



**DELACHAUX REELING
DRUM TECHNOLOGY
MAGNETIC COUPLER DRIVE**

CONTENTS

A	DESCRIPTION OF DELACHAUX MOTORISED REELING DRUM TECHNOLOGY	3
A.1	Main gearbox unit	5
A.2	Secondary and additional gearboxes	7
A.3	Drive unit with electric motor and magnetic coupler	8
A.3.1	Drive motor	9
A.3.2	Magnetic coupler	10
A.3.3	Anti run back bearing (free-wheel)	13
A.4	Spool	14
A.5	Slip ring assembly/rotary joint/fibre optic transmitter	15
A.5.1	Slip ring assembly	15
A.5.2	Rotary joint	15
A.5.3	Fibre optic transmitter	16
A.6	Cable	17
B	SURFACE TREATMENT AND PAINTING PROCEDURES	18
B.1	Standard procedure	18
B.2	Special protection on request	18
C	OPTIONS ON MOTORISED REELING DRUMS, ACCESSORIES AND CUSTOMER SERVICE	19
C.1	Options	19
C.2	Accessories	20
C.3	Customer service	20
D	FEATURES AND BENEFITS OF DELACHAUX MOTOR REELS	21
E	APPLICATION PICTURES	22

MODULAR MOTORISED REELING DRUMS WITH HYSTERESIS MAGNETIC COUPLER

The motorised reeling drum market is characterised by 2 factors :

1. A conspicuous and continuing increase in performance :

- speeds
- rates of use
- length of travel
- cable size
- mounting height

2. A greater spread of problems to overcome, for in spite of ever faster operations, many installations operate still at quite low speeds.

In this situation, the conventional reeling drum technologies have increasing difficulty in responding adequately to the requirements of the market :

- Friction coupler in oil
- Torque motor
- Electro-magnetic coupler
- Chain drive
- Worm gear...

Since 1974, DELACHAUX has been developing and successfully marketing a specific motor reel technology focused on 2 patented concepts :

MAGNETIC COUPLER motorisation using efficient, reliable **permanent magnets**,

A **MODULAR ASSEMBLY SYSTEM**, enabling the construction of a great variety of motor reels by combining a limited number of standard components.

