be higher or lower than ambient temperature due to cooling, heat transfer, and heat generation while working.*		
Sheltered Stiffness (Ksh)	**N/A**	**5 – 15 x TDBF**
Exposed Stiffness (Kex)	**N/A**	**14 – 39 x TDBF**
WHAT IT MEANS TO YOU *Ksh and Kex indicate the effective stiffness of a tail in motion driven environments. The stated values correspond to the tested mean loads and load ranges only. The effective stiffness of a tail is influenced by mean load, load range, and load rate as well as tail length, construction, and fabrication. Grommet tails have two times the stiffness of a single leg tail of the same diameter. The effect of reduced stiffness is to decrease peak loads induced by motion driven environments. However, reduced stiffness may also cause greater ship offsets for force based environmental loads (e.g. wind/ current loads). It is recommended that values of tail stiffness are used in mooring analysis which correspond with known environmental conditions. Both Ksh, Kex, and immediate strain values should be closely matched when tails are replaced*		
Tension-Tension Endurance @ 20%	**N/A**	**110,000 –1.7 trillion cycles**
Tension-Tension Endurance @ 50%	**N/A**	**1,400 – 44 million cycles**
WHAT IT MEANS TO YOU *The number of cycles that would cause a tail to fail when cycled continuously between reference tension and the stated loads, as a percentage of TDBF, in new eye and eye configuration when tested in laboratory conditions. A higher cycle to failure value indicates a higher resistance to Tension-Tension fatigue. The cycles to failure values should be used for comparison and selection purposes. Laboratory tests do not fully reflect the compound nature of Tension-Tension fatigue, or the risks to reliability posed by other hazards, such as mechanical damage.*		

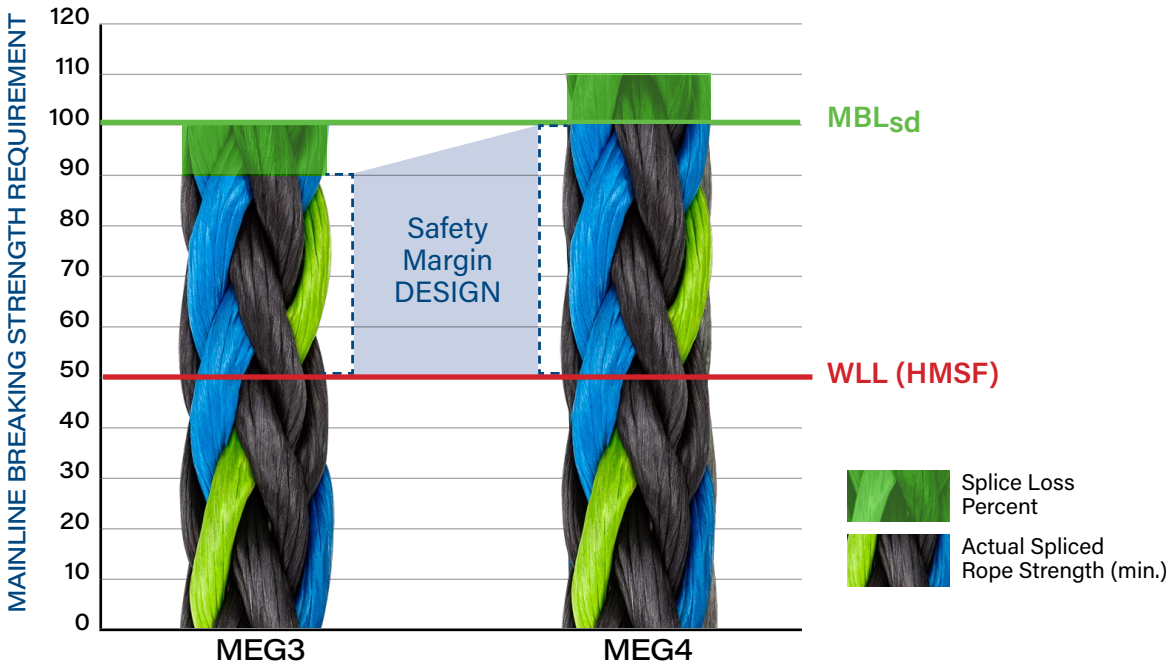
LINE DESIGN BREAK FORCE / TAIL DESIGN BREAK FORCE (LDBF/TDBF)

LDBF is the minimum force that a new, dry, spliced mooring line will break at when tested according to MEG4 Appendix B: Guidelines for the purchasing and testing of mooring lines and tails. This is for all mooring line and tail materials except those manufactured from nylon which is tested wet and spliced. This value is declared by the manufacturer on each line's mooring line certificate (see MEG4 Appendix B) and is stated on a manufacturer's line data sheet. As outlined in MEG4 Appendix B, when selecting lines, the LDBF of a line shall be 100–105% of the ship design MBL. Mooring tails are specified with TDBF and should be purchased with a value 125–130% of the ship design MBL.

MINIMUM BREAKING STRENGTHS: MEG3/MEG4 DIFFERENCES

> MEG3 did not prescribe a test method or robust definition of product "Minimum breaking strengths". As a result, manufacturers typically specified rope strengths based on their own internal spec-setting methodology. MEG3 references ISO 2307, however previous versions of the ISO 2307 test method allow for tested ropes to break up to 10% below the stated value and be considered to have met the minimum strength (by assuming the rope's splice accounted for a universal 10% loss of strength).

