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1. INTRODUCTION

1.1 Company

MELCAL is a dynamic engineering, research, and manufacturing company, building on the world renowned Italian tradition of hydraulic lifting devices and dedicated to the marine and offshore industry. MELCAL cranes are always tailor made to your specific requirements at standard product quality and price.

Sales, engineering, production development and after sales support take place in our main offices in Italy and are internationally supported through worldwide factory trained and supported sales and service partners.

At the preliminary stages of any project MELCAL works closely with you in finding the most efficient solution, always bearing in mind innovative design, safety, international rules and regulations. As an independent company, all departments within our company pull tighter to guarantee feasibility and quick response. You will always have a significant participation during the preliminary steps of each project, choosing desired accessories, safety features, special requirements, painting procedures, etc.

All production processes followed by MELCAL quality control department are certified to ISO 9001:2015, verified and accredited by DNV.

1.2 Product

The FL Series, FOLDABLE KNUCKLE TELESCOPIC pedestal cranes, are a reliable and low maintenance crane. Designed for general cargo handling, service, and offshore applications, onboard various vessel types and offshore units. Tailor made to your requested specifications, in different boom lengths and lifting capacities and for different on-board and off-board sea state working conditions. All FL series cranes can be equipped with different accessories and class certified by all leading classification societies.

1.3 Benefits

Tailor engineered to client's specific requirements
Manufactured to the most demanding safety rules and regulations
Designed to operate in the harshest environments
Experienced engineering and technical support
Versatile applications
Box boom structure with low center of gravity
User and maintenance friendly
Maintenance free hydraulic luffing cylinders
Operation of 2 or more functions simultaneously
Continuously variable speed control from zero to max speed
360° Continuous slewing
Norsok M 501 Coating System 1
Worldwide 24-hour aftersales support

2. DESIGN CONSIDERATIONS

2.1 Design Codes

Federation Europeenne de la Manutention, F.E.M. 1.001, 3rd Edition, Revised 1998.10.01, "Rules for the Design of Hoisting Appliances": U3, Q2, A3 & T5, L2, M5

2.2 Applications

Shipboard

2.3 Environmental Conditions

Ambient temperature	Min	-20°C
	Max	+40°C
Humidity		85%

2.4 Area Classification

	Boom	Crane column	Pedestal
Zone	Safe Zone	Safe Zone	Safe Zone
Gas group	--	--	--
Temp. class	--	--	--

3. PERFORMANCE DATA*

3.1 General

Drive system	Electro hydraulic
Performance matrix	Two functions can be operated simultaneous with max load and reduced speed All motions are of infinite variable control from zero to full speed

3.2 Luffing

Min/Max. boom angle (°)	-45 / 78
Luffing time full range +/- 5% (s)	50

3.3 Slewing

Slewing range (°)	360° Continous
Slewing speed +/- 10% (rpm)	1

3.4 Main Hoist

Speed last layer +/- 10% (m/min)	20 - 1 Fall (Empty Hook)

3.5 Load Forces/Reactions on Deck at max outreach**

Max dynamic lifting moment (kNm)	
Max dynamic axial load on crane base (kN)	To be submitted
Max dynamic slewing torque (kNm)	

3.6 Hydraulic Data

Max oil flow (l/min)	62
Max working pressure (bar)	300

3.7 Electric Data

Main power supply (V)	24Vdc

3.8 Weights & Dimensions

Crane weight (t)	Refer to general arrangement drawing

*All stated data are approx and to be confirmed upon completion of final crane. The above speeds are based on average volumetric efficiencies; a speed tolerance within acceptable range should be taken into consideration. Request for verification for weights that are crucial to vessel design.

** The above given loads are maximum design loads calculated in accordance with the design codes specified in Section 2.1 and not include required / additional safety factors for the pedestal.

4. STEEL STRUCTURES

4.1 Steel type

S355 & S690
Steel quality according to applicable rules and regulations defined in Sec. 2
All primary steel is fully traceable
Primary steel is certified by 3.1 certificate according to EN10204

4.2 Welding

Welding procedure according UNI EN ISO 15614-1
Welding carried out by certified welders according to UNI EN ISO 9606-01

4.3 NDT's

According to applicable rules and regulations defined in Sec.2
Third party inspection

4.4 Crane column

Totally enclosed watertight structure
Cylinder luffing bracket(s)

4.5 Column/ main boom and luffing cylinders pin

39 NiCrMo3

4.6 Main boom

Welded steel box structure
Internal stiffeners
Replaceable bushings in boom hinge
Cylinder luffing brackets

4.7 Knuckle jib

Hexagonal steel boom structure
Replaceable bushings in boom hinge
Cylinder luffing brackets
Winch foundation bracket(s)

4.8 Telescopic extensions

Hexagonal section
Large sliding pads made of Nylatron.

4.9 Pedestal

Cylindrical design steel pipe rolled and welded longitudinally
Weather tight manhole/access hole with reinforcement plates
Flange for bolting to counter foundation (including bolts and nuts)

5. MAIN COMPONENTS

5.1 Slewing bearing

Type	Ball slewing bearing with grease nipples
Bolts material	10.9
Gear	Internal

5.2 Slewing gearbox

Type	Internal pinion drive
Quantity	1
Mounting bolts material	10.9

5.3 Luffing cylinders

Double acting type
St 52,3 Housing material
Nikrom piston rods

5.4 Telescopic cylinders

Double acting type
St 52,3 Housing material
Nikrom piston rods

5.5 Main hoist

Max SWL (t)	3

Grooving type	Smooth drum
Mounting bolts material	10.9

5.6 Main hoist wire rope

Type of wire rope	Anti turn galvanized steel
Wire Rope Diameter (mm)	14
Wire Rope Tensile Strenght (N/mm^2)	2160
Min. req. safety factor	5,0
Lifting height (m)	25
No dead turns on drum	5
Preservation	Shell Gadus S2 OG 40 grease

