CHAPTER 4

MAJOR CONCERNS OF THE FIRE DIRECTION CENTER

This chapter contains information on some of the "tools" the FDC uses to accomplish its mission. It also discusses the methods and techniques used in FDCs to convert calls for fire into proper fire commands.

4-1. TYPES OF SHEAVES

When the mortar section or platoon engages a target, different sheaves can be used, which depend on the type of target being engaged.

a. **Parallel Sheaf.** A parallel sheaf (Figure 4-1) is usually used on area targets. With the parallel sheaf, the distance between impacts of rounds from two or more mortars is the same as the distance between the mortars. Also, mortars all fire the same deflection, elevation, and charge.

b. **Converged Sheaf.** The converged sheaf (Figure 4-2) is normally used on a point target such as a bunker or machine gun position. It causes rounds from two or more mortars, each firing a different deflection, to impact at the same point.

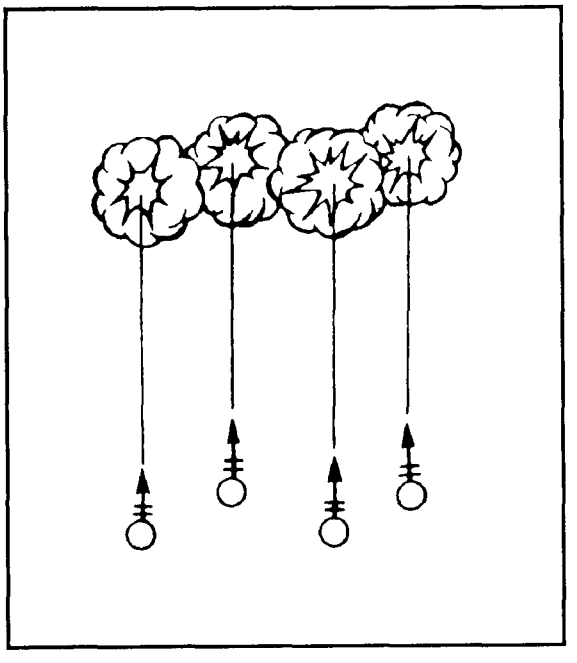


Figure 4-1. Parallel sheaf.

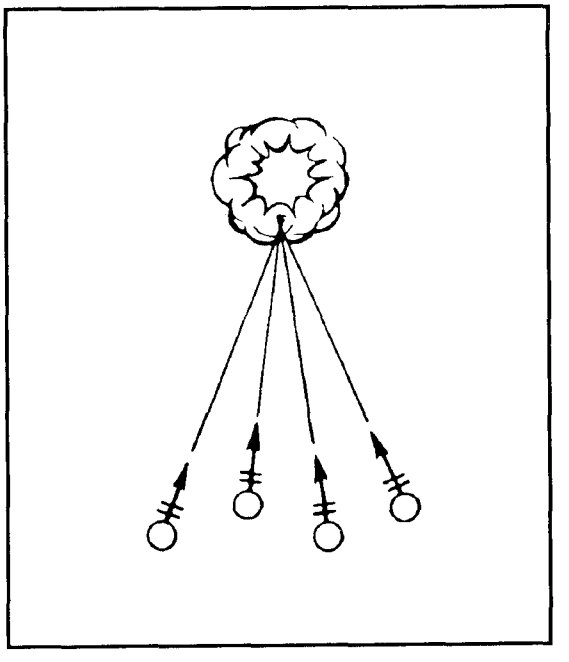


Figure 4-2. Converged sheaf.

c. **Open Sheaf.** The open sheaf (Figure 4-3) is normally used to engage targets that are wider than a standard sheaf can cover. With the open sheaf, the distance between impacts of rounds from two or more mortars is half again the distance between the bursts of the rounds in a standard sheaf. Normally, 81-mm and 4.2-inch mortar rounds impact 40 meters apart, and 120-mm rounds impact 60 meters apart. Thus, in an open sheaf with 60-mm mortars, which impact 30 meters apart in a standard sheaf, rounds would impact 45 meters apart. All mortars fire different deflections for an open sheaf.

d. **Special Sheaf.** The special sheaf (Figure 4-4) is normally used in an attitude mission and when needed for the FPF. With the special sheaf, each mortar has a certain point to engage. The mortars may have different deflections and elevations.