> Samson has always derived mooring line (and tail) breaking strengths based on spliced rope break tests. However, some customers preferred to purchase lines based on our ISO 2307 specifications. This was in alignment with MEG3 criteria, however, may result in the LDBF specification for existing ropes being up to ~10% below the ideal MEG4 recommendation.



LDBF, as defined in MEG4, will result in a slightly higher actual safety margin (compared to ropes specified based on the ISO 2307 standard) by assuring that strength specifications account for splice losses.

> **WET vs DRY (stiffness, strength)** Some synthetic materials (most popularly Nylon) experience a material strength loss when wet and is significant enough to be accounted for in the design of a mooring system. As this is most typically found in the case of mooring tails, the certain tests outlined in MEG4 Appendix B require certain tests to be conducted with soaked samples. In general, a ten to fifteen percent strength loss may be experienced by nylon ropes. The design break force for nylons should include the strength reduction due to wet conditions.

FREQUENTLY ASKED QUESTIONS

Do I need a break test and third-party witnessing every time I purchase a rope?

No. The intention behind the base design review process and 3rd party endorsement is to reduce the necessity of having single break testing requirements at time of order. Use of consistent test methods and defined statistical evaluation approaches outlined in MEG4 aims to ensure rope suppliers provide consistent specifications to make any additional testing requests at time of procurement unnecessarily redundant.

How do I prepare for a MEG4 SIRE inspection?

A vessel can prepare for a MEG4 SIRE inspection through development of a robust Mooring System Management Plan (MSMP), documented adherence to the vessel or fleet specific Line Management Plan (LMP), and procurement of lines that follow the specification process lined out in MEG4 guidance. Review of Chapter 9 of the OCIMF Vessel Inspection Questionnaire (VIQ), latest edition available at *www.ocimf.org,* should be performed during development of a vessel MSMP and LMP.

How do we adapt LDBF for existing ships (pre-MEG4)?

Ships built to MEG4 will already have a ship design MBL to satisfy OCIMF Standard Environmental Criteria restraint requirements and each mooring line will have a LDBF. Mooring fittings and mooring winch brake rendering values are based on the ship design MBL.

Ships built prior to MEG4 should still follow the same guidance of setting their mooring winch brake rendering values based on the "line MBL" which, should be assumed to be synonymous with the ship design MBL, which is termed "Design Rope" MBL (See Figure 7,3 in MEG3).

How do I use the performance indicators?

The MEG4 performance indicators should be used during the procurement cycle to help purchasers and operators make more accurate comparison of rope products (mainlines and tails). These indicators can play slightly different roles depending on the scenario – four specific scenarios are outlined in Figure 5.7 of MEG4. The different indicators describe specific performance properties of the mainline/tail so that selection can take into account characteristics that are important to the rope's intended application. These should all be documented on the product family's base design certificate and replicated where relevant on the product supply certificates.

What if my LDBF is lower than my hardware ratings?

If the vessel was designed based on MEG3 guidelines (or prior), operators should document whether the intended LDBF is below/above MBL_{sd} as an exception in their MSMP/LMP and define a timeline in that plan to transition to larger / smaller LDBF ropes as appropriate. As referenced in the book's introduction (Page V), this transition should be based on a comprehensive assessment and past performance data can and should be used to justify existing ropes on board the vessel and determine appropriate plans for changing over to new sizes or products. For more information, refer to the MEG4 Introduction Page V.

Do I need MEG4 certificates for secondary lines?

MEG4 does not explicitly mandate certification for secondary lines however as mentioned, if secondary lines are in use that have not been fully tested and endorsed, Samson may be able to provide MEG4 certificates upon request. Contact your Samson rep.

Why have the linear density values changed?

In general, linear density measurements are taken by loading a sample length of rope to a "reference" tension level (based on nominal rope diameter), adding two marks that are distanced at a specified length, cutting the rope at those marks, and then weighing the cut sample. Using these length and weight measurements, linear density can be calculated for that rope product and size.

An additional length measurement can be taken prior to weighing the cut sample. Synthetic ropes tend to shorten when relaxed and thus a "relaxed" length measurement can be taken. Samson has traditionally used this relaxed length measurement in linear density calculations. In MEG4, this property is dictated to base the calculation off the tensioned length measurement. To conform to the industry movement for standardization of performance indicators, customers may notice a slight reduction of the linear densities per rope diameter on Samson products.

When we are changing part of mooring system, (e.g. mooring tails) what reference values should be taken as reference to calculate 125–130%

The governing value to compare any line or hardware specifications to is the vessel specific MBL_{sd}. In the case of mooring tails for example, the specification for TDBF of tails utilized should fall within the corresponding range of 125–130% of the vessel MBL_{sd}.

How are other operators responding to terminal and SIRE queries, if vessel goes ahead with MEG3 recommendation for mooring system?

