International Standard 7130

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Earth-moving machinery — Guide to procedure for operator training

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

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Belgium	Ireland	United Kingdom
Brazil	Italy	USA
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Finland	Romania	

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India
Poland

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Earth-moving machinery — Guide to procedure for operator training

0 Introduction

In preparing this guide it has been assumed that the candidates for basic operator training will be without any significant operational experience with the types of machine specified, and that candidates for more advanced training will previously have received training to the standard included in the basic training syllabus.

Proper selection of potential operators is essential if training is not to be wasted on unsuitable candidates. Earth-moving machinery operation is arduous, skilful work, often carried out in poor site conditions and a high degree of aptitude and enthusiasm is required. Candidates must be medically fit, sufficiently robust physically, and well-coordinated with good reflexes.

1 Scope and field of application

This International Standard specifies the nature of operator training appropriate for earth-moving machinery. It does not specify any procedure for proficiency or assessment of competence of an operator's ability, since these factors are usually covered by local and national procedures and regulations. It does not specify who is responsible for the training. It applies to machines as defined in ISO 6165.

2 References

ISO 4510, *Earth-moving machinery — Maintenance and adjustment tools*

ISO 6165, *Earth-moving machinery — Basic types — Vocabulary.*

ISO 6405, *Earth-moving machinery — Symbols — Operator controls and others.*

ISO 6750, *Earth-moving machinery — Operation and maintenance — Guide to the format and content of manuals.*

3 Structure of training programmes

3.1 General

The content of each individual training programme should be integrated within the scope of all the programmes to provide a sequence of operational development from elementary principles to competent operation of the most sophisticated machines. Whilst the actual content of a programme may be adjusted to suit individual conditions, the sequence of development should be observed.

For practical machine operator training it is desirable that no more than two trainees per machine are under instruction at any one time, with a maximum of three machines under supervision by each instructor. Wherever practicable, and particularly during the first few hours of training, it is desirable that one instructor should be allocated to each machine. During the first four hours of practical machine operation, however, one instructor should not be expected to supervise more than four trainees using two machines.

3.2 Safety

Throughout the training it must continually be emphasized that one of the **MOST IMPORTANT** aspects of machine operation and servicing is **SAFETY** (see 6, 4.1 and 6.2.15).

3.3 Stages of training

3.3.1 General basic training

The objective is to impart to the trainee operator the essential knowledge and skills fundamental to correct machine operation. It should include : the principles of starting and stopping; the maintenance of basic mechanisms such as engine, transmission, etc.; basic dimensional data such as length, width, mass, ground bearing pressure, speed, etc.; an appreciation of the factors affecting machine productivity; the interpretation of diagrams and load charts; significance and use of operator instruction manuals; operation of basic machines, for example small dumpers, wheeled and crawler machines in basic applications (see 4.1 to 4.3).

3.3.2 Operator's training record book

This book may be issued to all operators on completion of the general basic training course. Details of further training courses and site operational experience should subsequently be entered (see clause 5).

3.3.3 Advanced training for specialized groups of machines

This training is only to be given after successful completion of general basic training. It covers the operation of specific machines within a group (see 6.1 to 6.3).

3.3.4 Specialized "in field" conversion or "retraining" courses

This training is to give experienced operators, who have completed advanced training for a machine group, further training to enable them to transfer from one type of machine to another within that group. Normally this training will be carried out on construction sites (see clause 7).

3.3.5 Refresher courses

These courses are given on site or at a training centre as appropriate to operational circumstances, so that an operator may be kept up to date with developments of machines and improvements and changes in operating techniques. Also to retrain operators who have not used a particular machine for some time (see clause 7).

3.3.6 Record of training course completion

A certificate specifying the content may be issued on successful completion of any training course (see clause 8 and annex).

IMPORTANT

The further development of an operator's abilities can only be achieved from the experience gained by working during normal site operations and under adequate supervision. This is a continuing process and most training experience must of necessity fall within this activity. No specific programme is included in this guide since it must depend upon local conditions and requirements. However, the content of 6.2.14 is typical of the scope for operator further development guidance during site productive employment.

4 General basic training

This syllabus specifies the minimum training to develop the necessary basic operational skills for earth-moving machines and the maintenance of their basic mechanisms. Appreciation of essential technical quantities and terms and the significance of information in operator instruction manuals is included. The training content should be suitably balanced between lectures/demonstrations and practical work in the workshop and under suitable site conditions. The actual training methods or training aids to be used are not specified in this guide, due to variations in local conditions and availability of equipment.

