

HANDBOOK OF DEFENCE LAND RANGES SAFETY

VOLUME II

**DESIGN, CONSTRUCTION, AND MAINTENANCE OF SMALL ARMS,
INFANTRY WEAPON SYSTEMS AND 30mm WEAPON SYSTEMS
RANGES.**

**BY COMMAND OF
THE DEFENCE COUNCIL**

MINISTRY OF DEFENCE

CONDITONS OF RELEASE

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**HANDBOOK OF DEFENCE LAND RANGES SAFETY
VOLUME II - DESIGN, CONSTRUCTION AND MAINTENANCE OF SMALL ARMS,
INFANTRY WEAPON SYSTEMS AND 30MM WEAPON SYSTEMS RANGES**

RECORD OF CHANGES

CHANGE NUMBER	DATE OF CHANGE
FIVE	Jan 10

Amendments

Amendment No.	Amendment Record	Effectuated Pages	Date
1	01/10	Preliminary Pages i – viii, Chapter 2 Pages 24 - 25, 35 - 45. Chapter 17 Page 11. Chapter 19 Page 7. Chapter 20 Page 6. Chapter 22 Pages 9, 10. Chapter 23 Pages 5, 6, 7, 12. Chapter 24 Pages 1 – 5. Chapter 32 Page 1.	Nov 10
2	02/10	Preliminary Pages ii, x, iv Chapter 1 Page 5, Chapter 2 Pages 3, 10, 11, 13, 15, 23, 24, 25, 33, 39. Chapter 3 Page 7. Chapter 6 Pages 4, 5 (insert Annex A Pages 6-A-1 to 6-A-3). Chapter 20 Pages 1, 2. Chapter 22 Page 3. Chapter 28 Pages 1 – 4 (insert new Page 9). Chapter 29 Page 16. Chapter 30 Pages 2, 5.	Dec10
3	Aug 11	Preliminary Pages ii, iv. Chapter 2 Pages 3, 4, 6, 8, `14, 25, 27, 29. Chapter 3 Page 1. Chapter 5 Page 7. Chapter 6 Pages 1, 3, 4, 6, 8. Chapter 6 Annex A Pages 6-A-1, 6-A-2. Chapter 8 Page 1. Chapter 9 Page 2. Chapter 11 Page 4. Chapter 15 Page 2, 3, 4, 8. Chapter 16 Page 4. Chapter 19 Page 7 Fig 19-2. Chapter 24 Page 4, 6 Fig 24-2, Page 7 Fig 24-3. Chapter 28 Page 1, 11 Fig 28-6. Chapter 29 Page 1, 7.	Aug 11

Joint Service Publication 403 - Handbook of Defence Land Ranges Safety (Volumes I -V)

Volume I: Range Management - policy, responsibilities, authorisation, use maintenance and inspection of land ranges.

Volume II: Design, construction and maintenance of small arms, infantry weapon systems and 30 mm weapon system ranges.

Volume III: Part 1 - Use of fixed wing aircraft and helicopter mounted weapon systems, and unmanned aircraft systems, on land ranges.

Part 2 - Use of surface to air weapon systems on land ranges.

Volume IV: Glossary of terms and definitions.

Volume V: Demolitions, ordnance disposal and battle simulation.

INTRODUCTION

GENERAL

1. **Aim.** The aim of JSP 403 Volume II is to give:
 - a. Advice on ballistic issues to those in the Ministry of Defence (MOD) and contractors who are responsible for planning, designing, constructing maintaining and inspecting Small Arms and Infantry Weapon Systems (SA and IWS) Ranges and 30mm weapon systems (WS) ranges.
 - b. Practical guidance on design, construction and maintenance standards of such ranges to ensure realistic but safe training in firing and the best possible use of the range space. With the exception of Chapter 30 which covers control of emissions from weapons, UK legislation and regulation relating to buildings and structures are not covered in this JSP but apply under normal works support to MOD facilities.
2. **Responsibilities.** All the volumes of JSP 403 are sponsored by the Chairman of the Defence Land Ranges Safety Committee (DLRSC). Authority for the content of this Volume is vested, by the Chairman DLRSC, in the Chairman of the Land Ranges Safety Sub Committee (LRSSC). Chairman LRSSC will always take into account approvals given by single Service authorities and the advice of Subject Matter Experts (SME).
3. **Associated Publications.** This Volume should be read in conjunction with Reference A1 (Volume I) and with Reference A4 (Volume IV). Reference will also be necessary at times to the associated publications listed on pages xxii-xxiii of this Volume. In particular, attention will be required to Reference X (LUMAT). For completeness Defence Ordnance Environment Safety Board Proceedings (DOESB Procs) Members Letters (ML) and DOSG advice are referred to, since they are the formal advice on ballistics and matters related to range safety.