For existing ships that have designed their systems and operations based on MEG3 guidelines, any deviations from guidance provided in MEG4 should:

a) be documented in a vessel MSMP that is available on the ship throughout its life

b) identify a timeline and measures needed to follow the recommendations of MEG4

c) detail interim measures taken to address the recommendations of MEG4, with reasons given for why the changes have not been implemented yet

GLOSSARY

OCIMF The Oil Companies International Marine Forum (OCIMF) *is an association of 100+ oil companies worldwide that have an interest in the safe and responsible shipment of oil products. Their practices aim to provide recommendations and minimum requirements to ship & terminal designers, ship operators, and mooring equipment manufacturers, hence their direct participation in establishing the new guidelines.*

MEG4 The Mooring Equipment Guidelines *is an industry publication issued by OCIMF for the safe mooring of tankers and gas carriers at terminals. Now on its fourth revision, this book provides further guidance on the safe mooring design for ships and terminals. The updates represent the most significant changes undergone for all considerations related to mooring lines: design, selection, maintenance, and retirement. All guidance on test regimes, documentation templates, and responsibilities can be found in this publication.*

IACS The International Association of Classification Societies (IACS) *is a not-for-profit membership organization that establish or survey technical standards and requirements that address maritime safety and environmental protection. More than 90% of the world's cargo carrying tonnage is covered by the classification design, construction, and through-life compliance rules and standards set by the twelve members of IACS. Their role as it relates to MEG4 is to act as independent inspectors assuring that the design, testing, specification and supply mooring line and tail products are derived and provided by the manufacturer in accordance with the guidance in Appendix B of MEG4.*

Independent Inspector *An individual experienced with mooring line inspection and testing, meeting the qualification given in MEG4 Appendix B, independent of the manufacturer, and contracted by the line manufacturer to observe, inspect and certify the manufacturing and testing of lines made for either prototype or project purposes. The independent inspection agency is normally a member of the International Association of Classification Societies (IACS) and the independent inspector is the representative of the independent inspection agency.*

Ship Design MBL (MBL_{sd}) *The minimum breaking load of new, dry mooring lines The minimum breaking load of new, dry mooring lines for which a ship's mooring system is designed, to meet OCIMF standard environmental criteria restraint requirements. The ship design MBL is the core parameter against which all the other components of a ship's mooring system are sized and designed with defined tolerances.*

Line Design Break Force (LDBF) *The minimum force that a new, dry, spliced mooring line will break at when tested according to MEG4 Appendix B.*

Tail Design Break Force (TDBF) *The minimum force that a new, wet, spliced mooring tail will break at when tested according to MEG4 Appendix B.*

New Straight Break Force (NSBF) *The maximum force sustained by a line or tail in a specific test conducted under the conditions described in this publication.*

Working Load Limit (WLL) *The maximum load that a mooring line should be subjected to in operational service, calculated from the standard environmental criteria. The WLL is expressed as a percentage of ship design MBL and should be used as a limiting value in both ship design and operational mooring analyses.*

Line Management Plan (LMP) *Contains the ship operator's requirements for the management of mooring line maintenance, inspection, and retirement during the operational phase of the mooring line lifecycle.*

Mooring System Management Plan (MSMP) *A framework developed by OCIMF to help ship owners and operators keep consistent information about a ship's mooring equipment.*

Size Range *The range of products, organized by nominal diameter, that performance indicators have been evaluated for during 3rd party evaluation.*

APPENDIX 1

SAMPLE INSPECTION & TEST PLAN

Base Design Inspection & Test Plan	
Revision date	2-Jul-18
Type Approval Authority	ABS
Requirements	See table below
Project & Product	Type approval of 1"– 2" diameter AmSteel-Blue synthetic rope

Location	Item	Category	Action	Responsibility	Control Document	
Samson	1	Raw material validation	HMPE fiber	Quality	Samson QWI-08	
Ferndale, WA, USA	2		Coating	Quality	Samson QWI-08	
Lafayette, WA, USA	3		Pigment	Quality	Samson QWI-08	
	4	Rope manufacturing	First Twist	Mfg	Quality section of SOP 30.1.070	
	5			Mfg		
	6		Second Twist	Mfg	Quality section of SOP 30.1.059	
	7			Mfg		
	8		Braid	Mfg	Quality section of SOP 30.1.010	
	9			Mfg		
	10	Coating	Coating Preparation	Mfg	CMIS	
	11		Coating	Mfg	Quality Section of SOP 30.1.004	
	12			Mfg		
	13		Dry	Mfg		
	14	Fabrication	Fabricate Thimble	Mfg	Quality Appendix	
	15			Mfg	Splicing book	
	16	Lab Testing	Break Strength Test	Quality	ISO 2307	
	17	Documentation	Witness Test	Quality	Per 3rd Party Surveyor	