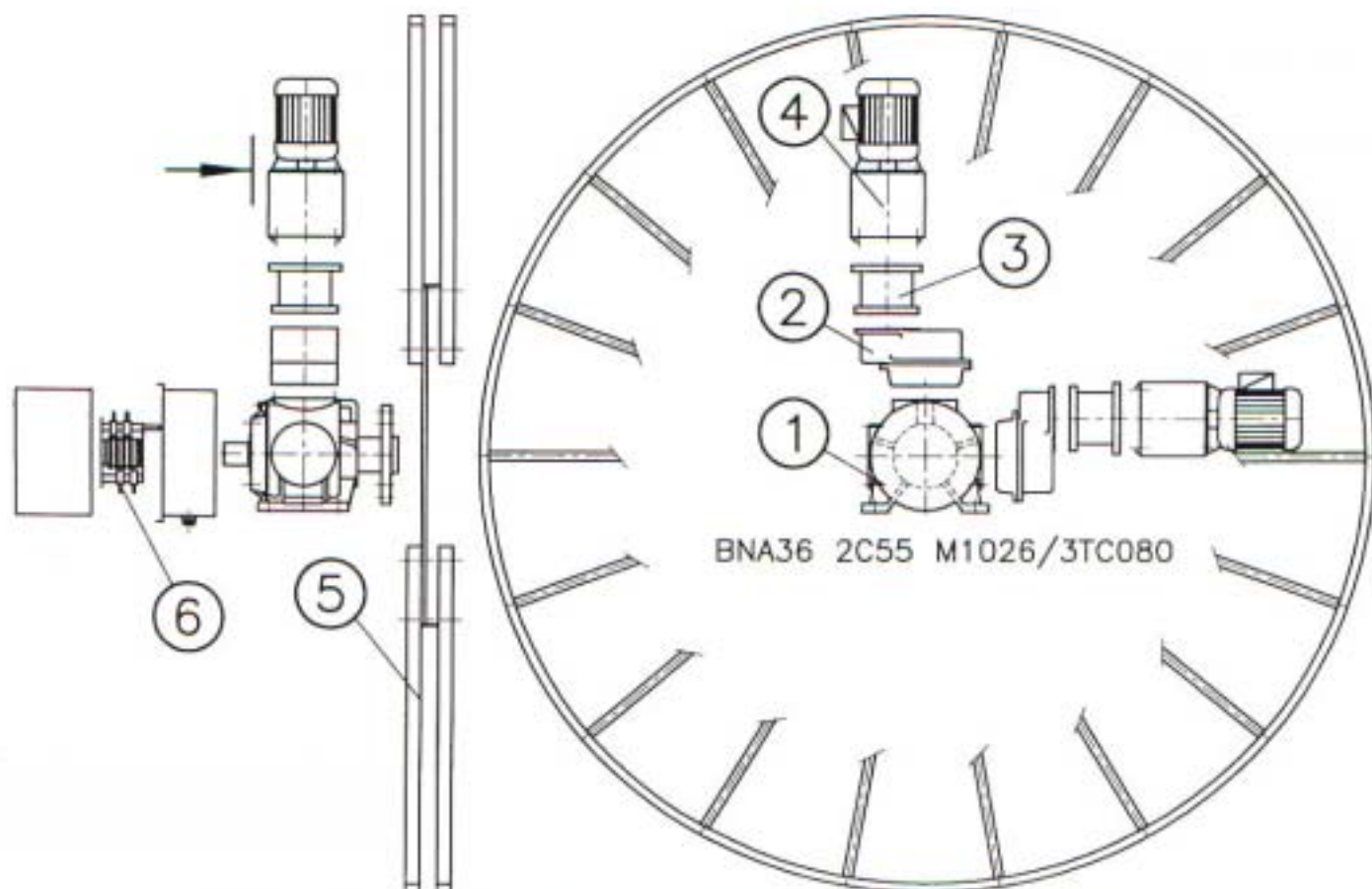
These technological developments have been regularly improved to meet the ever demanding needs of motor cable reel users and DELACHAUX, leaning on the experience of more than 80 years of manufacturing electrification systems for any kind of mobile equipment, has become a major supplier to the materials handling industry, on both domestic and international markets.

