ROJ
MECHATRONICS

DMD2

Installation
Operation
Maintenance

ORIGINAL INSTRUCTIONS

DMD2 – Rev. 1.2 – December 2019

This manual is intended for the users of DMD2 motor

ROJ reserves the right to change at any time the contents of this manual, without notice.

For any technical or commercial problem, please contact your local ROJ dealer or call directly ROJ customer service center. We will be glad to meet your needs.

Thank you for your trust and good job.

DMD2

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Edition: *December 2019*
Revision: *1.2*

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INDEX UPDATES

13/09/2018	Rev. 1.0
20/08/2019	Rev. 1.1 – Minor updates, added new P/N variants
03/12/2019	Rev. 1.2 – Updated with latest labels

INTRODUCTION

All machines [1] and equipment designed and manufactured by **ROJ** are supplied with User and Maintenance Manuals prepared in compliance with the Essential Health and Safety Requirement (EHSR) 1.7.4 – *Instructions* – of Machinery Directive 2006/42/EC Annex 1.
As the prescriptions of Machinery Directive, and in particular the EHSRs of Annex 1 represent **mandatory law obligations**, in writing the manuals, **ROJ** paid particular attention to all the items of EHSR 1.7.4, in particular:

1. The **ROJ** user and maintenance manuals are supplied in the language of machine target country, within the European Union and, when necessary, an "Original language" copy of the manual is also provided.
2. The **ROJ** manuals always contain a "proforma" copy of the EC Declaration of Conformity (or a "proforma" copy of the Declaration of Incorporation of the "Partly completed machinery" for the relevant machine. These have just an indicative value, and they shall not be considered substitutive of the actual Declaration of Conformity Incorporation subscribed by the supplier, and delivered separately to the Customer.
3. The **ROJ** User and Maintenance Manuals contain the information deemed important and necessary by the Manufacturer in order to:
   - Understand the principle of operation of the machine [1].
   - Carry out the handling/assembly/installation/connection operations under **Safety Condition**, taking into account the possible hazards connected with the above mentioned activities and providing the indications, prescriptions and suggestions resulting from a careful risk assessment performed by the Manufacturer following the principles of the Harmonized Standard EN 12100:2010 and of the Guide ISO/TR 14121-2.
   - Correctly use the machine in question (control devices, safety and emergency devices, operating procedures, etc.) under **Safety Conditions**, calling the operator attention on possible "Residual Risks", i.e. the risks that remain notwithstanding all the safety measures adopted against the risk assessment performed, as indicated on the previous point.
   - Carry out the ordinary/preventive maintenance operations on the machine [1] under **Safety Condition**, calling also in this case the maintenance technician attention on possible Residual Risks.
4. The **ROJ** User and Maintenance Manuals describe not only the intended used of the machine [1], but also the reasonably expected misuses, according to the experience accrued by the Manufacturer.

SAFETY

ROJ, after the risk analysis and assessment carried out following the principles of Harmonized Standard EN 12100:2010 (as described on point 3 above) selected the various control and safety system components, in such a way as to guarantee a reliability level suitable to the actual severity of the hazard. To this purpose, the prescriptions of the following Harmonized Standard have been followed: EN ISO 13849-1:2015. Where the severity of the hazard is high (3 or 4 according to the classification of EN 12100:2010 Standard), the countermeasures adopted are carefully evaluated in order to guarantee the necessary safety margins, through redundancy or over sizing principles.

The **ROJ** machines (1) respect the limits of Electromagnetic Immunity and Emission defined by the harmonized standard EN ISO 14982: 2009 for industrial environments

The **ROJ** User and Maintenance Manuals contain the updated list of the harmonized standards applied during the design stage to guarantee the compliance with the Essential Safety Requirement Listed on Annex I of 2006/42/EC Directive, while the design and implementation details are described on the Technical File kept by the manufacturer according to the prescriptions of Machinery Directive 2006/42/EC.

(1) The term "Machine" used within this manual refers generically to the definition given in 2006/42/EC Directive and thus combines both complete machines able to carry out a well-defined function and "Partly completed machinery" or equipment or drive systems not able to perform a defined function as they are intended to be incorporated in a complete Machine.

CE Identification Plate

The ROJ DMD2 motors are CE marked on the label placed on the motor body.