		VERIFYING	OBSERVED	SURVEILLANCE*	
	Acceptance criteria	Documents	Value	Internal QA	3rd Party
	Manufacturer specs	Manufacturer data	See XMR chart	R	R
	Manufacturer specs	Manufacturer data	See XMR chart	R	R
	Manufacturer specs	Manufacturer data	See XMR chart	R	R
	# of fiber ends	CPS Sheet		--	W
	Turns per foot	CPS Sheet		--	W
	# of 1st twist ends	CPS Sheet		--	W
	Turns per foot	CPS Sheet		--	W
	Strand count	CPS Sheet		--	W
	Lay length	CPS Sheet		--	W
	Mixing ratios	Manufacturing records		--	W
	Ropecon/Ropeprod	Manufacturing records		--	W
	Ropecon/Ropeprod	Manufacturing records		--	W
	% Moisture Content	None		--	W
	Sling length	Fabrication records		--	W
	Eye geometry	Fabrication records		--	W
	Minimum Break Strength	Per 3rd Party Surveyor	See XMR chart	--	W
	Per Samson specs	Per 3rd Party Surveyor	See XMR chart	--	R

** H=Hold, W=Witness, M=Monitor, R=Review*

SAMPLE SAMSON PRODUCT CERTIFICATE

THE STRONGEST NAME IN ROPE
2090 Thornton Street, Ferndale, WA 98248 USA

Certificate of Compliance

It is hereby certified that the products described herein have been produced in accordance with the design, performance and quality standards stated in our Quality Assurance Manual and as cited in the Catalog. In addition, it is certified that the product has been inspected and found to conform to all requirement of the customer's order or to our documentation cited herein.

Demonstrates that the product has been manufactured, tested, and documented following the guidelines in appendix B of the Mooring Equipment Guidelines, Fourth Edition. Certification does not indicate approval or certification by OCIMF.

Line Supply Information

Ship Design MBL:	154 mT	**Fiber Types(s):**	HMPE
Diameter:	48 mm	**Fiber Grades(s):**	Dyneema SK78
Length:	275 m	**Construction:**	12-Strand
Product Code:	87212880902601	**Jacketed:**	No
Product Name:	AMSTEEL®-BLUE	**Rotating:**	No
Splice Type:	12-Strand Class II		

Performance Indicators

Line Design Break Force (LDBF):	156 mT
Line Linear Density (LLD):	1.29 kg/100m
Load Bearing Linear Density (LBLD):	1,29 kg/100m
Line Tenacity (LT):	120.9 mT/kg/m
Axial Compression Resistance*:	95 %

	D/d Ratio: 5	**D/d Ratio: 10**
Angled Break Force*:	95 %	100 %
Angled Endurance*:	85 %	90 %

Break Force at Specified Temperature (% BF at 20°C)**:**	**-20°C**	**0°C**	**20°C**	**40°C**	**60°C**	**80°C**
	111 %	109 %	100 %	92 %	84 %	78 %

	% LDBF: 10	**% LDBF: 20**	**% LDBF: 30**	**% LDBF: 40**	**% LDBF: 50**
Average Immediate Strain*:	0.5	0.7	1.0	1.2	1.3

* Performance indicators are tested on 24 mm diameter mooring line
** Temperature indicator performed at yarn level

Assembly Description: 48MM X 275 METERS (903 FEET) OVERALL LENGTH DIRECT BURY SPLICED WITH 2.5 METER CORGARD COVERED EYE EACH END AND 1 PIECE OF 10 FT DC MOOR-GARD ON BODY.

Sales Order:	D60845	**Customer Name:**	SAMSON CUSTOMER
Certificate Number:	10151-7-1	**Customer Address:**	2090 THORTON ST
Date Is sued:	November 26, 2018		FERNDALE, WA 98248
			US

If requested, relevant design certificates and additional test reports are attached with this certificate. All procedures for operation, line maintenance, testing, inspection, and discard criteria will be provided upon request. Please contact Samson if more information is needed.

MEG4 Line Metric | V. 2. 1

SAMPLE SAMSON BASE DESIGN CERTIFICATE

samson
THE STRONGEST NAME IN ROPE
2090 Thornton Street, Ferndale, WA 98248 USA

REVIEWED
Details of this review are as indicated in the ABS letter
ABS

Base Design Certificate

It is hereby certified that the products described herein have been produced in accordance with the design, performance, and quality standards stated in our Quality Assurance Manual and as cited in the Catalog. In addition, it is certified that the product has been inspected and found to conform to all requirements of the customer's order or to our documentation cited herein.

Demonstrates that the product has been manufactured, tested, and documented following the guidelines in appendix B of the Mooring Equipment Guidelines, Fourth Edition. Certification does not indicate approval or certification by OCIMF.

Line Supply Information

Issue Date:	19 April 2024	Independent Inspection Agency:	American Bureau of Shipping
Expiry Date:	18 April 2029	Fiber Type(s):	HMPE
Line Manufacturer:	Samson Rope Technologies	Fiber Grade(s):	Dyneema SK78
Product Family Code:	872	Construction:	12-Strand
Product Name:	AmSteel®-Blue	Jacketed:	No
Design Range:	24 mm - 60 mm		
Splice Type & Design:	12-Strand Class II		

Performance Indicators

	Smallest Diameter		Largest Diameter	
Diameter:	Design: 24 mm	Measured: 26.7 mm	Design: 60 mm	Measured: 66 mm
Line Design Break Force (LDBF):	44.5 mT		240 mT	
Line Linear Density (LLD):	0.323 kg/m		2.10 kg/m	
Load Bearing Linear Density (LBLD):	0.323 kg/m		2.10 kg/m	
Line Tenacity (LT):	138 mT/kg/m		114 mT/kg/m	