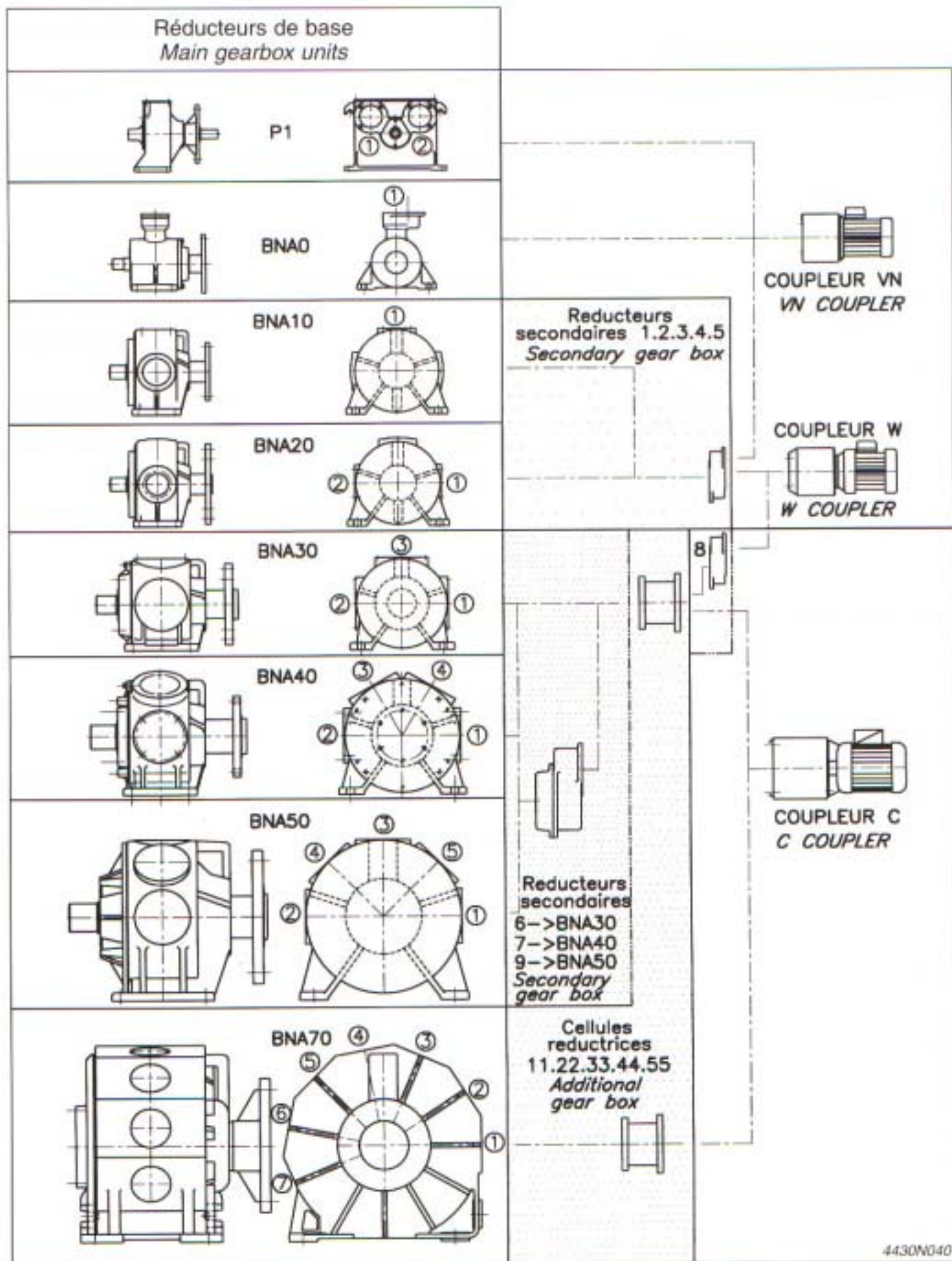
A. DESCRIPTION OF DELACHAUX MOTORISED REELING DRUM TECHNOLOGY

DELACHAUX motor reels are composed of 6 modular components :

1. Main gearbox unit
8 sizes
2. Secondary gearboxes
9 models
3. Additional gearboxes
5 models
4. Drive unit with electric motor and magnetic coupler
3 models
5. Spool
5 types and an extended range of sizes and options
6. Slip ring assembly :
Power, control, mixed power / control, fibre optics transmitter
Rotary joint :
Water, air and other Fluid.

This patented modular assembly technology enables a wide choice of combinations, using the same standard components.



