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To whom it may concern

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Repairs or modifications made by companies other than the OEM (Original Equipment Manufacturer)

Legal Note: *This paper should serve only as a reference and overview: it is meant to provide guidance in the assessment of risks related to repairs or modifications made by companies other than the OEM. It neither addresses each and every imaginable scenario, nor is it a binding interpretation of the existing legal framework. It does not replace the study of the relevant directives, laws and regulations. In addition, the specific features of different products and their various applications have to be taken into account. This is why the assessments and procedures referred to in this paper may be impacted by a large variety of circumstances. Accordingly, a number of other interpretations are also possible*

Summary:

Crane owners and insurance companies should be informed about the potential risks related to crane repairs performed by 3rd party companies or persons not accredited or recognized by the OEM. The risks described in this paper depend on various circumstances, and are subject to applicable local regulations.

Companies other than the OEM (and its recognized partners) often do not have the appropriate or complete knowledge of the product and the manufacturing processes which are necessary to evaluate and carry out repairs, particularly when load bearing parts and/or safety related components are involved. Some crucial examples of this data include:

- Product knowledge: engineering data such as CAD and Finite Element models, calculation rules and tools, material specifications, acceptance criteria of components, etc.
- Process knowledge: e.g. welding and heating parameters, possible restrictions in material grade (range of strength, thickness, etc.)
- Comprehensive procedural knowledge: criteria for crane acceptance, including load testing methods and validation, overhaul inspection, etc.
- Supplier supported ability to re-certify assemblies contingent of the affected parts of the crane

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Repairs and modifications done by companies other than the OEM and its affiliated entities may lead to the following issues:

- increased risks of accidents and/or machine failures (for current, and potential future owners)
- possible non-compliance (e.g. loss of validity of the Declaration of Conformity [CE] within the EU)
- loss of warranty
- the crane manufacturer may refuse service request, and discontinue providing spare parts.

Regarding spare parts, some companies, not authorized by the OEM claim to manufacture parts according to the original specifications and with the same quality as the original. Manufacturing of counterfeit parts is usually illegal and those involved may be subject to legal prosecution in some countries. Owners may also be impacted in such situations because the crane may thereafter be prohibited for use by local authorities until restored back to original condition.

In conclusion it is highly recommended that owners contact their OEM for guidance before performing any major repair or modifications whether by themselves, or contracted to another company, particularly when this work involves the load bearing parts, or safety relevant components (such as the rated capacity limiter and control systems).

Background:

The repair and modification of crane safety related components and load-bearing structures often require detailed information of the product and the manufacturing processes used to build the product which are proprietary to the manufacturer. The repair must also be validated, i.e. the repaired/modified crane must pass acceptance test which may include calibrations, adjustments and overload testing in order to complete the final post repair / modification commissioning.

Only companies with the knowledge mentioned above should conduct such repairs or modify the machine. It is understood that the OEM and its authorised repair companies will have this knowledge.

It is also highly recommended that completed repairs or modifications to safety relevant components and/or load-bearing structures are approved by the OEM to ensure that the original standards of strength and safety have been maintained.

TEREX Cautionary Statement:

If a crane repair or modification does not follow OEM recommendations, or is executed by a company not recognized by the OEM as a qualified workshop, or if non-OEM spare parts are used, the resulting consequences may be:

- the OEM will not bear any responsibility for lack of compliance related to the repair, *and*
- the validity of the load capacity of the crane and the load capacity charts cannot be confirmed by the OEM, *and*
- the OEM warranty may no longer be valid, *and*
- service and spare parts support request may be refused by the OEM.

When major repairs or modifications are planned, OEM's strongly encourage crane owners to contact them for guidance. This will enable the OEM to consider and consul as to if the repair or modification can safely, and with minimal risk, be executed by an unaffiliated third party entity.

TEREX strongly recommends crane owners plan to repair their machines with the assistance of the OEM or its appointed workshops for the following reasons:

- A repair or modification done by the OEM is done according to the original specifications and with the required technical knowledge (e.g. verifiable material, specified welding and manufacturing procedures, certified and competent welders, specific testing procedures in accordance with the affected parts). Much of this technical knowledge is proprietary intellectual property of the OEM and will not be shared with third parties.
- The repair or modification will be properly evaluated in terms of conformity to applicable regulatory requirements
- Post repair or modification assessment verification will be properly documented by the OEM; these documents in turn may be requested by local authorities to receive continued use permits.
- OEM's cannot comment on re-sale value of cranes that have repairs done by companies not authorized by the OEM.
- The crane documentation may list some repairs that should be performed exclusively by the manufacturer, or by one of its accredited companies.
- A repair by the OEM can be combined with a general inspection of the crane. This would include an evaluation of wear, and extenuating damages to other parts/components; in addition the OEM can confirm if any updates to the machine are unresolved.