Axial Compression Resistance*: 89%

	D/d Ratio: 5	D/d Ratio: 10
Angled Break Force*:	180%	191 %
Angled Endurance*:	81%	95 %

Break Force at Specified Temperature**	-20°C	0°C	20°C	40°C	60°C	80°C
(%BF at 20°C):	111 %	109 %	100 %	92 %	84 %	78 %

	%LDBF: 10	%LDBF: 20	%LDBF: 30	%LDBF: 40	%LDBF: 50
Average Immediate Strain*:	0.20	0.43	0.67	0.88	1.06

* *Performance indicators are tested on 24 mm diameter mooring line*
** *Temperature indicator performed at yarn level*

Manufacturer Information

Name of Manufacturer:	Samson Rope Technologies
Headquarter Location:	2090 Thornton St, Ferndale, WA 98248 USA
Independent Inspector:	American Bureau of Shipping

Base Design Testing Information

Name of Test Facility:	Samson Rope Technologies
Address of Test Facility:	2090 Thornton St, Ferndale, WA 98248 USA
Independent Inspector:	Brian Klages, American Bureau of Shipping
Address of Independent Inspector:	5950 6th Ave S #204, Seattle, WA 98108

SAMPLE SAMSON BASE DESIGN CERTIFICATE (continued)

samson
THE STRONGEST NAME IN ROPE

REVIEWED
Details of this review are as indicated in the ABS letter
ABS

Base Design Sample and Product Documentation Reviewed

Independent Inspector:	American Bureau of Shipping
Date of Review:	**April 2024**
Base Design Sample Manufacturing Report:	Y
Base Design Sample Manufacturing ITP:	Y
Base Design Sample Test Report:	Y
Material Test Report:	Y
Design Specification:	Y
Manufacturer's Discard & Inspection Criteria:	Y
Splicing Instructions:	Y
Jacketed Line Internal Inspection Report:	Y
Procedures for Testing & Inspection of Retired Mooring Lines:	Y

Base Documents from Other Type Approval Programmes (list):

Class Society:	American Bureau of Shipping
Certificate Number:	24-2528172-PDA
Issue Date:	19 April 2024

APPENDIX 4

SAMSON SAMPLE ABS PDA CERTIFICATE

CERTIFICATE NUMBER	24-2529172-PDA
EFFECTIVE DATE	19-Apr-2024
EXPIRY DATE	18-Apr-2029
ABS TECHNICAL OFFICE	London Engineering Department

CERTIFICATE OF

Product Design Assessment

This is to certify that a representative of this Bureau did, at the request of

SAMSON ROPE TECHNOLOGIES

located at

2090 THORNTON STREET, , FERNDALE, WA, United States, 98248

assess design plans and data for the below listed product. This assessment is a representation by the Bureau as to the degree of compliance the design exhibits with applicable sections of the Rules. This assessment does not waive unit certification or classification procedures required by ABS Rules for products to be installed in ABS classed vessels or facilities. This certificate, by itself, does not reflect that the product is Type Approved. The scope and limitations of this assessment are detailed on the pages attached to this certificate.

Product:	**Rope**
Model:	**AmSteel®-Blue**
Endorsements:	
Tier:	**3 - Type Approved, unit certification not required**

This Product Design Assessment (PDA) Certificate remains valid until 18/Apr/2029 or until the Rules and/or Standards used in the assessment are revised or until there is a design modification warranting design reassessment (whichever occurs first).

Acceptance of product is limited to the "Intended Service" details prescribed in the certificate and as per applicable Rules and Standards.

This Certificate is valid for installation of the listed product on ABS units which exist or are under contract for construction on or previous to the effective date of the ABS Rules and standards applied at the time of PDA issuance. Use of the Product for non-ABS units is subject to agreement between the manufacturer and intended client.

American Bureau Of Shipping

Roderick M.C. Yam,Engineer/Consultant

NOTE: This certificate evidences compliance with one or more of the Rules, Guides, standards or other criteria of ABS or a statutory, industrial or manufacturer's standards. It is issued solely for the use of ABS, its committees, its clients or other authorized entities. Any significant changes to the aforementioned product without approval from ABS will result in this certificate becoming null and void. This certificate is governed by ABS Rules 1-1-A3/5.9 Terms and Conditions of the Request for Product Type Approval and Agreement (2010)

Confirmation of Product Type Approval

Company Name: SAMSON ROPE TECHNOLOGIES

Address: 2090 THORNTON STREET FERNDALE WA 98248 United States

Product: Rope

Model(s): AmSteel®-Blue

Endorsements:

Certificate Type	Certificate Number	Issue Date	Expiry Date
Product Design Assessment (PDA)	24-2529172-PDA	19-APR-2024	18-APR-2029
Manufacturing Assessment (MA)	20-4483511	16-OCT-2020	15-OCT-2025
Product Quality Assurance (PQA)	NA	NA	NA

Tier
3 - Type Approved, unit certification not required

Intended Service
Marine Applications - Used primarily for Vessel Mooring Lines at the quayside. First Ashore / Emergency Tow System Primary Marine Mooring Line / Non-jacketed General Working Line / Vessel Mooring

Description
12 Strand Class II Marine High Modulus Polyethylene (HMPE) Rope

Ratings
Line Design Break Force - LDBF (ref. to OCIMF MEG4):

Smallest Diameter: 1.000" (24 mm): 98,100 lbs (44,500 kg)

Largest Diameter: 2.500" (60 mm): 529,000 lbs (240,000 kg)

Pls refer to rope designer/manufacturer for

a) complete list of technical specifications.

b) intermediate line diameters / ratings

Service Restrictions
- Unit Certification is required for this product if procured for usage on an ABS Certified/Classed facility or mooring system.