SCOPE

4. **SA and IWS Range Design and Construction.** This Volume explains in detail the design and construction of standard and non-standard military SA and IWS Ranges. The Volume does not deal with the standard works requirements or conduct of firing on these ranges or the application of Weapon Danger Area (WDA) templates, both of which are covered in Reference B (Pamphlet 21).
5. **Danger Areas.** It contains the Range Danger Area (RDA) and WDA templates approved for Joint Service use. The authority for taking a DA template into use rests with the respective Integrated Project Team (IPT) in accordance with Reference A1 (Volume 1).
6. **Signs and Fences.** Danger area signs and fences specified in Chapter 2 of this Volume apply to all Defence Land Ranges (DLR) and training areas.

7. **Safety Standards.** The safety standards set out in this Volume or in Range Safety Notices issued between changes to the JSP provide the minimum acceptable levels of design and construction which are to be achieved for ballistic compliance. Should the minimum standards for a range to be categorised as compliant not be met, firing must not take place without a Dispensation or Approved Range status being authorised (see Reference A1 (Volume I)).
8. **Targetry.** The targetry approved for Service use by SA, Inf and 30 mm WS on DLR is described in Chapter 29.
9. **Provisos.** The whole basis of this Volume rests on the premise that:
- a. Training is completed prior to firing in accordance with appropriate Service training directives.
 - b. Only Service Approved Weapons and ammunition, the limitations of which are given in Chapter 2 Table 3, may be used. Other weapons and ammunition may be used as static single shot marksmanship practices but must be within the ME and MV limitations set out in this JSP.
- Note 1: Service Approved Weapons are those that have a Safety Case and WDA issued by the respective Project Team (PT).
- c. The ranges are run not less safely than as directed by the conduct and safety rules set out in Reference B (Pamphlet 21), and the practices in Reference C (Army Operational Shooting Policy (AOSP)) or other a Service directives authorised at not less than 2* level.
 - d. Firing is under the direction of a competent Range Conducting Officer (RCO). A competent RCO is one who is competent by virtue of qualification, currency, experience and maturity. He may not be authorised.
 - e. Ranges are maintained and inspected in accordance with current regulations.
10. **Range Inspections.** This Volume may be used to assist in inspecting SA, Inf and 30 mm WS Ranges. The construction characteristics of a particular range may differ considerably from the detail illustrated in this JSP. In all cases the principles, policy and criteria contained in this JSP should be applied. Advice should always be sought from TAS(RE) where there is any doubt on the safety of a range.
11. **Terminology.** The weapon categories of fullbore and smallbore are not used in this Volume as they are caliber related and do not account for weapon performance. SA munitions are categorised as centrefire or rimfire which enables performance to be expressed in muzzle velocity (MV) or muzzle energy (ME). Ranges are designed for specific maximum levels of MV and ME, which are stated in the relevant chapters that follow.

12. **Technical Advisory Section (Royal Engineers) (TAS(RE)).** TAS(RE) is referred to throughout this Volume. It is part of the Defence Training Estate (DTE) and provides authoritative, specific advice on range design and construction. Advice is also available from OC TAS (RE) on general principles and policy contained in this JSP. TAS(RE)'s address is:

Technical Officer
TAS(RE), Defence Training Estate
Blenheim Hall
Land Warfare Centre
WARMINSTER
Wilts
BA12 0DJ
Contact:

Technical Officer – 94381 2434

DTO1 – Ranges UK East and Scotland – 94381 2108

DTO2 – Ranges UK West and Northern Ireland – 94381 8747

DTO3 – Indoor and specialist ranges. – 94381 2433

Geo Sp – Training area mapping – 94381 2433 or 94325 4719

13. **Information and Advice issued by TAS(RE).** From time to time TAS(RE) produce the following advice:

a. **Type Standards** – Performance specifications aimed at contractors involved in the development of a range. A Type standard will be developed from this JSP for each range type. Progress of this work is recorded in Land Ranges Safety Sub Committee (LRSSC) Minutes.

b. **Range Advice Notes** – Issued from time to time to explain and clarify range safety or construction issues that do not directly effect the safety of a range. Safety issues are covered by Range Safety Notices, issued as advance copy by LRSSC and formal issue by DLRSC.

c. **Technical Data Sheets (TDS)** – Internal research covering many aspects contained in JSP 403 not issued but available if required. Contact AO TAS (RE) on 94381 2433 for information relating to existing TDS.