Note: The OEM is the entity that is able to proficiently create the appropriate repair procedures after having reviewed the damage. The repair procedure established by the OEM is only valid for one repair and must not be used for something similar on another machine. Only the OEM has all of the technical data necessary to perform an evaluation from a product design standpoint (strength margins, compliance to product and welding standards, calculations, etc.), and the OEM can accurately test the crane to validate the repaired/modified part(s) without affecting other parts of the machine. The OEM is adequately equipped and has the required infrastructure, and equipment to test the machine in a controlled and safe environment.

Applicable legislation:

Cranes are designed according to applicable international standards:

In Europe, Cranes are marked with CE decal which is a declaration of conformity to the machinery directive issued for each crane. If a major modification has to be made to the machine, the risk assessment must be reviewed. If needed, complementary calculations have to be performed and the crane needs to be finally tested to validate the modification or repair made. The risk assessment as well as the validation process can require specific OEM knowledge related to the engineering and manufacturing of the crane.

According to Annex II 1.A. of the Machinery Directive, *“the CE declaration of conformity related exclusively to the machinery in the state in which it was placed on the market, and excludes components which are added and/or operations carried out subsequently by the final user.”* And in the official guide §382: *“the manufacturer is not legally responsible for any additions or modifications made to the machinery without his authorization by other economic operators or by the final user.”*



In the USA, the OSHA rules for Cranes and Derrick in Construction requires the crane owner and/or a qualified or competent person assessing the modification to inform the crane manufacturer about any modification/addition or repair affecting the safe condition of the machine and to get its approval (See in annex B extracts of the OSHA rule 1926.1412: Inspections and 1926.1434: Equipment modifications)

Note: as an example, a repair consisting of a partial replacement (patchwork) of part of a telescopic boom section can be considered a modification as such (change of the initial design and typically additional not foreseen welds); this can potentially affect the safe operation of the crane (refer to OSHA 1926.1434 and EU Machinery Directive Art. 2 and §82, §94, §140 in the official Guide)).

Typical examples in form of case studies are described in annex A.

A handwritten signature in black ink that reads "Klaus Meissner".

Klaus Meissner
Director Product Integrity
Terex Cranes

Annex A

Illustrative case studies:

Following are examples illustrating the risks induced by a repair done by a 3rd party not having the adequate product knowledge:

Typical case 1:

Following a boom collapse of a telescopic crane, the owner asked a 3rd party to repair the damaged boom section. The 3rd party made a quotation of the repair that was below the repair price made by the OEM. The main difference was that the OEM repair offer was based on the replacement of the whole section shell, whereas the 3rd party intended to repair only a partial area (patchwork-wise). Because the 3rd party did not own the detailed technical documentation of the crane (in this case typically the Finite Element model of the boom section showing the stress peaks and the corresponding safety margin as required in the product standard), he could not check if a partial repair of the shell was sufficient in regards to safety for this special case and therefore offered a repair that was cheaper and quicker but not any longer in compliance with the required product standard and directive.

The OEM cannot bear the responsibility for the repair of this machine..

NOTE: partial replacement of boom shells may be a possible repair solution but needs to be evaluated and approved in terms of resistance and safety factors on a case by case basis.

Typical case 2:

Another typical case is when the OEM uses special material properties such as increased yield or tensile strength for load bearing parts (e.g. material specifications defined by the OEM are above standard and require special treatment by the manufacturers); such type of specifications are not known to 3rd parties since this is special know-how of the OEM. A 3rd party usually orders standard raw material such as sheets in standard dimensions and with the standard material properties.

If the 3rd party proceeds with the repair using parts that have mechanical properties beyond those specified by the OEM, the strength margins of this part may be compromised and may lead to unsafe situations.

Typical case 3:

Some repairs or modification require either a calibration/adjustment or at least a verification of the settings and adjustments of the Rated Capacity Limiter (RCL). This can only be done by the OEM or authorized persons who have access to the RCL program and to the parameters to be adjusted.

In the case of a crane accident where the sensors (angle sensor, length sensor, pressure sensor, etc.) have been overloaded or severely shaken during the incident, this verification is crucial to ensure the accuracy of the RCL.

NOTE: the accuracy of the RCL, especially for the cut-off limits is defined in the product standards and non-compliance to these requirements may create unsafe situations and would lead to non-compliance with the relevant standards.

Annex B

OSHA rule – Extract

(Source: <http://www.osha.gov/doc/cranesreg.pdf>)

§ 1926.1412 Inspections.

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(b) *Repaired/adjusted equipment.*

(1) Equipment that has had a repair or adjustment that relates to safe operation (such as: a repair or adjustment to a safety device or operator aid, or to a critical part of a control system, power plant, braking system, load-sustaining structural components, load hook, or in-use operating mechanism), must be inspected by a qualified person after such a repair or adjustment has been completed, prior to initial use. The inspection must meet all of the following requirements:

(i) The qualified person must determine if the repair/adjustment meets manufacturer equipment criteria (where applicable and available).