- Unit Certification shall include linear density (one per batch), and Break force tests (user specified no of tests), material tests during production (in accordance with B10 of OCIMF MEG4).

SAMSON SAMPLE ABS TYPE APPROVAL *(continued)*

Certificate Number: 24-2529172-PDA

- If the production rope is procured and ABS is not involved in the certification of the product, then it will be the responsibility of the alternative 3rd party to certify the project supply.

- Not intended for anchoring of Offshore floating structures.

- Fiber type restrictions as detailed by the manufacturer.

- Tests to be repeated every 5 yrs as per OCIMF MEG4

1) Linear density :- CI-1500A-2015 Test Methods for Fiber Rope Physical Properties, Section 9

2) Diameter:- CI-1500A-2015 Test Methods for Fiber Rope Physical Properties, Section 8

3) New straight break force :- CI-1500A-2015 Test Methods for Fiber Rope Physical Properties, Section 8

4) Immediate strain :- CI-1500A-2015 Test Methods for Fiber Rope Physical Properties, Section 11

5) Angled break force (D/d 5) MEG Appendix B (4th ed), Section B8.5.6

6) Angled break force (D/d 10) MEG Appendix B (4th ed), Section B8.5.6

7) Angled endurance (D/d 5) MEG Appendix B (4th ed), Section B8.5.7

8) Angled endurance (D/d 10) MEG Appendix B (4th ed), Section B8.5.7

9) Axial compression fatigue :- API 2SM Appendix D - Design, Manufacture, Installation, and Maintenance of Synthetic Fiber Ropes for Offshore Mooring (1st ed)

10) Material break force at specified temperature - DSM Dyneema Test Method - Tensile Properties - DTM YA001 - (Based on ISO 2062 & ASTM D885);

Comments
The Manufacturer has provided a declaration about the control of, or the lack of Asbestos in this product.

Notes, Drawings and Documentation
Drawing No. 40455069 Amsteel-Blue Physicals, 40455069 Amsteel-Blue Physicals, Revision: 0, Pages: 1

Drawing No. AMSTEEL-BLUE 872 DS, ITEM 01 Product Data Sgeets, Revision: 1, Pages: 1

Drawing No. AMSTEEL-BLUE 872 DS, ITEM 01 Product Data Sgeets, Revision: 0, Pages: 1

Drawing No. AmSteel-Blue_Immediate_Strain, AmSteel-Blue_Immediate_Strain, Revision: 0, Pages: 1

Drawing No. Amsteel-Blue 1in, Amsteel-Blue 1in, Revision: 0, Pages: 1

Drawing No. Amsteel-Blue 2-1)2in, Amsteel-Blue 2-1)2in, Revision: 0, Pages: 1

Drawing No. Amsteel-Blue Transmittal, Test, and Video - File Breakdown, Amsteel-Blue Transmittal, Test, and Video - File Breakdown, Revision: 0, Pages: 1

Drawing No. Amsteel-Blue_Angled Break_1in_S18457_PDF_10Dd, Amsteel-Blue_Angled Break_1in_S18457_PDF_10Dd, Revision: 0, Pages: 1

Drawing No. Amsteel-Blue_Angled Break_1in_S18458_PDF_10Dd, Amsteel-Blue_Angled Break_1in_S18458_PDF_10Dd, Revision: 0, Pages: 1

Drawing No. Amsteel-Blue_Angled Break_1in_S18459_PDF_5Dd, Amsteel-Blue_Angled Break_1in_S18459_PDF_5Dd, Revision: 0, Pages: 1

SAMSON SAMPLE ABS TYPE APPROVAL *(continued)*

Certificate Number: 24-2529172-PDA

Drawing No. Amsteel-Blue_Angled Break_1in_S18460_PDF_5Dd, Amsteel-Blue_Angled Break_1in_S18460_PDF_5Dd, Revision: 0, Pages: 1

Drawing No. Amsteel-Blue_Tensile Test_1in_S18450_PDF, Amsteel-Blue_Tensile Test_1in_S18450_PDF, Revision: 0, Pages: 1

Drawing No. Amsteel-Blue_Tensile Test_1in_S18451_PDF, Amsteel-Blue_Tensile Test_1in_S18451_PDF, Revision: 0, Pages: 1

Drawing No. Amsteel-Blue_Tensile Test_1in_S18452_PDF, Amsteel-Blue_Tensile Test_1in_S18452_PDF, Revision: 0, Pages: 1

Drawing No. Amsteel-Blue_Tensile Test_1in_S18453_PDF, Amsteel-Blue_Tensile Test_1in_S18453_PDF, Revision: 0, Pages: 1