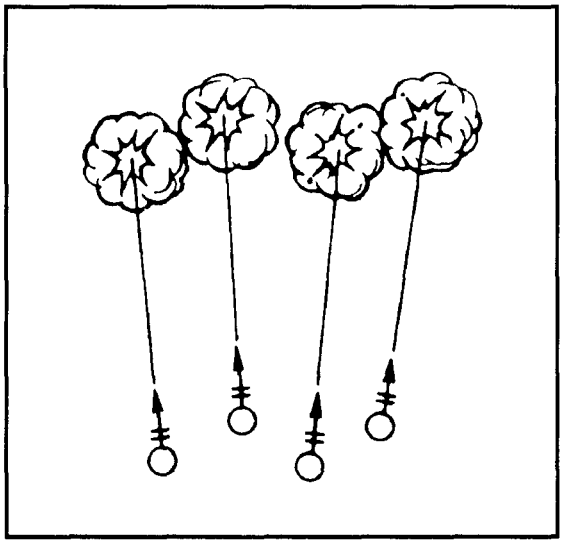


Figure 4-3. Open sheaf.

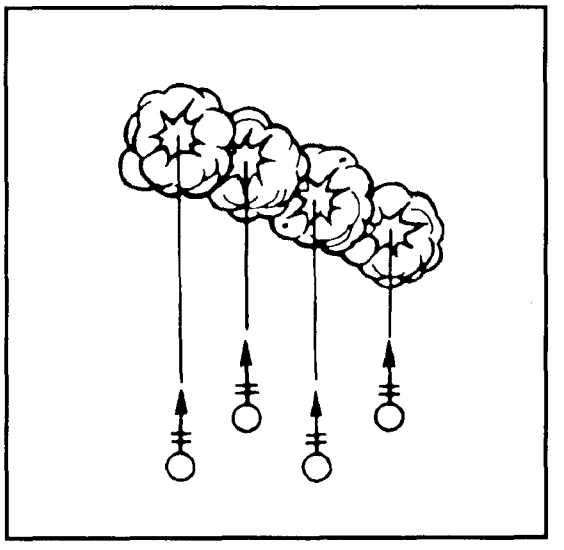


Figure 4-4. Type of special sheaf.

e. **Standard Sheaf.** With the standard sheaf (Figure 4-5), rounds impact within the total effective width of the bursts, regardless of the mortar formation.