4.1 Safe operation

Safety practices and accident prevention must be a constant feature of all basic and advanced instruction. Safety should be given priority during training in operator skills, and particular care must be taken to discourage the adoption of "unsafe" habits during initial training. Emphasis should be given to operator manual safety messages and data, and attention drawn to safety signs and symbols on the machine, especially where recognized ISO and/or other symbols are used. The significance of structural (for example, ROPS) safety devices and visual and audible alarms, including the importance of their remaining fully intact and operational at all times should be fully explained. Correct use of hand and other signals should be included.

4.2 Typical content

a) Use of operator instruction, lubrication and safety manuals (see ISO 6750).

b) Development of ability to use fully the relevant information shown in diagrams and symbols (see ISO 6405).

c) Basic dimensional data, for example, mass, ground pressure, speed, etc.

d) Actual machine operation in basic applications, including an appreciation of the factors involved in maximising machine productivity.

e) Use of load charts related to machine capability and stability.

f) Operator maintenance of items such as engine, transmission, cooling system, lubrication, battery, tyres, tracks, brakes, etc., including use of tools (see ISO 4510) and maintenance and lubrication manuals (see ISO 6750).

g) Starting and stopping, indicating precautions.

h) Purpose and use of instruments on dashboard and elsewhere.

i) Principles and use of air and hydraulic control systems relative to operator's responsibilities.

k) Operator's general duties and particularly the limits of those duties in machine assembly and dismantling, changing equipment, maintenance and servicing, etc.

l) Correct and safe practices to ensure accident-free operation.

m) Daily "walk-around" inspection to cover items specified in operator manual (see ISO 6750).

4.3 Duration and location of course

The time indicated is a minimum and is for the training of literate and receptive candidates. Wherever possible, and for less literate persons (particularly those not familiar with the language of instruction) the course length should be increased as necessary.

The course should be carried out at an established training centre, or under adequate supervision on a manufacturer's or contractor's test or construction site.

The training syllabus content and course duration should be related to the trainees' educational background. The minimum instruction duration should preferably be not less than 40 h but whenever necessary this should be increased as appropriate.

The course should include sufficient classroom work to cover the level of technical competence needed, and the remainder of the instruction should be carried out on actual machines.

This practical instruction can be undertaken either at a training establishment or on a suitably selected operational site.

5 Operator's training record book

When an operator has completed a general basic course he may be issued with a training record book which will serve as a record of his future experience in operating the various groups of earth-moving machinery.

The book will be in two sections, the first for entry of details of courses attended and the second will be a chronological record of operational experience.

5.1 Formal training courses

This section can be set out to record details of courses attended, together with the authorisation by the training supervisor and organization represented, or, alternatively, the section can consist of a series of blank pages to which formal certificates signed by the trainer(s) can be attached.

5.2 Chronological operational experience

The purpose of this section of the book is to record types of machine actually operated by the individual on construction projects.

The record should be set out as indicated in the annex and information inserted under the following headings :

a) name of employer;

b) machine group;

c) detail of machine (or machines) operated;

d) dates of commencement and termination of operation of a particular machine;

e) signature of person responsible for training.

6 Advanced training for specialized groups of machines

This training is intended for operators who have achieved sufficient experience following completion of a general basic course, to acquire advanced level operator skills.

A single course syllabus will only cover one of the groups of machines listed, other groups will be covered by courses of equivalent standard. The machines will be grouped in categories of general similarity.

As for basic training (see 4.1) **SAFE OPERATION** shall be a constant feature during all training. Some elements of safe practices may only be fully appreciated by a trainee towards the end of his course, at which time these aspects should be re-emphasized. Typical examples are shown in 6.2.15.

6.1 Groups

The suggested groupings for the main types of earth-moving machines are as follows :

a) group A, tractors (wheeled and crawler) including equipment, and general principles for towing scrapers, etc.;

b) group B, excavators;

c) group C, loaders;

d) group D, dumpers;

e) group E, tractor scrapers;

f) group F, graders;

g) group G, rollers/compactors (towed, self-propelled, single and multiple roll, both plain and vibratory, pneumatic tyred);

h) group H, miscellaneous plant (courses to be scheduled as necessary for such items as trench diggers, etc.).

6.2 Typical training content for a machine group

The general content will cover the items included in 4.2 which are applicable to the particular machine group, but the instruction will be in the greater detail and depth necessitated by a specialized training programme. The minimum content is as follows.