Label type valid for P/N 54T01097 and 54T01098

Label type valid for P/N 54T01085, 54T01090, 54T01099, 54T01111

Compliance with the Directives and European Regulations

Herein under a summary of the Declaration of Incorporation, prepared in accordance with the requirements of Annex II B to the 2006/42/EC Directive, with which **ROJ** declares that the following "Partly completed machinery":

Type:	DMD2 (P/N 54T01085, 54T01090, 54T01097, 54T01098, 54T01099, 54T01111, 54T01120, 54T01121)
Manufacturing year:	*See Official Declaration of Incorporation*
Serial Number:	*See Official Declaration of Incorporation*
Target use:	*Servomotors for Seed Drills machines*

can not be commissioned until the agricultural machine in which it will be incorporated will be declared compliant with the provisions of 2006/42/EC Directive - Annex II A - relating to Safety of Machinery, by the agricultural machine manufacturer or by system integrator

and that for its design and manufacturing the principles and concepts introduced by the applicable paragraphs of the following Harmonized Standards were adopted:

- EN ISO 12100:2010
- EN 50581:2012
- EN ISO 14982: 2009

The equipment complies with the requirements of the following Directives:

- 2014/30/EU - Electromagnetic Compatibility.
- 2011/65/EU - RoHS II and delegated Directive (EU) 2015/863

The person authorized to collect the Technical File is:
Ing. Luca Bagatin (luca.bagatin@roj.com)

The EHSRs (Essential Health and Safety Requirements) listed on Annex I of Machinery Directive 2006/42/EC met by **ROJ** are as follows:

1.1.1 - 1.1.2 - 1.1.3 - 1.3.2 - 1.5.5 - 1.5.6 - 1.5.11 - 1.6.1 - 1.7.1 - 1.7.2 - 1.7.3 - 1.7.4

The compliance with applicable EHSRs not included in the above list, shall be provided by the agricultural machine manufacturer or by system integrator.

In response to a reasoned request by the national authorities, ROJ is committed to send via e-mail or ftp relevant information on the partly completed machinery in question.

☞ *The above indications are merely indicative and shall not be considered as an "alias" of the actual Conformity Declaration signed and released by the Manufacturer.*

Warranty and Responsibility of the Manufacturer

The DMD2 motor described in this manual is designed to be incorporated into agricultural machines and it's therefore destined to work exclusively in combination with the above machines.

The installation of the various system components on the Seed Drill can be performed:

- by the Seed Drill manufacturer
- by specialized personnel authorized by **ROJ**

The test and commissioning of the system is in any case entrusted to specialized personnel.

ROJ rejects any responsibility in case of system installation not compliant with the assembly instructions provided in this manual or in case of system commissioning carried out without the **ROJ** authorization.

The end user must ensure that the equipment is used in accordance with the law and rules in force in the country of installation, in particular for what concerns the safety of workers and, more generally, with regard to the requirements for health, safety and accident prevention.

Possible claims must be notified promptly upon detection of any defect attributable to the DMD2 motor.

If, after a careful evaluation, the validity of the complaint is recognized, **ROJ** may, at its sole discretion, replace or repair the defective parts.

Other warranty terms

ROJ guarantees the quality and reliability of the equipment that has been designed and manufactured to provide optimal performance.

The warranty does not cover any damages or indirect costs due to machine downtime, or irregular operation caused by improper use of the equipment or of individual **ROJ** devices.

It is the responsibility of the end user to periodically perform cleaning and ordinary preventive maintenance activities, aimed at maintaining the equipment operation within the expected performance range.

The warranty expires in case of equipment failure due to improper connections.

The warranty does not apply in case of floods, fire, electrostatic/inductive discharges or in case of discharges caused by lightning or other phenomena external to the **ROJ** equipment.

The warranty does not cover possible damage to operators or other equipment/devices connected to **ROJ** equipment.

The customer is responsible for the proper use and proper maintenance of the equipment, according to the instructions provided in this operating manual.

Parts subject to normal wear are not covered by warranty.

Any other warranty form is excluded.

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1 - GENERAL INFORMATION

1.1 INTRODUCTION

1.1.1 The ideal solution for control and optimization for distributor control

The DMD2 motor is designed to be installed on agricultural machines, such as precision seeder metering units in order to control and optimize the distribution process.