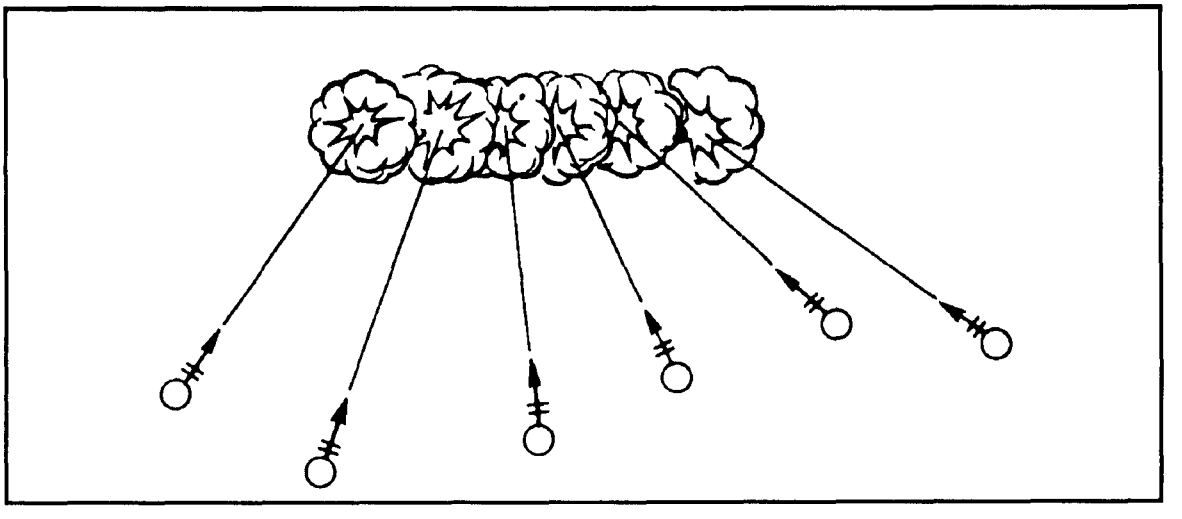
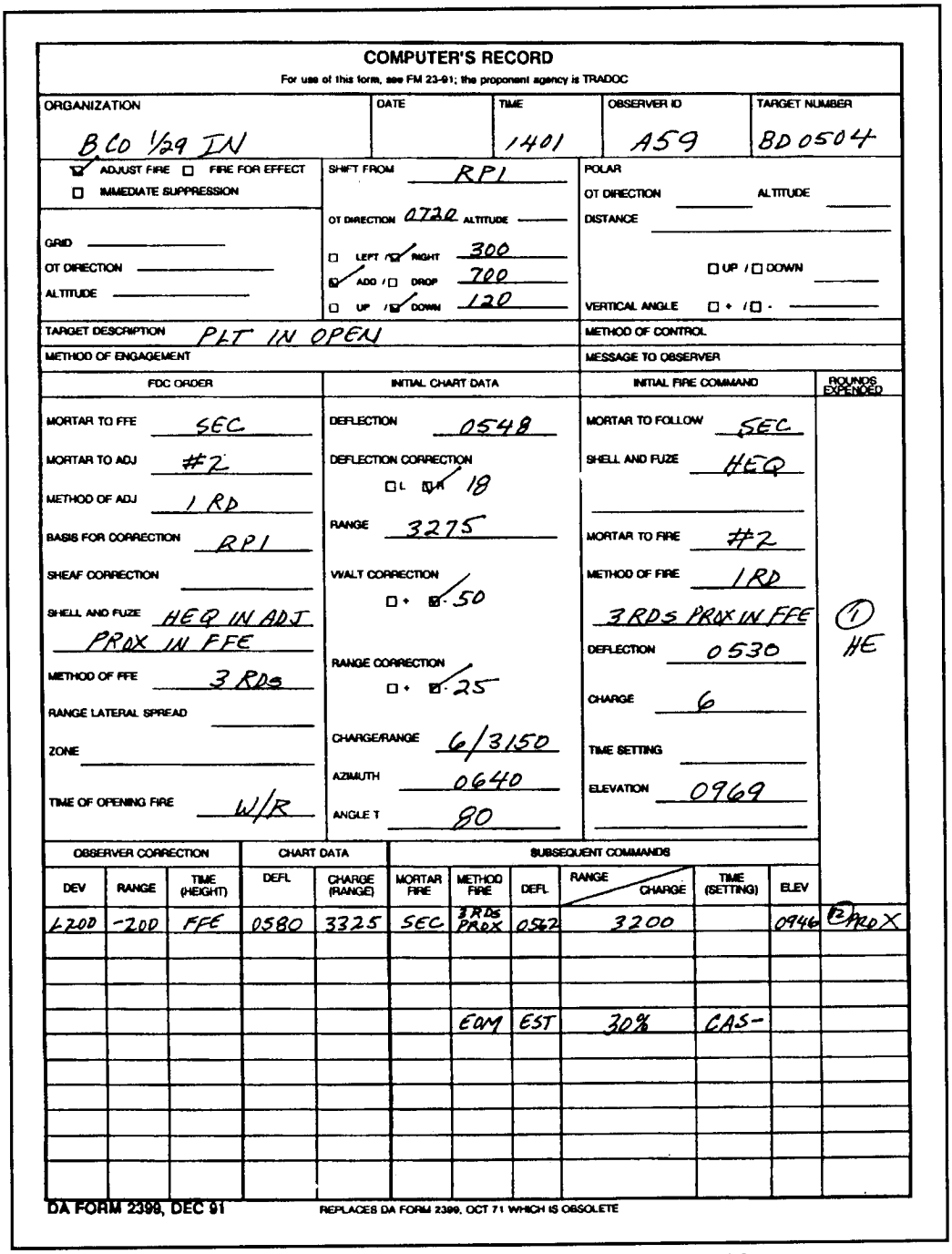


Figure 4-5. Standard sheaf.

4-2. COMPUTER'S RECORD

The DA Form 2399, Computer's Record (Figure 4-6), is a worksheet used to record the FO's call-for-fire and corrections, firing data, and commands to the mortars during a fire mission. The FDC uses this form for each mission received and fired by the FDC. Instructions on how to complete DA Form 2399 are discussed below.