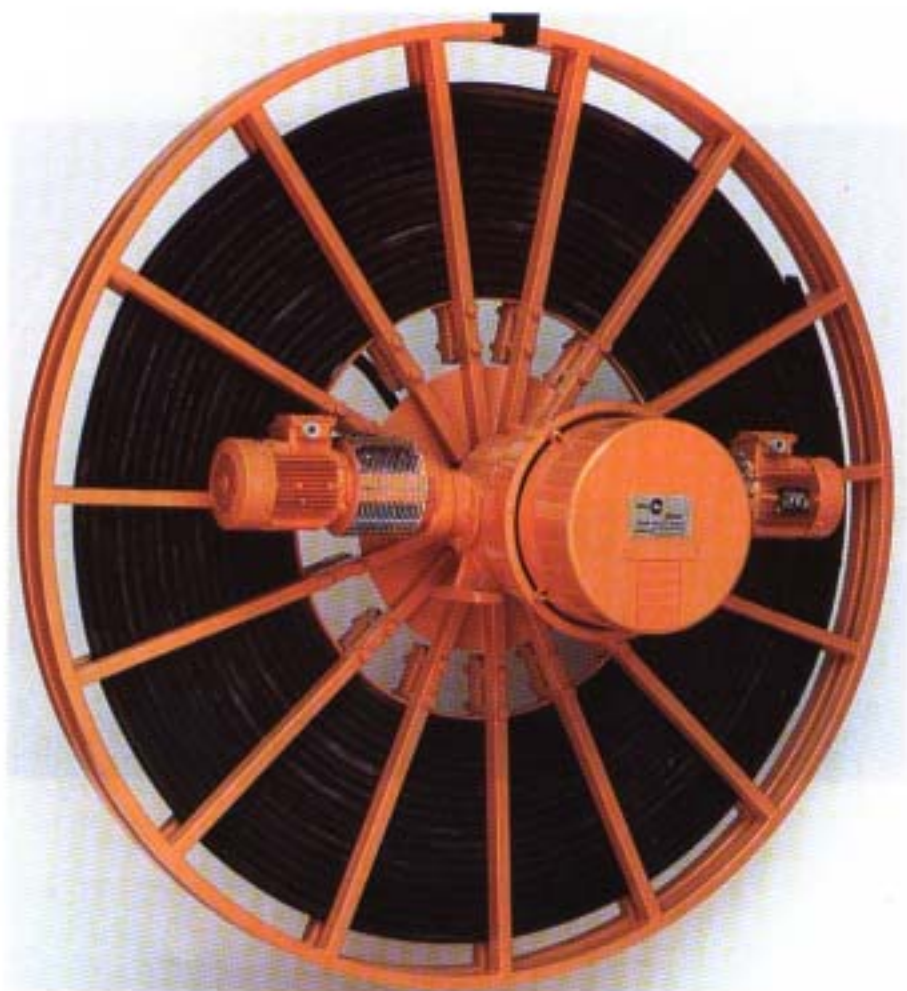


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A.1. Main gearbox unit

As primary constitutive part of the reeling drum, the main gearbox unit carries the slip ring assembly, the spool and the drive units.

Due to its supporting function, the specification of the main gearbox unit is directly related to the size and type of reel.



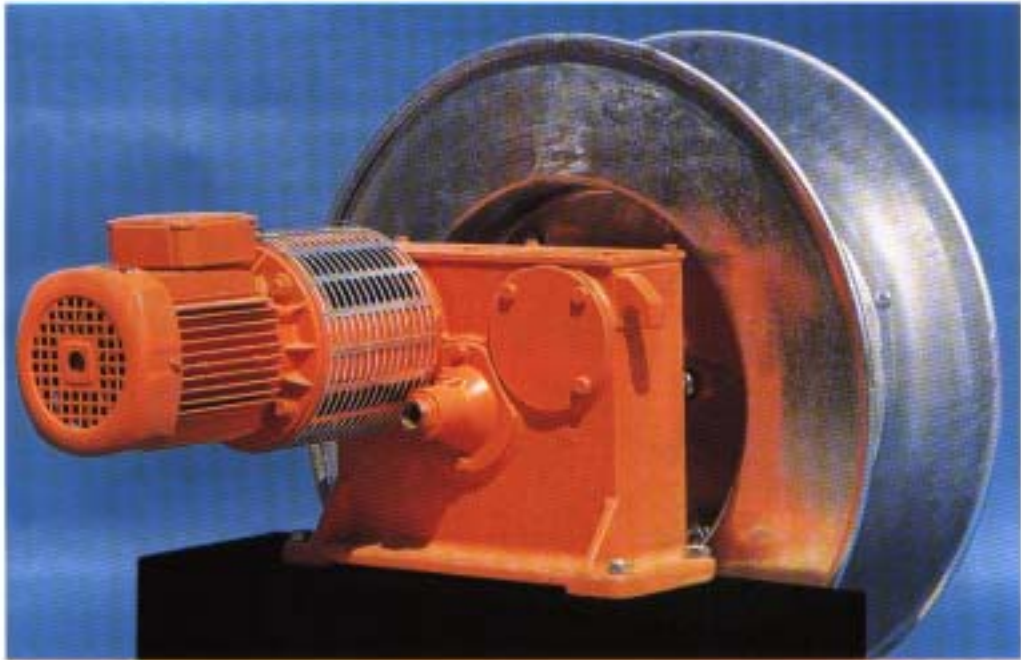
The above picture shows the design of the BNA series gearbox :

The motors are mounted radial to the axis of the spool.

The gearbox has from 1 to 7 inputs depending on size (2 inputs on the picture).