1.1.2 Manual objectives

This manual has been prepared to supply the users of DMD2 with the essential information required to:

- Correctly install and connect the system components in safety conditions.
- Configure the system and program the various operation parameters according to the end-user needs.
- Perform ordinary preventive maintenance of the system in safety conditions.

1.1.3 How to Use this Manual

The manual is subdivided into 3 sections:

Section 1 – explains the main characteristic of the product and contains the notes and warnings for safety, in addition to the technical data.

Section 2 – describes the operations and procedures required for a correct installation and commissioning of the system.

Section 3 – contains the information and warnings necessary for the proper maintenance of the system.

1.1.4 Symbols used

☞ *Highlights notes, warnings and subjects to which the attention of the reader should be directed.*

It indicates a particularly critical situation, which could affect either the user safety or the correct system operation.

It indicates the obligation to dispose of the environment impact material, in compliance with the local regulations.

It indicates the activities executed through a simple but essential visual inspection.

1.1.5 Environment protection

Handling of electrical or electronic equipment at the end of the life cycle (Applicable to all countries of the European Union and to those countries where a separate collection of waste is in force).

This symbol shown on the product or on packaging indicates that the product itself shall not be considered as normal house-waste, but rather that it must be delivered to an appropriate collection point, for recycling of electrical and electronic equipment. Making sure that this product will be correctly disposed of, you will contribute to prevent potential negative effects to the environment and to the health, which otherwise could be caused by a non-adequate disposal. For more details about the recycling of this product, you may contact your municipal technical office, your local waste disposal service or your dealer.

The exhausted batteries must be correctly recycled into appropriate containers. DO NOT DISPERSE THE BATTERY IN THE ENVIRONMENT.

1.2 GENERAL INFORMATION AND PERFORMANCES

1.2.1 Introduction

The DMD2 is an application specific brushless motor with integrated orthogonal gearbox and electronic drive. The motor can be used to replace mechanical or hydraulics transmissions in agricultural or other off-highway applications (e.g. variable rate applications).

Application example are:

- Actuation of seeding element in pneumatic precision planting machines
- Actuation of seed distributor in air-drills or small grain planters
- Actuation of fertilizer and microganular spreaders in agricultural machines
- Salt, fertilizer, grain spreaders

The **main features** of the motor can be summarized as follows:

- Designed for 12V agricultural equipment
- CANOpen DS402 communication (speed and position control)
- Integrated brushless motor drive
- 2 digital inputs (eg. seed sensor or hopper level sensor)

1.2.2 Acronyms used

EHSR Essential Health and Safety Requirement of Annex I of Machinery Directive

PL Performance Level (level of reliability of the safety functions) according to EN 13849-1

AD Analog/Digital Converter

CAN Controller Area Network (BUS)

AP Access point

MD Motor with integrated drive

1.3 TECHNICAL DATA

DMD2	P/N:54T01085
Operational Temperature:	-10°C…+55°C (full specs) -10°C…+70°C (derated)
Storage Temperature:	-40°C…+80°C
IP grade	IP65
Vibrations	Sinusoidal vibration test: IEC 600-68-2-6 Random vibration test: IEC 600-68-2-64 Temperature change test: IEC 60068-2-14 Shock test: IEC 600-68-2-27
Nominal Torque at output shaft	4,5
Peak Torque at output shaft	6,75 (single pulse, duration 500ms)
Nominal Speed at output shaft	80 rpm
Gear ratio of integrated gear	1:26,85 axial planetary gear
EMC	The unit fulfills EN ISO 14982: 2000 standard (Agricultural and forestry machinery)
Supply voltage	11-16V Note: Voltage is intended at MD connector input pins. Voltage drop due to cable harness shall be taken into account.
Supply current (at nominal Torque, nominal Speed and minimum supply voltage)	6A
CAN	1 CAN bus line (compliant ISO SO 11898-2 and 5. Up to 1 Mbit/s)
Sensor interface	2 x inputs: 3 pin (8V – 80mA supply, GND, signal), up to 2,5 kHz suitable for NPN output sensors.
Safety switch input	Contact switch input to remove supply to power stage.
Daisy Chain CAN addressing line	Input and output signal for automatic CAN node assignement