Drawing No. Amsteel-Blue_Tensile Test_1in_S18454_PDF, Amsteel-Blue_Tensile Test_1in_S18454_PDF, Revision: 0, Pages: 1

Drawing No. Amsteel-Blue_Tensile Test_2.50_S18470_PDF, Amsteel-Blue_Tensile Test_2.50_S18470_PDF, Revision: 0, Pages: 1

Drawing No. Amsteel-Blue_Tensile Test_2.50_S18471_PDF, Amsteel-Blue_Tensile Test_2.50_S18471_PDF, Revision: 0, Pages: 1

Drawing No. Amsteel-Blue_Tensile Test_2.50_S18472_PDF, Amsteel-Blue_Tensile Test_2.50_S18472_PDF, Revision: 0, Pages: 1

Drawing No. Amsteel-Blue_Tensile Test_2.50_S18473_PDF, Amsteel-Blue_Tensile Test_2.50_S18473_PDF, Revision: 0, Pages: 1

Drawing No. Amsteel-Blue_Tensile Test_2.50_S18474_PDF, Amsteel-Blue_Tensile Test_2.50_S18474_PDF, Revision: 0, Pages: 1

Drawing No. AmsteelBlue_AxialCompression_1.00_S18478_PDF_54cycles, AmsteelBlue_AxialCompression_1.00_S18478_PDF_54cycles, Revision: 0, Pages: 1

Drawing No. AmsteelBlue_AxialCompression_1.00_S18479_PDF_9946cycles, AmsteelBlue_AxialCompression_1.00_S18479_PDF_9946cycles, Revision: 0, Pages: 1

Drawing No. AmsteelBlue_TensileAfterAngledEnduranceA_1in_S18485_PDF_5Dd, AmsteelBlue_TensileAfterAngledEnduranceA_1in_S18485_PDF_5Dd, Revision: 0, Pages: 1

Drawing No. AmsteelBlue_TensileAfterAngledEnduranceA_1in_S18486_PDF_10Dd, AmsteelBlue_TensileAfterAngledEnduranceA_1in_S18486_PDF_10Dd, Revision: 0, Pages: 1

Drawing No. AmsteelBlue_TensileAfterAngledEnduranceB_1in_S18487_PDF_5Dd, AmsteelBlue_TensileAfterAngledEnduranceB_1in_S18487_PDF_5Dd, Revision: 0, Pages: 1

Drawing No. AmsteelBlue_TensileAfterAngledEnduranceB_1in_S18488_PDF_10Dd, AmsteelBlue_TensileAfterAngledEnduranceB_1in_S18488_PDF_10Dd, Revision: 0, Pages: 1

Drawing No. AmsteelBlue_TensileAfterAxialCompression_1in_S18484_PDF, AmsteelBlue_TensileAfterAxialCompression_1in_S18484_PDF, Revision: 0, Pages: 1

Drawing No. Base design ITP - AmSteel-Blue, Base design ITP - AmSteel-Blue, Revision: 0, Pages: 1

Drawing No. Design Specification - AmSteel-Blue, ITEM 02 Design Specification, Revision: 1, Pages: 1

Drawing No. Design Specification - AmSteel-Blue, ITEM 02 Design Specification, Revision: 0, Pages: 1

Drawing No. Design Specification - AmSteel-Blue, ITEM 02 Design Specification, Revision: 2, Pages: 1

Drawing No. MEG4 Base Design Cert - AmSteel-Blue (2024 Renewal), MEG4 Base Design Cert - AmSteel-Blue (2024 Renewal), Revision: 0, Pages: 1

SAMSON SAMPLE ABS TYPE APPROVAL *(continued)*

Certificate Number: 24-2529172-PDA

Drawing No. Performance Indicator Analysis- AmSteel-Blue 2024 Recertification, Performance Indicator Analysis- AmSteel-Blue 2024 Recertification, Revision: 0, Pages: 1

Drawing No. QWI-18, Production quality checks and traceability, 12 strand rope, ITEM 04 Base_Design Manufactuiring reports _QWI-18 Production 12 strand, Revision: 0, Pages: 1

Drawing No. QWI-18, Production quality checks and traceability, 12 strand rope, ITEM 04 Base_Design Manufactuiring reports _QWI-18 Production 12 strand, Revision: 1, Pages: 1

Drawing No. Quality_Assurance_Manual_Tier_1, ITEM 08 QA Manual, Revision: 0, Pages: 1

Drawing No. Quality_Assurance_Manual_Tier_1, ITEM 08 QA Manual, Revision: 1, Pages: 1

Drawing No. SATEC 4-25-2018, ITEM 05 Base Design Test Specification - calibration cert, Revision: 1, Pages: 1

Drawing No. SATEC 4-25-2018, ITEM 05 Base Design Test Specification - calibration cert, Revision: 0, Pages: 1

Term of Validity
This Product Design Assessment (PDA) Certificate remains valid until 18/Apr/2029 or until the Rules and/or Standards used in the assessment are revised or until there is a design modification warranting design reassessment (whichever occurs first).

Acceptance of product is limited to the "Intended Service" details prescribed in the certificate and as per applicable Rules and Standards.