The slip ring assembly is located on the opposite side to the spool and is independent, thus allowing an easy access for connections or maintenance.

The picture hereafter displays the general arrangement of the P1 series gearbox :
The motor is mounted parallel to the axis of the spool.
The gearbox has 1 or 2 inputs (1 input used on this application).
The collector assembly is located inside the drum.
The internal constant reduction is obtained through straight toothed gears.



A.2. Secondary gearboxes Additional gearboxes

The function of the intermediate gearbox is to match the reduction on the motor reeling drum to the speed of the mobile machinery. A parallel train of straight toothed gears greased for at least 5 years or 15 000 hours operation is fitted, giving an excellent mechanical efficiency to these components.



Secondary gearboxes



Additional gearbox

A.3. Drive unit with electric motor and magnetic coupler

This sub-assembly is composed of a permanent magnetic coupler, an electric motor and a locking or braking device.



Electric motor

Magnetic coupler

A.3.1. Drive Motor

The electric motor drives the magnetic coupler at a constant speed.



Anti run back bearing

Electric motor

Most generally used are AC - 3 phase - IP 55 - insulation class F electric motors, complying with international standards such as IEC or NEMA standards.

Using standard off-the-shelf motors means that these parts are easily available world-wide.

3 sizes of motors are used depending on the types of magnetic couplers :

- 0,37 kW at 1500 rpm
- 0,75 kW at 1500 rpm
- 1,5 kW at 1500 rpm

On request, electric motors with special specifications (voltage, frequency, degree of protection, operation in harsh environments, explosion proof motors...) as well as pneumatic or hydraulic motors can easily be fitted.

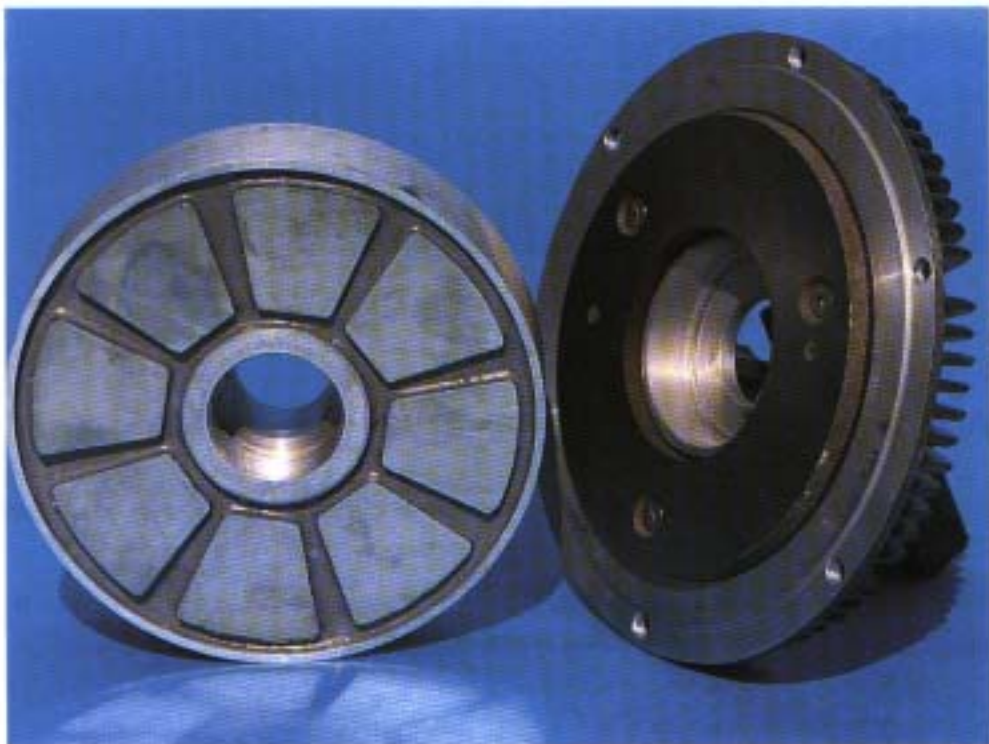
A.3.2. Magnetic coupler :

There are 3 types of Permanent Magnet Hysteresis Couplers with 3 different maximum torque levels :

- Type VN : 1,8 Nm
- Type W : 3,0 Nm
- Type C : 5,5 Nm

As shown on the picture, the magnetic coupler type C is made of 2 parts.