(ii) Where manufacturer equipment criteria are unavailable or inapplicable, the qualified person must:

(A) Determine if a registered professional engineer (RPE) is needed to develop criteria for the repair/adjustment. If an RPE is not needed, the employer must ensure that the criteria are developed by the qualified person. If an RPE is needed, the employer must ensure that they are developed by an RPE.

(B) Determine if the repair/adjustment meets the criteria developed in accordance with paragraph (b)(1)(ii)(A) of this section.

(iii) The inspection must include functional testing of the repaired/adjusted parts and other components that may be affected by the repair/adjustment.

(4) Equipment must not be used until an inspection under this paragraph demonstrates that the repair/adjustment meets the requirements of paragraph (b)(1)(i) of this section (or, where applicable, paragraph (b)(1)(ii) of this section).

§ 1926.1434 Equipment modifications.

(a) Modifications or additions which affect the capacity or safe operation of the equipment are prohibited except where the requirements of paragraphs (a)(1), (a)(2), (a)(3), (a)(4), or (a)(5) of this section are met.

(1) *Manufacturer review and approval.*

(i) The manufacturer approves the modifications/additions in writing.

(ii) The load charts, procedures, instruction manuals and instruction plates/tags/decals are modified as necessary to accord with the modification/addition.

(iii) The original safety factor of the equipment is not reduced.

(2) *Manufacturer refusal to review request.* The manufacturer is provided a detailed description of the proposed modification/addition, is asked to approve the modification/ addition, but it declines to review the technical merits of the proposal or fails, within 30 days, to acknowledge the request or initiate the review, and all of the following are met:

(i) A registered professional engineer who is a qualified person with respect to the equipment involved:

(A) Approves the modification/addition and specifies the equipment configurations to which that approval applies, and

(B) Modifies load charts, procedures, instruction manuals and instruction plates/tags/decals as necessary to accord with the modification/addition.

(ii) The original safety factor of the equipment is not reduced.

(3) *Unavailable manufacturer.* The manufacturer is unavailable and the requirements of paragraphs (a)(2)(i) and (ii) of this section are met.

(4) *Manufacturer does not complete the review within 120 days of the request.*

The manufacturer is provided a detailed description of the proposed modification/addition, is asked to approve the modification/ addition, agrees to review the technical merits of the proposal, but fails to complete the review of the proposal within 120 days of the date it was provided the detailed description of the proposed modification/addition, and the requirements of paragraphs (a)(2)(i) and (ii) of this section are met.

(5) *Multiple manufacturers of equipment designed for use on marine work sites.*

The equipment is designed for marine work sites, contains major structural components from more than one manufacturer, and the requirements of paragraphs (a)(2)(i) and (ii) of this section are met.

(b) Modifications or additions which affect the capacity or safe operation of the equipment are prohibited where the manufacturer, after a review of the technical safety merits of the proposed modification/addition, rejects the proposal and explains the reasons for the rejection in a written response. If the manufacturer rejects the proposal but does not explain the reasons for the rejection in writing, the employer may treat this as a manufacturer refusal to review the request under paragraph (a)(2) of this section.

(c) The provisions in paragraphs (a) and (b) of this section do not apply to modifications made or approved by the U.S. military.

Annex C

European Machinery Directive – Extract

(Source: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:157:0024:0086:en:PDF>)

ANNEX II

Declarations

1. CONTENT

A. EC DECLARATION OF CONFORMITY OF THE MACHINERY

This declaration and translations thereof must be drawn up under the same conditions as the instructions (see Annex I, section 1.7.4.1(a) and (b)), and must be typewritten or else handwritten in capital letters.

This declaration relates exclusively to the machinery in the state in which it was placed on the market, and excludes components which are added and/or operations carried out subsequently by the final user.

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Guide to application of the Machinery Directive 2006/42/EC (2nd Edition 2010)

(Source:

http://ec.europa.eu/enterprise/sectors/mechanical/files/machinery/guide_application_directive_2006-42-ec-2nd_edit_6-2010_en.pdf)

§382

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The second paragraph of Annex II 1 A underlines that the EC Declaration of Conformity relates only to the machinery as it has been designed, constructed and placed on the market by the manufacturer. If the manufacturer authorizes another economic operator such as an importer or a distributor to modify machinery before it is supplied to the final user, the manufacturer remains legally responsible for the machinery as supplied. However the manufacturer is not legally responsible for any additions or modifications made to the machinery without his authorization by other economic operators or by the final user. This must be taken into account when machinery in use is examined by the market surveillance authorities.