COMPUTER'S RECORD

For use of this form, see FM 23-91; the proponent agency is TRADOC

ORGANIZATION	DATE	TIME	OBSERVER ID	TARGET NUMBER
B CO 1/29 IN		1401	A59	BD 0504

☑ ADJUST FIRE ☐ FIRE FOR EFFECT
☐ IMMEDIATE SUPPRESSION

GRID
OT DIRECTION
ALTITUDE

SHIFT FROM RP1
OT DIRECTION 0720 ALTITUDE
☐ LEFT ☑ RIGHT 300
☑ ADD ☐ DROP 700
☐ UP ☑ DOWN 120

POLAR
OT DIRECTION ALTITUDE
DISTANCE
☐ UP ☐ DOWN
VERTICAL ANGLE ☐ + ☐ -

TARGET DESCRIPTION PLT IN OPEN
METHOD OF ENGAGEMENT
METHOD OF CONTROL
MESSAGE TO OBSERVER

FDC ORDER	INITIAL CHART DATA	INITIAL FIRE COMMAND	ROUNDS EXPENDED
MORTAR TO FFE: SEC	DEFLECTION: 0548	MORTAR TO FOLLOW: SEC	
MORTAR TO ADJ: #2	DEFLECTION CORRECTION ☐L ☑R 18	SHELL AND FUZE: HEQ	
METHOD OF ADJ: 1 RD	RANGE: 3275	MORTAR TO FIRE: #2	
BASIS FOR CORRECTION: RP1	WALT CORRECTION ☐+ ☑- 50	METHOD OF FIRE: 1 RD	
SHEAF CORRECTION		3 RDS PROX IN FFE	(1) HE
SHELL AND FUZE: HEQ IN ADJ PROX IN FFE	RANGE CORRECTION ☐+ ☑- 25	DEFLECTION: 0530	
METHOD OF FFE: 3 RDS	CHARGE/RANGE: 6/3150	CHARGE: 6	
RANGE LATERAL SPREAD	AZIMUTH: 0640	TIME SETTING	
ZONE	ANGLE T: 80	ELEVATION: 0969	
TIME OF OPENING FIRE: W/R			

OBSERVER CORRECTION			CHART DATA		SUBSEQUENT COMMANDS						
DEV	RANGE	TIME (HEIGHT)	DEFL	CHARGE (RANGE)	MORTAR FIRE	METHOD FIRE	DEFL	RANGE / CHARGE	TIME (SETTING)	ELEV	
L200	-200	FFE	0580	3325	SEC	3 RDS PROX	0562	3200		0946	(2) PROX
						EOM	EST	30%	CAS-		

DA FORM 2399, DEC 91 REPLACES DA FORM 2399, OCT 71 WHICH IS OBSOLETE

Figure 4-6. Example of completed DA Form 2399, Computer's Record

a. **ORGANIZATION.** Unit that is firing the mission.

b. **DATE.** Date the mission is fired.

c. **TIME.** Time the mission was received (the call-for-fire recorded).

d. **OBSERVER ID.** Forward observer's callsign.

e. **TARGET NUMBER.** Number assigned to the mission.

f. **WARNING ORDER.** Type of warning order used for the mission (adjust fire, FFE, immediate suppression).

g. **TARGET LOCATION.** Method used to locate target (grid, shift from, polar).

h. **TARGET DESCRIPTION.** Details of target (type, size, number, protection).

i. **METHOD OF ENGAGEMENT.** Types of adjustment and ammunition (when used).

j. **METHOD OF CONTROL.** The adjustment gun (when named by the FO) and time of delivery (when used).

k. **MESSAGE TO OBSERVER.** Space used to record any message sent to the forward observer (when used).

l. **FDC ORDER.** This includes the following:

(1) MORTAR TO FFE (mortar to fire for effect) — Mortar(s) that will be used during the FFE phase of the mission.

(2) MORTAR TO ADJ (mortar to adjust) — Mortar(s) that will be used during the adjustment phase of the mission. Leave blank if the mortar to adjust is the same as the mortar to fire for effect.

(3) METHOD OF ADJ (method of adjustment) — Number of rounds used by the adjusting mortar(s) for each correction during the adjustment phase of the mission.

(4) BASIS FOR CORRECTION — Point (usually the registration point) from which the correction factors to be applied are determined (surveyed chart only).

(5) SHEAF CORRECTION — Type of sheaf, other than parallel sheaf, that will be used during the FFE.

(6) SHELL AND FUZE — Shell and fuze combination that will be used for the mission. The first line is used for the ammunition that will be fired in the adjustment phase. The second line is used for the ammunition that will be fired in the FFE if it changes from the adjustment round type. If different types of ammunition will be used during the mission, the different rounds are listed – for example:

SHELL AND FUZE: HEQ in Adj, HEQ/WP in FFE

(7) METHOD OF FFE (method of fire for effect) — Number and type rounds for each mortar in the FFE phase of the mission — for example:

METHOD OF FFE: 2 Rds HEQ, 2 Rds WP.

(8) RANGE LATERAL SPREAD — This is used with illumination with one of the following:

(a) Rg Spread: 60-mm mortar, 250 meters between rounds; 81-mm mortar, 500 meters between rounds; and 4.2-inch and 120-mm mortars, 1,000 meters between rounds.

(b) Lateral Spread: 60-mm mortar, 250 meters between rounds; 81-mm mortar, 500 meters between rounds; and 4.2-inch and 12-mm mortars, 1,000 meters between rounds.