- Right part of the picture :
The primary plate, or induced plate, consists of a magnetically hard annular magnet having a flat hysteresis curve and on the back a support housing with cooling fins.
- Left part of the picture :
The secondary plate, or inductor plate, containing 8 ticonal blocks of alternate polarity fixed to an armature and permanently magnetising the induced plate, thus generating a ring of alternating polarity.



A.3.2.1. Benefits of the magnetic coupler

- Low inertia
- Constant torque
- Purely magnetic in function
- No contact
- No wear
- No loss of magnetism
- No coil or electric supply
- Spark free and explosion proof
- Maintenance free
- Operates in any mounting position
- Easily adjustable by modification of the air gap
- Heavy duty
- No brake required

A.3.2.2. Operation of the magnetic coupler

Winding of the cable / hose :

During winding of the cable / hose, the induced plate rotates at the speed of the electric motor. The inducer plate is then driven by the magnetic field and the cable / hose is wound *irrespective* of the moving machinery translation speed.

Unwinding of the cable / hose :

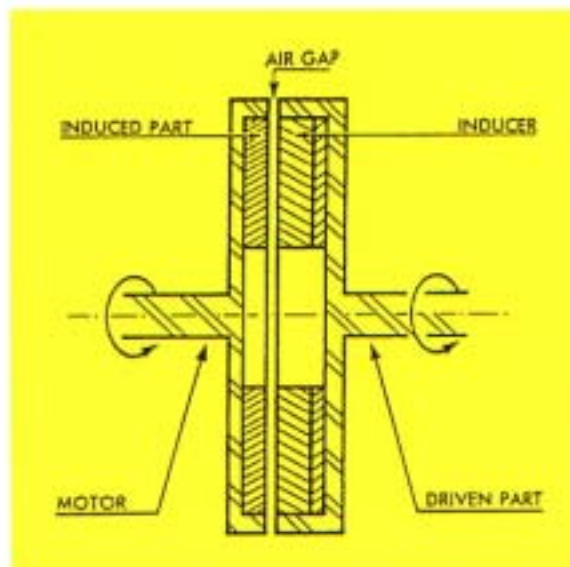
The induced plate still rotates in the winding direction at the output speed of the electric motor, but the inducer plate, driven by the cable rotates in the opposite direction.

NOTE : *The motor always turns in the same direction irrespective of the winding or unwinding of the cable.*

Switching off the power :

When the equipment is switched off (motor not energised), the induced plate is blocked by the means of an anti run back bearing. Thanks to the permanent magnetic field, the inducer plate generates a torque which prevents the cable from unwinding.

However, it is possible to unwind the cable by applying a pull stronger than the magnetic coupler torque. This has the advantage not to block the cable / hose completely and to release cable / hose when the mobile machinery (e.g. ship to shore crane) is pushed by the wind.



A.3.2.3. Thermal behaviour of the magnetic coupler

Even though the slip of the DELACHAUX magnetic coupler generates much less heat than the other technologies (friction type, torque motor...), this heat has to be dissipated.

The coupler housing is designed with cooling fins on the induced part fixed to the motor, thus allowing a permanent cooling of the device.

Therefore, this arrangement guarantees a 100 % operation within a given range of ambient temperature from -15°C to + 40°C.

Systems capable of functioning at unusually high or low temperatures may also be supplied. In such cases, the customer has to provide precise details on the ambient conditions so that the suitable lubricant is used and the appropriate adjustments to the performance of the coupler are made.

A.3.3. Anti run back bearing (free wheel)

Techniques previously in use consisted in fitting an electromagnetic brake on the drive unit. Experience has shown that outdoor conditions (cold and damp weather, long periods out of use, corrosion...) frequently lead to breakdowns affecting the reliability of the whole motor reel.

For this reason, every DELACHAUX motorised reeling drum is fitted with an anti run back bearing mounted on the motor shaft. Cf. picture on page 9.