1.4 GENERAL SAFETY INFORMATION

1.4.1 Design Criteria

The principles introduced by the relevant paragraphs of the following Harmonized Standards have been adopted in the design and manufacturing of the DMD2 motor:

EN ISO 12100: 2010	Safety of machinery - General principles for design - Risk assessment and risk reduction.
EN ISO 14982: 2009	Agricultural and forestry machinery - Electromagnetic compatibility - Test methods and acceptance criteria
EN 50581:2012	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

The compliance with the applicable paragraphs of the above listed standards allowed us to eliminate or reduce risks in the best possible way, during normal operation and during maintenance and/or adjustment tasks, for the entire life cycle of the machine.

All components have been carefully selected among those available on the market, and the materials used in manufacturing the system present no risk to the health and safety of persons.

In addition, for the DMD2 motor the safety measures aimed at eliminating or reducing within acceptable limits the residual risks, have been implemented *(see paragraph "warning information about the Residual Risks").*

In particular, the Essential Health and Safety Requirements of Annex I to Directive 2006/42/EC listed in the Incorporation Declaration have been respected.
The respect of non-listed requirements must be assured by the by the system integrator and shall be confirmed during the commissioning of the DMD2 motor system.

1.4.2 Safety Devices and Solutions

All moving parts of the gearmotors are adequately protected to prevent mechanical hazards and the parts of the driving device electrically powered are enclosed in casing with minimum protection degree IP65.

On the guards of seeding units a safety device (electromechanical microswitch or electromagnetic sensor) must be installed by the system integrator, to prevent the gearmotor start in case of guard open.

☞ *For more details, please refer to paragraph 2.2.6.*

This safety measure is not foreseen for the fertilizers and micro-granular distribution units, since the guard open condition does not involve exposure to hazards for the operator.

Access to components of the integrated drive inside the gearmotor can be carried out only using suitable tools and can be exclusively carried out by skilled and authorized staff, with machine stationary and disconnected from power sources.

Any attempt to remove or by-pass the safety measures installed, thus reducing the overall safety level, IS FORBIDDEN.

The responsibility for consequent damages to people and/or properties resulting from the non-fulfilment of recommendations will entirely fall upon the user.

1.4.3 Warning About Residual Risks

Notwithstanding all the safety measures taken and listed in the previous paragraph, some risks remain during installation, use and maintenance due to:

- the presence of electricity even in conditions of agricultural machine stationary
- the presence of potential high temperatures in the gearmotors units

During these stages you must then proceed with utmost care to avoid dangerous situations.
The presence of these residual risks is indicated by special warning labels attached to the containers of the gearmotor built-in drives.

It indicates the need to pay due attention to avoid the risk of burns.

1.4.4 Warning and Rules of Behaviour for the Operator

To avoid any dangerous condition for the operator or damages to equipment, we advise you to scrupulously follow the warnings and the rules of behaviour listed below.

☞ ***ROJ** will assume no liability for possible damage to people and/or properties deriving from non-observance of these warnings.*

- Operators shall be properly trained to use the equipment without risk, and must have read and understood the instructions and warnings given in this manual.
- Personnel performing installation and maintenance of the machine must read this manual before performing any electrical or mechanical intervention.
- Operators must wear appropriate clothing, avoiding or paying attention to:
  - fluttering clothes
  - necklaces, bracelets and rings
  - wide sleeves
  - long hair
  - hanging ties or scarves
- Before using the machine equipped with DMD2 motor ensure that any dangerous condition for safety has been appropriately eliminated, that all guards or other protective devices are properly installed and that all safety devices are efficient.
- Do not start the machine in case of anomalies.

DO NOT attempt to remove or by-pass any of the safety measures: doing so will reduce the safety level of the system.

DO NOT perform any type of work with machine powered.

At the end of every maintenance work, ensure that no used tool remained near the gearmotors.

☞ *Prior to startup the machine, restore and always check the correct functioning of the safety devices, if they have been de-activated during the operation.*

All environmentally hazardous materials to be eliminated after a maintenance work carried out on the equipment (such as electrical cables, components, etc.) must be disposed of in conformity with current laws.