5.7 Main hoist rope sheaves

Rope sheave diameter (mm)	Twenty times wire rope diameter
Bearing	Cylindrical roller bearings
Material	Nylatron

5.8 Main hoist hook

According to applicable rules/regulations defined in sec. 2
Swivelling type with safety latch

6. HYDRAULIC SYSTEM

6.1 Hydraulic system

System type — Open loop system

6.2 Main control valve block

Proportional type

6.3 Slewing system

Hydraulic orbital motor

6.4 Hoisting system

Hydraulic orbital motor

6.5 Hydraulic slip ring

For transfer hydraulic connections to crane rotating sections

6.6 Hydraulic pipes

Hydraulic pipes of stainless steel/AISI 316

6.7 Pipe fittings

SS 316L

6.8 Hydraulic hoses

According to ISO 6945
High quality for resistance to salinity and sunlight
Wired braided for applicable specified hydraulic pressure ratings
Hoses identification tags according to hydraulic diagrams

6.9 Hose fittings

SS 316L

6.10 Hydraulic line clamps

According to DIN 3015
Made of fire retardant material
Bolts in SS 316L

6.11 Hydraulic oil filtering

Pressure filter

6.12 Hydraulic system cleanliness

Flush test	According to ISO 4406 17/15/12
Pressure test	According to ASME B31.3

7. ELECTRIC SYSTEM

7.1 General

Protection against moisture and internal humidity using calculated quantities of silica gel or similar.
Cables identification tags according to electric diagrams.

7.2 Electric cables

Halogen free
Flame retardant

7.3 Cable glands

Cable glands of marine brass

7.4 Cable trays

External cable trays and pipes of stainless steel/AISI316

7.5 Electric slip ring

For transfer of electric power connections to crane rotating sections
Spare rings available upon request.

7.6 Junction box(s)

External junction boxes of stainless steel/AISI316, IP66

Internal junction boxes of galvanized steel, IP 54

8. LUBRICATION

AISI 316L Stainless steel grease nipple

9. CONTROL SYSTEM

9.1 Radio remote control

Control functions	Joysticks controls Emergency stop button

Radio installation will be delivered with a back-up cable of 15 meters and a spare battery.

9.2 Manual emergency operator controls

Position	Left hand location
Type	Fixed on crane column
Control	Control levers, in SS 316L
Instrumentation	Load diagrams Emergency stop button Pressure gauge

10. SURFACE-COATING SYSTEM

10.1 Surface protection system

Coating Procedure	NORSOK M-501 System 1 ISO 12944-5 C5-M High durability
Paint supplier	International Marine Coatings
Surface preparation	SA 2.5 (ISO8501-1)
Roughness/Profile height	Grade Medium G (50 µm to 85 µm) (ISO 8503)
No. of coats	3
Primer coat	International Interzinc 52 – DFT 75 µm
Intermediate coat	International Intergard 7600 – DFT 160 µm
Top coat	International Interthane 990 – DFT 65 µm
Total DFT	300 µm
Finish Color (RAL)	White (9010)

11. SAFETY DEVICES

11.1 Controls system

Load limiting system (Overload protection)
Main overpressure valve for safety of the whole hydraulic system
Dead man type control levers/spring centered controls
Failsafe control functions
Load diagram(s)/curve(s)
Emergency stop button (s)

11.2 Hydraulic system

Pressure gauge (s)
Load holding valves to prevent dropping of load in case of system pressure loss

11.3 Luffing system

Load holding valves

11.4 Slewing system

Fail safe brakes
Slew load holding valve

11.5 Main hoisting system

Load holding valve
Fail safe multi-disc brake
Hook stop in upper and lower most positions
Empty drum protection with 5 wraps of wire rope remaining on winch drum

11.6 Other

SWL marking on boom/jib

12. NAMEPLATE, LABELS & TAGGING

12.1 Nameplate and instrumentation labels

Language*	English
Crane nameplate material	AISI 316 stainless steel
Crane load diagram material	AISI 316 stainless steel
Instrumentation labels material	Trafolite

* Different instrumentation languages upon request.

12.2 Tagging

Hydraulic line tagging system*	MELCAL standard
Hydraulic line tagging material	AISI 316 stainless steel
Electric cables tagging system*	MELCAL standard
Electric cables tagging material	AISI 316 stainless steel

* Client tagging system upon request.

13. INSPECTION & TESTING

ISO 9001:2015 accredited by DNV
Class society requirements (if applicable)
Factory acceptance test procedure issued 30 days before FAT date
Other client specific inspections / testing upon request

14. CERTIFICATION

14.1 Manufacture certification

Declaration of conformity
FAT Test report
Loose gear certificates (ILO Format)

14.2 Class Society certification

Not available

15. DOCUMENTATION

15.1 Language

All documents are supplied in English language. Upon request documentation can be supplied in other languages.

15.2 Copies

1 (one) PC Electronic copy
Upon request, desired number of copies of each type document can be issued.

15.3 Document list

Dimension drawings
Load diagram
Installation Procedure
Preservation procedure
Use & Maintenance Manual
Spare Parts Manual
Electric Diagram
Hydraulic Diagram
Loose Gear Component Certificates
Declaration of Conformity
Factory Acceptance Test Procedure (FAT)
Upon request MELCAL can issue desired number of copies of each type document.

16. SPECIAL TOOLS

N/A

17. ATTACHMENTS

General arrangement drawing no. 190018A00C00DFZ Rev.00
Winch load diagram drawing no. 190018A00C00DBZ Rev.00
Hook load diagram drawing no. 190018A00C00DCZ Rev.00