A.3.3.1. Operation of the anti run back bearing

When equipment is stopped, an unwinding torque is applied to the reeling drum, mainly due to the cable weight and to a certain extent to the wind effect.

The magnetic coupler transmits the unwinding torque (motor not energised) to the motor which tends to turn in the unwinding direction, but fitting an anti run back bearing allows rotation of the motor in the winding direction only and prevents it from rotating in the unwinding direction.

A.4. Spool

DELACHAUX offers 5 types of spools :

- Semi wide spool with random winding
- Monospiral spool
- Level wind spool
- 3-2-3 spool
- Special spools

The type of spool is determined by the customer's design and requirements ; a wide choice of standard sizes as well as special sizes are available on request.

A.4.1. Semi wide spool with random winding

This type of spool is particularly suitable for short or medium cable or hose lengths. The cable / hose winds freely on the drum without guiding device.

A.4.2. Monospiral spool

On this type of spool, the cable or hose winds neatly as a spiral. Depending on the cable / hose diameter, the spool can accommodate 400 m or more with a speed in excess of 200 m/min.

A.4.3. Level wind spool

This spool has been designed to wind very long cable / hose (in excess of 1000 m). The cable or hose is wound in 2 or 3 layers on a cylindrical drum and layering is assisted by a guiding device.

A.4.4. 3-2-3 spool

This spool is a combination of monospiral and semi wide spools. Winding in 3 then 2 layers successively. The benefit of this type of spool is the compact size of the drum.

A.4.5 Special spools

On request, for example : double monospiral spools, plain monospiral spools, protected spools, special dimensions, special material.

A.5. Slip ring assembly / rotary joint / fibre optic transmitter

A.5.1. Slip ring assembly

DELACHAUX benefits from several decades of experience in the design and manufacturing of slip rings assemblies.

Based on the experience gained with motor reeling drums, and complying with IEC, UL, NEMA, VDE standards among others, the DELACHAUX slip ring assemblies are available for the following applications :

Power : low voltage up to 690 V - AC or DC - up to 1250 A
high voltage up to 24 kV - AC or DC - up to 320 A
Duty factor up to 100 %

Control : 500 V - AC or DC - max. amperage 24 A
Suitable for transmission of data signals including control,
measurement, video and telecom equipment and computers
Duty factor up to 100 %

Mixed applications power / control with rings of same or different diameters

Explosion proof assemblies to EExd II B T3 and EExd IIC T4, certified by the independent French laboratory LCIE (Laboratoire Central des Industries Electriques).

A.5.2. Rotary joint

Single or double hydraulic rotary joints can also be fitted on motor reeling drums and the following sizes are available :

- 3/8"
- 1/2"
- 3/4" - 1"
- 1" 1/4
- 1" 1/2
- 2"
- 2" 1/2
- 3"

These rotary joints have a standard kanigen treatment.

L.V. SLIP RING
TYPE 3TP080
+ 18C080
+ 6C080A



A.5.3. Fibre optic transmitter

The latest progress in control systems and the high level of requirement in the materials handling industry has made essential the development of fast and trouble free transmission data.

Automated Stacking Cranes and Continuous Container Unloaders for example operate thanks to a continuous flow of information and the introduction of fibre optics cable has been necessary to cope with this increasing stream of computer data, video signals and the high speed of operation of the moving machinery.



• TFO 40.6

The R & D Department of DELACHAUX has been one of the first motor reel manufacturer to develop a *Continuous Fibre Optics Transmitter* to meet the demanding requirements of the industry.

This fibre optics transmitter is mounted as additional constitutive part on the motorised reeling drum ; it allows the transmission of a large amount of information with a very low level of attenuation — less than 1 dB — without strain on the fibre optics.

This innovation benefits also from the DELACHAUX modular assembly design, bringing to the customer a high level of experience and a cost effective solution.

Furthermore, the DELACHAUX design team remains at your disposal to plan a tailor made solution in the field of fibre optics transmission.

A.6. Cable

Any cable intended for use on a motorised reeling drum must possess the appropriate characteristics of :

- flexibility, i.e. with short pitch assembled cores.
- strength (tension, rotation, bending), i.e. braided inside and double-sheathed outside.