1.4.5 Noise Levels

The DMD2 motor has been designed and manufactured to reduce the noise to minimum levels during operation.
In any case, since the only potential noise sources introduced by the DMD2 motor are negligible (<70 dBA) with respect to the noise produced by agricultural machine as a whole, the determination of the weighted sound pressure level generated by the whole machine is the responsibility of the manufacturer of the machine itself and/or of the end user.

1.4.6 Proper and Improper Use

The DMD2 motor is designed to be incorporated in agricultural machines.

The DMD2 motor use for different purposes, can cause injuries or damages to the machine itself and it is considered **Improper Use**, which the Manufacturer cannot be responsible for.

1.4.7 Safety and reliability of control systems

On the Seeding Machine where the DMD2 Servomotor will be installed, a safety control system compliant with the requirement of Harmonized Standard EN ISO 13849-1:2015 shall be implemented by the system integrator.

Such safety control system shall inhibit the motor operation in case of metering unit guard open.

According to the Risk Analysis and Assessment carried out by ROJ, the Performance Level Required for the above mentioned safety function is:

PLr = c, cat. 1.

This shall be confirmed by the system integrator.

☞ *For more details about the safety devices recommended by ROJ, please refer to paragraph 2.2.6.*

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2 - INSTALLATION

2.1. DMD2 CHARACTERISTICS

For more information, please refer to the following documents enclosed:

- *TD_DMD2_revH.pdf or later revision.*
- *54T01085d00_cl.pdf or later revision*

2.1.1. Output shaft torque and speed

The following characteristics refer to the variables of the geared motor outlet shaft (slow shaft)

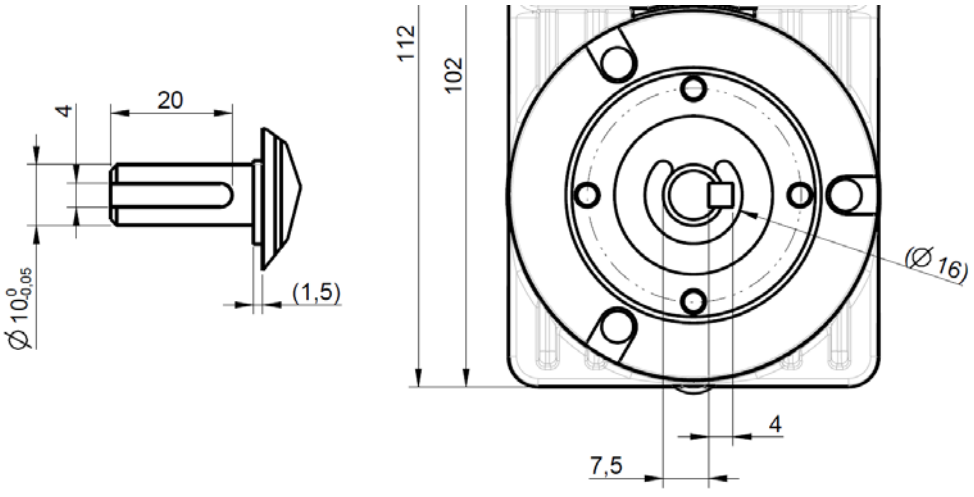
Nominal Torque at output shaft	4,5
Peak Torque at output shaft	6,75 (single pulse, duration 500ms)
Nominal Speed at output shaft	80 rpm

The application must have the torque and speed requirements compliant with such indications

.

The usage of the motor outside the above limit will cause permanent damage to the motor and/or reduce its life-length.

2.1.2. Output shaft dimension



For more details, refer to 54T01085d00_cl.pdf or later revision

2.2. INSTALLATION

2.2.1. General principles

The fastening of motors to the machine, whether they are used for the seeding disc shaft or the fertilizer or micro-granular distributor shaft rotation, must be carried out in order to ensure a perfectly aligned coupling between the disk/distributor shaft and the gear output shaft.

In the absence of a perfect alignment, radial forces may occur on the bearings, causing an increase of the necessary torques and a reduction of the device life.

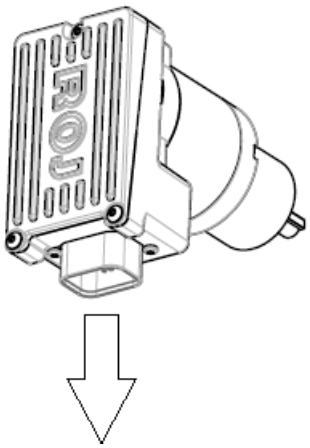
In order to relieve the bearing stress, an elastic coupling can be used. This one is not supplied with the motor kit and it must be chosen and dimensioned according to the application.