6.2.1 Introduction to machine

Uses, general design features, data, functions and general limitations. Classroom work followed by machine review by inspection.

6.2.2 Operator's controls

The following instruction should be included :

a) description and use of the operator's controls;

b) layout of the controls with respect to the operator at his post;

c) identification of instrumentation.

6.2.3 Commissioning, starting and stopping

Include information regarding the different preliminary checks, the instructions and the safety controls that must precede putting a machine into operation such as :

a) The checks and verifications to be performed prior to starting the machine, for example :

— fluid levels and inspection for leaks;

— loose, worn and missing parts;

— removal of built-up material on tracks, axles and undercarriage;

— tyre pressure and condition of tracks, and whilst walking around the machine ensure no person is in danger.

b) Sequential order of operations to start the engine :

— position of the controls;

— starting the engine at various ambient temperatures and in adverse climatic conditions.
WARNING : if jump starting, observe relevant safety precautions in operator's manual.

c) Sequential order of operations to stop the machine :

— operations to halt machine;

— operations to park machine (positions of controls and equipment, and any necessary pressure bleed-off such as for steering accumulators);

— period of idling;

— operations to stop engine;

— safety locking.

6.2.4 Daily operation

Demonstrate the role of the different operating controls and how to use them, as follows :

a) Daily checks to be performed prior to operating the machine :

— position seat and adjust (if provided) steering column, clean compartment and windows. Ensure entrance and exit is free from obstruction;

— instrumentation checks (oil pressure, etc.);

— warm-up;

— systems checks (steering, brakes, etc.).

b) Checks to be performed while operating the machine :

— instrumentation checks;

— function of warning devices;

— operator safety warnings.

c) Advice on efficient operation :

— selection of gears;

— steering;

— operation of equipment;

— operation techniques;

— stopping and parking;

— operating adjustment (i.e. dozer angle, etc.);

— daily precautions after work;

— emergency operation;

— advice on action to be taken in case of brake or steering failure, etc.

6.2.5 Preparation for mounting of equipment

a) Operation to be performed.

b) Use of operator's tool kit.

c) Precautions to be taken.

6.2.6 Movement of machine between work sites

a) Driving on the road (example, follow the traffic regulations with respect to construction machinery).

b) Method of loading and securing on a road vehicle or railway platform car.

c) Methods of handling including sling points, towing attachment, etc.

6.2.7 Special conditions of use

a) Precautions to be taken during cold weather:

— refer to manufacturer's manual and relevant service bulletins regarding cold weather operation;

— refer to lubrication manual (see ISO 6750) regarding lubricants, hydraulic fluids, coolants, etc.;

— special precautions (for example, electrical equipment, starting motor, etc.);

— operations to warm up machine.

b) Precautions to be taken during hot and/or humid weather.

c) Precautions to be taken for utilization in water, mud, etc.

d) Precautions to be taken for utilization in dusty atmospheres.

e) Precautions to be taken for other special conditions, for example, high altitude or corrosive atmospheres.

6.2.8 Fuels, lubricants, hydraulic fluids, coolants, etc.

Instruction in the use of fuels, lubricants, etc as specified in the manufacturer's lubrication manual (see ISO 6750) should be included :

a) specifications of the fuels, lubricants, hydraulic fluids, coolants, etc. to be used;

b) precautions and the importance of cleanliness, etc. (see ISO 6750);

c) tank and circuit capacities in litres (gallons);

d) follow manufacturer's instructions for pressure refuelling.

6.2.9 Methods of lubrication and precautions

The following instructions should be included :

a) daily reading of the hour meter (it is this operation which determines the time of the lubrication operations);

b) use of lubrication schedule in manufacturer's manual at appropriate intervals (see ISO 6750);

c) general recommendations regarding safety while lubricating a machine (for example, do not grease a machine which is not parked according to the manufacturer's instructions, take precautions to prevent fire);

d) emphasize other precautions :

— avoid mixing lubricants, flush before refilling;

— ensure the machine is level before filling sumps and tanks;

— oil should only be changed with the engine hot;

— clean carefully all lubricating fittings, breathers, oil check windows, etc.;

— change/clean all filters as appropriate;

— check the condition of the sealing gaskets (do not forget to put them back);

— when an engine is drained clearly mark it so that it is not operated before it is refilled.

6.2.10 Routine servicing of hydraulic and air systems

Emphasize precautions specific to these systems.

6.2.11 Routine and preventive maintenance

Include the maintenance operations and their frequency as specified in the manufacturer's maintenance manual (see ISO 6750).