AMENDMENTS

14. Proposals for amendments should be directed, through Service representatives, to:

Technical Officer
TAS(RE) Defence Training Estate
Blenheim Hall
Land Warfare Centre
WARMINSTER
Wilts BA12 0DJ
Telephone: 01985-222434 ATN 94381-2434
Fax: 01985-222259 94381-2259

to whom queries should also be addressed.

with information copies to:

The Secretary of the Defence Land Ranges Safety Committee
Fir 3b
MOD Abbey Wood #4304
Bristol
BS34 8JH
e-mail: deswpnsdosg-dlrsc1@mod.uk
Telephone: 030 679 35339 ATN 9352-35339
Fax: 030 679 31920 9352-31920

15. Secretary DLRSC will pass proposed amendments to the Technical Officer TAS(RE) for consideration and action. Chairman LRSSC will approve routine amendments, keeping Secretary DLRSC informed and, where necessary, seeking the agreement of the DLRSC.

HISTORICAL RECORD

16. Issue 3 dated February 2003 replaced Issue 2 dated September 1998, which is to be destroyed. Issue 1 superseded Infantry Training, Volume IV, Ranges, Pamphlet No. 22, Range Construction and Regulations (All Arms), 1976 (Army Code No: 71053), on 1 April 1998. However, Pamphlet 22 may be kept for historical reference purposes only but it is no longer the authoritative document.

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ASSOCIATED PUBLICATIONS

Where an associated publication is referred to in this volume or any other volume of JSP 403 it is to be taken as the authoritative MOD document on the subject.

Reference	Code	Title
A1	JSP 403 Vol 1	Handbook of Defence Land Ranges Safety Volume I - Range Management (Policy, Responsibilities, Authorisation, Use, Maintenance and Inspection of Land Ranges).
A3	JSP 403 Vol 3	Handbook of Defence Land Ranges Safety Volume III – Part 1: Use of Fixed Wing and Helicopter Mounted weapon Systems, and Unmanned Aerial Vehicles, on Land Ranges. Part 2: Use of Surface to Air Weapon Systems on Land Ranges.
A4	JSP 403 Vol 4	Handbook of Defence Land Ranges Safety Volume IV -- Glossary of Terms and Definitions.
A5	JSP 403 Vol 5	Handbook of Defence Land Ranges Safety Volume V - Demolitions, Ordnance Disposal and Battle Simulation.
B	Army Code No. 71855	Infantry and Armoured Training Volume IV, Ranges and Training Safety, Pamphlet 21, Regulations for Training with Armoured Fighting Vehicles, Infantry Weapon Systems and Pyrotechnics.
C1	Army Code No. 71810	Army Operational Shooting Volume 1 - Personal Weapons.
C2	Army Code No. 71850	Army Operational Shooting Volume 2 – Individual Weapons.
C3	Army Code No. 71852	Army Operational Shooting Volume 3 – Support Weapons.
C4	Army Code No 71671	Army Operational Shooting Policy Volume 4 - AFV Weapons.

D	JSP 315	Service Accommodation Code.
E	JSP 375	MOD Health and Safety Handbook.
F	JSP 362	Defence Lands Handbook.
G	JSP 434	Defence Construction in the Built Environment.
H	JSP 482	Explosives Regulations
I	JSP 462	Financial Management Policy Manual.
J	JSP 390	Military Laser Safety.
K	Army Code 71670	Military Engineering Volume II, Field Engineering Pamphlet No. 4, Demolitions.
L	Army Code 71035	Artillery Training Volume III, Field Artillery, Pamphlet No. 19, Regulations for Planning, Control, Conduct and Safety for Firing Practices.
M	Army Code 71687	Helicopter Training Volume III, Ranges, Pamphlet No. 300, Regulations for the Planning, Conduct and Supervision of Firing (Helicopter Weapons).
O	JSP 418	Environment Manual
P	AP 3205	RAF Land Ranges Policy
Q	Army Code No. 71855-C	Infantry Training, Volume IV, Ranges, Pamphlet No. 21C, Regulations for Cadets Training with Cadet and Infantry Weapon Systems and Pyrotechnics.
R - V	Reserved	
W	Army Code 71053	Infantry Training Volume IV, Ranges, Pamphlet No. 22, Range Construction and Regulations (All Arms), 1976 (for historical reference only).

JSP 403 Volume 2
Edition 3 Change 5

X	Army Code 62230	Limitations in the Use of Missiles and Ammunition for Training (LUMAT), Volume 2, Ammunition other than Field Artillery Natures.
Y	ACAWEWROs	Air Command Weapon and Electronic Warfare Range Orders
Z1		The Setting of Safety Standards - A Report by an Interdepartmental Group and External Advisers, HM Treasury, 28 June 1996.
Z2		Managing risks to the public: appraisal guidance - draft for consultation, HM Treasury, October 2004.