2.2.2. Output shaft axial/radial forces limitations

- Maximum axial load: 100N
- Maximum radial load: 200N

2.2.3. Orientation limits

It is preferable to mount the DMD2 motor so that the connector is facing downward to prevent stagnation of water over the sealing gaskets.



2.2.4. Water ingress protection

Motor has a **IP65** rating, excluding the front flange/output shaft.

☞ *The system integrator shall provide means of protecting this surface when integrating the motor into the machine*

2.2.5. Output connector

The output connector on the motor is a AMP Ampseal 14 poles, with the following pinning:

Pin	Signal
1	POWER +12V
2	GND
3	SENSOR_POWER (8V-80mA)
4	SENSOR_POWER (8V-80mA)
5	AUX_IN
6	CAN_H
7	CAN_L

Pin	Signal
8	MOTOR_ENABLE_OUT
9	SEED_SENSOR_CNT
10	CAN_SYNCHR_OUT
11	CAN_SYNCHR_IN
12	MOTOR_ENABLE_IN
13	SENSOR_GND
14	SENSOR_GND

It matches with connector **AMP Ampseal 776273-1**.

☞ *ROJ can supply standard motor cable harnesses in various lengths and power distribution boxes.*

2.2.6. Safety switch

A safety switch shall be connected to signals MOTOR_ENABLE_IN/ MOTOR_ENABLE_OUT. If the contact is open, the DMD2 cannot rotate.
The safety switch must be implemented using:

- an electro-mechanical switch with “positive opening” NC contact (condition indicated by the symbol ⊖)
  or
- an electromagnetic sensor with high reliability (e.g. SICK RE11-SA03 or equivalent)

☞ *In order to ensure the requested safety level (Performance Level = c – see paragraph 1.4.7), it is necessary to provide a safety contact with the following characteristics:*

- B10d >= 2 x $10e^6$ *(see note below)*

Note: B10d is the reliability parameter declared by the device Manufacturer that corresponds to the number of switching operations guaranteed without errors.

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3 – MAINTENANCE AND TROUBLESHOOTING

3.1 GENERAL INSTRUCTIONS ABOUT MAINTENANCE WORKS

Thanks to its intrinsic sturdiness of the DMD2 motor, heavy preventive maintenance works are not required.
However, to guarantee high reliability levels and avoid hazard conditions, it is advisable to scrupulously read the instructions and warning listed hereunder.

For safety reasons, all maintenance works on the transmission devices must be carried out EXCLUSIVELY with machine stationary and disconnected from the electric power supply, by qualified and trained maintenance personnel having sufficient experience and knowledge of the DMD2 motor.

Prior to start the maintenance works, thoroughly clean the relevant zone.
Do not use solvents!

All environmental impact materials that is necessary to eliminate as a result of maintenance operations (such as lubricants, dirty clothes, filter elements) must be disposed of according to applicable regulations.

Make sure that unauthorized personnel CANNOT have access to the working area during the maintenance activity.
After the intervention, check that no tool used is left inside the equipment or electrical cabinet.

3.2 ORDINARY PREVENTIVE MAINTENANCE INTERVENTIONS IN CHARGE OF THE OPERATOR

Operation	Frequency	Notes
Cleaning	Before long periods of inactivity	Unit is rated IP65, DO NOT clean with pressure water
Tightening check	Every year, after long periods of inactivity (ex. at the beginning of the seeding season)	
Lubricate replacement	Not necessary	The motor is equipped with maintenance free planetary gearbox, lubricated with grease.

3.3 MAINTENANCE / REPAIR RESERVED TO SPECIALIZED PERSONNEL

Operation	Frequency	Notes
Check safety devices operation	At the beginning of each season	The check can be done by activating the motors, and verifying that when opening the safety contact of each DMD2, the motor stops its movement.

ENCLOSURES

- *TD_DMD2_revH.pdf or later revision.*
- *54T01085d00_cl.pdf or later revision*

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ISO 9001 Certificates by DNV from 1996
ISO 9001:2008 Certificates in 2009