6.2.12 Field repairs and malfunctional problems

a) Repairs and adjustments which can be carried out with the operator's tool kit (see ISO 4510), refer to manufacturer's maintenance manual (see ISO 6750).

b) Location of troubles with particular reference to the classified information in the manufacturer's maintenance manual (see ISO 6750).

6.2.13 Operator identification of parts for routine requirements

Importance of accurate and intelligent use of the information in the manufacturer's parts manual (see ISO 6750).

6.2.14 Optimum machine performance and output

Guidance to indicate good practice to maximise machine productivity, with minimum operator uneconomic effort, and minimum fuel consumption and wear and tear, should be included at all stages of the instruction, taking account of the necessity to work safely. Preferably, a specific period of instruction should be given at the end of the course to emphasize operation for productivity to include for example :

a) positioning of an excavator or similar machine to ensure minimum arc of swing (and, therefore, minimum cycle time);

b) operation of tractor scrapers to take full account of ground conditions and weather conditions (it may improve hourly output and greatly reduce wear on the machine to operate with reduced bowl capacity in very wet and muddy conditions);

c) development of proficiency in grading, rock ripping, operation on slopes (including transverse slopes) etc., necessity to observe caution when turning on side slopes;

d) adjustment of tracks to take account of ground, movement per cycle, amount of slewing, etc. to achieve maximum output with minimum machine wear and operator fatigue;

e) establish a proficiency standard to a recognised evaluation procedure.

6.2.15 Safety — general

Re-emphasis at the end of the course in the observation of safety by the operator, typical subjects being :

a) regarding the machine (for example, chocking the wheels, parking, etc.);

b) regarding the site (for example, do not work on a machine on a slope which is liable to collapse);

c) do not work under overhanging embankments or undercuts;

d) ensure buckets, blades and similar items are lowered to ground after completing the work;

e) watch for trees and branches and high voltage lines;

f) ensure all safety devices are always intact and fully operational, including, for example, emergency brakes and steering, reverse alarms and seat belts;

g) greasing and other servicing or repair work should not be carried out when the engine is running;

h) identification of safety signs and symbols;

j) one of the **MOST IMPORTANT** aspects of training and machine operation is **SAFETY**.

6.3 Duration and location of the training course

The actual duration will depend upon the category and complication of the individual machine, and wherever possible the course length should be increased as necessary.

a) The course should include sufficient classroom work to cover the level of technical competence needed, and the remainder of the instruction should be carried out on actual machines.

This practical instruction can be undertaken either at a training establishment or on a suitably selected operational site.

b) The minimum instruction duration for this advanced training for most groups of machines, should preferably be not less than 70 h, subject to adjustment as appropriate.

7 Specialized "in field" conversion or "retraining" courses and refresher courses

Training in these two areas would normally be given on site, but, for refresher courses in particular, it may be more convenient to base the instruction at a training centre.

a) Conversion courses are to give operators experienced within a group of machines, training to enable them to transfer from one type of machine to another within that group.

b) Refresher courses are to enable an operator to be kept up to date with the development of machines and improvements and changes in operating techniques, also to re-train operators who have not used a particular machine for some time.

c) The content of the courses should be selected from the syllabus contained in 6.2.1 to 6.2.15 inclusive, with the addition of such other subjects as may be appropriate in the circumstances.

d) The duration should be adequate to cover the scope of training required.

8 Record of training course completion

On successful completion of a course, a certificate may be issued. Where appropriate full details of the course may be recorded in the operator's training record book (see clause 5).

Since in some countries statutory forms of certificate may already exist, this International Standard does not specify a format but it is suggested that the following minimum information should be included :

a) certificate registration serial number, when applicable;

b) operator's name and other identification;

c) contents of course and machine group covered, where necessary specific types of machine should be indicated;

d) duration of course, including dates of commencement and completion;

e) authorisation signature.

Annex

Operator's training record book — Chronological operational experience

Name of employer (1)	Machine group (2)	Details of machine(s) operated (3)	Dates from (4)	Dates to (5)	Remarks (6)	Employer's responsible official (7)

Entries should be made in the columns shown, and the following procedure should be observed :

Column 2 : The machine group letter should be stated (see 6.1)

Column 3 : Make and size of each machine operated should preferably be inserted

Column 6 : Brief details of any relevant additional facts should be included

Column 7 : The name of a senior individual within whose responsibility the operator has worked, and who could be approached when appropriate