ABBREVIATIONS

For full list of abbreviations see Reference A4 (Volume IV)

AAAD	All Arms Air Defence
AC	Alternating Current
ACMT	Annual Combat Marksmanship Test
ACOP	Approved Code of Practice
ADA	Air Danger Area - also Ammunition Danger Area (obsolete)
ADH	Air Danger Height
AF	Army Form
AFV	Armoured Fighting Vehicle
AGL	Above Ground Level
AIS	Aeronautical Information Services
ALARP	As Low As Reasonably Possible
AMS	Automatic Marking System
AMSL	Above Mean Sea Level
AofS	Angle of Sight
AOSP	Army Operational Shooting Policy (see Reference C)
APDS	Armour Piercing Discarding Sabot
Apers	Anti-personnel
APSE	Armour Piercing Secondary Effects
ARA	Army Rifle Association
ARS	Approved Range Status
Atk	Anti-tank
ATO	Ammunition Technical Officer
BOD	Base Ordnance Depot
BS	British Standard
BSD	Burst Safety Distance
C	Centigrade
CAA	Civil Aviation Authority
CCTV	Close Circuit Television
CES	Complete Equipment Schedule
CGR	Converted Gallery Range
Ch	Charge
CL	Centre Line
CLAW	Control of Lead at Work (Regulations)
CO	Commanding Officer
CofF	Cone of Fire
COP	Code of Practice
CP	Control Post
CQB	Close Quarter Battle
CQBR(U)	Close Quarter Battle Range (Urban)
CTTE	Cine Target Training Equipment
DA/Z	Danger Area/Zone
DAUG	See UK DAUG
DC	Direct Current
DCCPT	Dismounted Close Combat Project Team

DCDS (EC)	Deputy Chief of the Defence Staff (Equipment Capability)
DCTA	Defence Clothing & Textile Agency
DDOR	Deputy Director Operational Requirements
DE	Defence Estate
DEC (DEB)	Director of Equipment Capability (Direct Battlefield Engagement)
DEF STAN	Defence Standard
DE	Defence Estates
Dia	Diameter
Dist	District
Div	Division
DLA	Defence Land Agent
DLR	Defence Land Range
DLRSC	Defence Land Ranges Safety Committee
DOSG	Defence Ordnance Safety Group
DPA	Defence Procurement Agency
DTRO	Defence Training Requirements Organisation
DSEAR	Dangerous Substances and Explosive Atmospheres Regulations.
DSTL	Defence Scientific and Technical Laboratories (formerly Retained DERA)
DTE	Defence Training Estate
EA	Estate Advisor (was DLA)
EASI	Electronic Automatic Sequence Initiator
EEC	European Economic Community
EFS	Enemy Fire Simulators
EHO	Environmental Health Officer
EHT	Environmental Health Team
EM	Equipment Manager
ENO	Environmental Noise Officer
ET(LDA)R	Electric Target (Limited Danger Area) Range
ETR	Electric Target Range
FDA	Full Danger Area
FET	Fixed Electric Target
FFA	Field Firing Area
Fig	Figure
FLOOs	Fleet Operating Orders.
FMX	Fire and Manoeuvre Exercise
FOSM	Flag Officer Submarines
FOST	Flag Officer Sea Training
FP	Firing Point
ft	Foot/Feet
ft lb	Foot Pound
ft/s	Foot second(s)
g	Gram(s)
gr	Grain(s)
GMG	Grenade Machine Gun
GPMG	General Purpose Machine Gun
GR	Gallery Range

GRP	Glass Reinforced Plastic
G&Z	Grouping and Zeroing
HE	High Explosive
HEAT	High Explosive Anti-Tank
HEF	High Elevation Fire
HMSO	Her Majesty's Stationery Office
HMT (RAF)	Health Monitoring Team
HO	Hydrographic Office
HQ	Headquarters
HSE	Health and Safety Executive
HT/ht	Height
HV	High Velocity
H&S	Health and Safety
Hz	Hertz
IBSR	Individual Battle Shooting Range
ILAW	Interim Light Antitank Weapon
Illum	Illuminating
in	Inch(es)
Inf Wpn Sys	Infantry Weapon Systems (PE)
IP	Identified Project
IPT	Integrated Project Team
IR	Infra-red
ITTR	Indoor Training Theatre Range
IWS	Infantry Weapon System
J	Joule(s)
JSP	Joint Service Publication
kg	Kilogram(s)
kt	Knot(s)
kph	Kilometres per Hour
kVA	Kilovolt Amperes
LANDSO	Land (Command) Standing Order
LAW	Light Anti-Tank Weapon
lb	Pound(s)
LDA	Limited Danger Area
LH	Left Hand
LMG	Light Machine Gun
LNV	Limit of Night Visibility
LofF	Line of Fire
LofS	Line of Sight
LPA	Local Planning Authority
LRSSC	Land Ranges Safety Sub Committee
LSW	Light Support Weapons
LTC	Long Term Costings
LUMAT	Limitations in the Use of Missiles and Ammunition for Training
LV	Low Velocity
LWC	Land Warfare Centre