This Certificate is valid for installation of the listed product on ABS units which exist or are under contract for construction on or previous to the effective date of the ABS Rules and standards applied at the time of PDA issuance. Use of the Product for non-ABS units is subject to agreement between the manufacturer and intended client.

ABS Rules
ABS Rules for Building and Classing Marine Vessels, 2024, 1A-1-4/7.7, 1A-1-A3, 1A-1-A4, 4-1-1/7.13

ABS Rules for Building and Classing Marine Vessels, Part 3, (2024) : 3-5-1/9, 3-5-1/9.7

International Standards
CI 1500A, Test Methods for Fiber Rope Physical Properties, 2015

CI 1500B, Test Methods for Fiber Rope Performance Properties, 2015

ISO 2307 (2010), Fibre ropes -- Determination of certain physical and mechanical properties (as referenced in OCIMF MEG 4th Edition)

OCIMF Marine Equipment Guidelines (MEG), 4th Edition.

API 2SM Annex F - Design, Manufacture, Installation, and Maintenance of Synthetic Fiber Ropes for Offshore Mooring (2nd ed, 2014)

ISO 2062 Textiles -- Yarns from packages -- Determination of single-end breaking force and elongation at break using constant rate of extension (CRE) tester (2009)

ASTM D885 Standard Test Methods for Tire Cords, Tire Cord Fabrics, and Industrial Filament Yarns Made from Manufactured Organic-Base Fibers (2014)

EU-MED Standards
N/A

National Standards
N/A

Government Standards
N/A

SAMSON SAMPLE ABS TYPE APPROVAL *(continued)*

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Other Standards
NA

Corporate ABS Programs
American Bureau of Shipping
Print Date and Time: 22-Apr-2024 4:11

ABS has used due diligence in the preparation of this certificate, and it represents the information on the product in the ABS Records as of the date and time the certificate is printed.

If the Rules and/or standards used in the PDA evaluation are revised or if there is a design modification (whichever occurs first), a PDA revalidation may be necessary.

The continued validity of the MA is dependent on completion of satisfactory audits as required by the ABS Rules. The validity of both PDA and MA entitles the product to receive a **Confirmation of Product Type Approval**.

Acceptance of product is limited to the "Intended Service" details prescribed in the certificate and as per applicable Rules and Standards.

This Certificate is valid for installation of the listed product on ABS units which exist or are under contract for construction on or prior to the effective date of the ABS Rules and standards applied at the time of PDA issuance. ABS makes no representations regarding Type Approval of the Product for use on vessels, MODUs or facilities built after the date of the ABS Rules used for this evaluation.

Type Approval requires Drawing Assessment, Prototype Testing and assessment of the manufacturer's quality assurance and quality control arrangements. The manufacturer is responsible to maintain compliance with all specifications applicable to the product design assessment. Unless specifically indicated in the description of the product, certification under type approval does not waive requirements for witnessed inspection or additional survey for product use on a vessel, MODU or facility intended to be ABS classed or that is presently in class with ABS.

Due to wide variety of specifications used in the products ABS has evaluated for Type Approval, it is part of our contract that; whether the standard is an ABS Rule or a non-ABS Rule, the Client has full responsibility for continued compliance with the standard.

Questions regarding the validity of ABS Rules or the need for supplemental testing or inspection of such products should, in all cases, be addressed to ABS.

APPENDIX 5

TEST METHODS

MAINLINES	
TEST TYPE	**TEST METHOD**
Linear density	CI-1500A-2015 Test Methods for Fiber Rope Physical Properties, Section 9
Diameter	CI-1500A-2015 Test Methods for Fiber Rope Physical Properties, Section 8
New straight break force	CI-1500A-2015 Test Methods for Fiber Rope Physical Properties, Section 8
Immediate strain	CI-1500A-2015 Test Methods for Fiber Rope Physical Properties, Section 11
Angled break force (D/d 5)	MEG Appendix B (4th ed), Section B8.5.6
Angled break force (D/d 10)	MEG Appendix B (4th ed), Section B8.5.6
Angled endurance (D/d 5)	MEG Appendix B (4th ed), Section B8.5.7
Angled endurance (D/d 10)	MEG Appendix B (4th ed), Section B8.5.7
Axial compression fatigue	API 2SM Appendix D—Design, Manufacture, Installation, and Maintenance of Synthetic Fiber Ropes for Offshore Mooring (1st ed)
Material break force at specified temperature	DSM Dyneema Test Method —Tensile Properties—DTM YA001—(Based on ISO 2062 & ASTM D885);

TAILS	
TEST TYPE	**TEST METHOD**
Linear density	CI-1500A-2015 Test Methods for Fiber Rope Physical Properties, Section 9
Diameter	CI-1500A-2015 Test Methods for Fiber Rope Physical Properties, Section 8
New straight break force	CI-1500A-2015 Test Methods for Fiber Rope Physical Properties, Section 8
Immediate strain	CI-1500A-2015 Test Methods for Fiber Rope Physical Properties, Section 11
Sheltered Stiffness	MEG Appendix B (4th ed), Section B8.5.5
Exposed Stiffness	MEG Appendix B (4th ed), Section B8.5.5
Tension-tension endurance	Guidelines for the Purchasing and Testing of SPM Hawsers, section F-10

NOTES

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