DELACHAUX developed reeling drum cable to its own stringent specifications :

- GP cable for every standard reeling drum application, 1000 V supply voltage, from 4G2,5 mm² to 3 x 300 + 3G50 mm².
- TSP cable for every standard reeling drum application, 750 V supply voltage, from 7G2,5 mm² to 37G2,5 mm².
- TRA cable for heavier applications, particularly suitable for vertical lift, 750 V supply voltage, from 7G2,5 mm² to 52G2,5 mm².

These cables comply with the latest European standards (VDE, NF, IEC...)

Furthermore, DELACHAUX recommends and uses cable made by the foremost cable manufacturers who have developed their own range of special cable for reeling drum applications.

B. SURFACE TREATMENT AND PAINTING PROCEDURES

B.1. Standard procedure

Thanks to DELACHAUX long experience in different applications and hard environment, the following standard procedure for surface treatment and painting has been developed :

Components treated : every part, including motor(s), magnetic coupler(s), gearbox(es), except the spool.

SA or DS 2.5 sandblasting.

40 μ rich zinc epoxy primary coating.

160 μ Acrylic finish coating in RAL 2008 orange.

Total thickness of dry film : 200 μ .

The spools and low voltage slip ring housings are 70 μ hot dip galvanised.

Galvanisation provides in-depth protection, even for the hollow components.

B.2. Special protections on request

Special paint or colour on request.

Special treatments available on request, such as DELACHAUX SP 201 corrosion protection system : marine / chemical environment.

- DELACHAUX MA1 treatment for low temperature
- DELACHAUX MA3 treatment for seaside environment
- DELACHAUX MA4 treatment for off shore environment
- DELACHAUX MA5 treatment for chemical environment

Other treatments on request : nuclear environment, customer's specifications.

C. OPTIONS ON MOTORISED REELING DRUMS, ACCESSORIES AND CUSTOMER SERVICE

DELACHAUX aim is to offer a complete package and service with the delivery of motor reeling drums.

To ensure an optimal use of your equipment, an extensive range of options, accessories and services has been developed.

C.1. Options

- One-way or two-way guiding devices with optional slack cable, over pull and position detection systems.
- Anchoring drums with or without connection boxes.
- Connection boxes for power, control and fibre optics cable and splicing kits.
- End limit switches.
- Heating resistance for slip ring housing.
- Slip ring housing in stainless steel (L.V. Slip rings only as H.V. slip rings have a stainless steel housing as standard).
- Stainless steel spools and reinforced design for heavy applications
- Diverting devices
- Cable sleeves and shock absorber springs.

This list of options is not exhaustive. Please consult us.

C.2. Accessories

Example : channel rubber or steel cover

The cable can be protected against damage caused by vehicles or falling objects by the means of a channel with rubber or steel plate cover developed by DELACHAUX.

This system includes the following elements :

Pre-fabricated galvanised steel sheet channel or stainless steel channel

Flexible rubber cover or steel plate cover to assemble on the channel

Fastening parts in stainless steel

Lift up device on the cable guide

The DELACHAUX channel can be planned with a new project or included in an existing or refurbishment scheme.

C.3. Customer service

A few examples :

- Commissioning on site
- Personnel training
- Preventive maintenance
- Spare parts and service department
- International sales and technical network

D. FEATURES AND BENEFITS OF DELACHAUX MOTOR REELS

- High mechanical **efficiency**.
- Torque **adjustment** by modifying the air gap between the induced and inductor magnetic plate of the coupler.
- The moment of inertia of the drive system is low and the operating speed is **rapidly** reached.
- Standard off-the-shelf electric motors are used instead of special motors.
- Straightforward and **reliable** anti run back bearings or brake motors.
- Standard design throughout the range to allow **standard** maintenance procedures.
- The **modular assembly** design enables an **accurate** computer aided calculation of every motor reeling drum.
- **Compact** range.
- The modular assembly design also means that the number of spare parts is limited.
- The magnetic coupler is by definition also a torque limiter and acts as a **safety** device. It provides protection for the cable, the equipment and the service personnel.
- The slip ring housings are **IP 55 as standard**.
- Design and manufacturing assessed and found to conform to the requirements of the **ISO 9001** standard.
- **International** sales and service network.