m	Metre(s)
max	Maximum
ME	Muzzle Energy (in joule (J))
MFC	Mortar Fire Controller
MG	Machine Gun
mg	Milligram
MHE	Materials Handling Equipment
min	Minimum
Mk	Mark
ML	Member's Letter (OB)
mm	Millimetre(s)
MMTTR	Mechanized Moving Target Trainer Range
MOD	Ministry of Defence
mph	Miles per Hour
MPI	Mean Point of Impact
MRATGW	Medium Range Anti-Tank Guided Weapon
MTS(R)	Moving Target System (Rural)
MS	Mild Steel
m/s	Metres per Second
MSL	Mean Sea Level
MV	Muzzle Velocity (in m/s)
MVEE	Military Vehicle Engineering Establishment
N	Newton(s)
NBSD	Normal Burst Safety Distance
NDA	No Danger Area
NLAW	Next Light Anti Tank Weapon
No.	Number
NOTAM	Notice to Airmen
NRA	National Rifle Association
NSN	NATO Stock Number
NSRA	National Smallbore Rifle Association
OBUA	Operations in Built Up Areas
OEL	Occupational Exposure Limit
OOB	Out of Bounds
OP	Observation Post
OTR	Operational Theatre Range
PA	Public Address
Pam	Pamphlet
para	Parachute
PE	Probable Error
PM	Project Manager
POD	Protected Observation Down-range
PPE	Personal Protection Equipment
Prac	Practice
Proc	See OB Proc
PROM	Property Management
PS	Project Sponsor
PTE	Pre-Tender Estimates
PTR	Permanent Training Range

QE	Quadrant Elevation
QMG	Quartermaster General
RAF	Royal Air Force
RAO	Range Authorising Officer
RAU	Range Administrative Unit
RBSD	Reduced Burst Safety Distance
RCO	Range Conducting Officer
RDA	Range Danger Area
RE	Royal Engineers
RF	Radio frequency
RFCA	Reserve Forces & Cadet Associations
RGGS	Rifle Grenade General Service
RH	Right Hand
RHA	Rolled Homogenous Armour
RM	Royal Marines
RN	Royal Navy
RNRSO	Royal Naval Range Safety Officer
ROC	Rough Order Cost(s)
RPC	Regional Prime Contractor
RT	Reverberation Time
RTAAB	Ranges and Training Area Audit Board
RTADB	Ranges and Training Areas Development Board
SA	Small Arm
SASC	Small Arms School Corps
SC105A	Concrete Post
SCOC	Supply Chain Operations Centre
SCOTS(A)	Standing Committee On Training Safety (Army)
SDA	Sea Danger Area
SF	Special Forces
SK	Sketch
SME	Subject Matter Expert
SMG	Sub-Machine Gun
Smk	Smoke
SO	Standing Orders
SOR	Statement of Requirement
STA & SPSS	Surveillance, Target Acquisition and Special Project Support Systems
STP	Short Term Plan (was LTC)
STPS	Static Target Projection System
SS105A	Steel Post
SW105A	Wooden Post
SWO	Staff Warfare Officer
TAG SASC	Training Advisory Group Small Arms School Corps
tan	Tangent (trigonometric)
TAS(RE)	Technical Advisory Section (Royal Engineers)
TAVRA	Territorial, Auxiliary and Volunteer Reserve Association
TB	Technical Bulletin
TE	Tangent Elevation
TER	Temporary Exercise Range
Tgty	Targetry

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TO	Technical Office(r)
TOPL	Training On Private Land
TP&N	Triple Phase and Neutral
TWA	Time Weighted Average
UGL	Underslung Grenade Launcher
UK	United Kingdom
UK DAUG	United Kingdom Danger Area User Group
USA	United States of America
V	Volt(s)
VHI	Visual Hit Indicators
Vol	Volume
VTT	Video Target Trainer
WBP	Water and Boil Proof grade Plywood
WDA/Z	Weapon Danger Area/Zone
WP	White Phosphorous
WS	Weapon System
yd	Yard(s)