(c) Rg/Lateral Spread: A combination of range spread and lateral spread.

(9) ZONE — This is used only with the 4.2-inch mortar. The zone will normally cover 100 or 200 meters. A platoon-size target would require a 100-meter zone, while a company-size target would require a 200-meter zone. Should the target require it, the 4.2-inch mortar can fire a larger zone. Zone missions fired by 60-mm, 81-mm, and 120-mm mortars are fired using searching fire.

(10) TIME OF OPENING FIRE — The fire control for the mission.

W/R = When ready
AMC = At my command (either the FO or FDC)

The chief computer/section sergeant usually completes the FDC order. This area describes how the FDC will engage the target.

m. **INITIAL CHART DATA.** This includes the following:

(1) DEFLECTION — Initial deflection from the mortar position to the target being engaged.

(2) DEFLECTION CORRECTION — Deflection correction used for the mission.

(3) RANGE — Initial range from the mortar position to the target being engaged.

(4) VI/ALT CORRECTION — Vertical interval/altitude difference used for the mission.

(5) RANGE CORRECHON — Range correction factor used for the mission.

(6) CHARGE/RANGE — Charge and corrected range used for the mission.

(7) AZIMUTH — The direction from the gun position to the target.

(8) ANGLE T — Mil difference between the GT line and the OT line. (Recorded to the nearest 10 mils and transmitted to the nearest 100 mils.)

n. **INITIAL FIRE COMMAND.** This is the first fire command that is sent to the mortar section for a mission. To complete the initial fire command, the computer must use the initial chart data, plus any corrections, and the information in the FDC order.

(1) MORTAR TO FOLLOW (mortars to follow or FFE) — The mortar(s) to follow all commands or the mortar(s) that will be used in the FFE.

(2) SHELL AND FUZE — The shell and fuze combination used during the mission. If it is an adjustment mission, that is the round used during the adjustment.

(3) MORTAR TO FIRE — The number of mortar(s) being used during the adjustment phase.

(4) METHOD OF FIRE — The number of rounds being used for adjustment and in the FFE, and the type, if mixed. Any control by the FDC would be placed here — for example:

(a) One round HEQ in adjustment; two rounds HEQ/two rounds WP in FFE, AMC. Announcing the number of rounds in the FFE gives the ammunition bearer time to prepare those rounds, such as, in the event of an immediate-suppression mission.

(b) Three rounds HEQ.

(5) DEFLECTION — The command deflection to fire the first round.

(6) CHARGE — The command charge needed to fire the first round.

(7) TIME SETTING — The time setting needed on mechanical-time fuzes (normally, illumination) to obtain the desired effects over the target area.

(8) ELEVATION — The elevation used for engaging the target (800, 900, and 1065 for 4.2-inch mortar; for 60-mm, 81-mm, and 120-mm mortars, it is the elevation obtained from the FTs for the range to be fired). The elevation is also the command to fire in the absence of any type of fire control.

o. **ROUNDS EXPENDED.** A cumulative count of the number of rounds fired for the initial fire command.

p. **OBSERVER CORRECTION.** This includes the following:

(1) DEV (deviation) — The LEFT/RIGHT, in meters, sent in by the observer — for example:

DEV: L200 = The observer wants a "left 200 meters" correction.

(2) RANGE — The ADD/DROP, in meters, sent in by the observer — for example:

RG: "Add 200" is recorded as + 200, while "Drop 200" is recorded as -200.

(3) TIME (HEIGHT) — The height correction the observer wants, usually used with illumination. For corrections in height, the observer will send UP/DOWN: "UP 200" or "DOWN 200" and record the same.

q. **CHART DATA.** Chart data are obtained from the M16/M19 plotting boards for the observer's requested corrections. This section is used only when firing corrections are to be applied to the chart data to obtain firing data. (Disregard this portion of the computer's record when using the MBC.)

(1) DEFL (deflection) — The deflection read from the plotting equipment before any corrections are applied.

(2) CHARGE (RANGE) — Chart charge (or range) is read from the plotting equipment before any corrections are applied. If a range is recorded, the charge corresponding to it may be written either in the lower part of the CHG box or in parentheses in the adjoining unused MORT FIRE box.

r. **SUBSEQUENT COMMANDS.** The command data are sent to the mortar(s) to fire the next round(s). Those commands, DEFL/CHG/ELEV, contain chart data and all firing corrections to apply. In the subsequent fire command, the only commands that are announced are any changes from the initial fire command or the previous subsequent fire command. The elevation is always given regardless of any changes.

(1) MORTAR TO FIRE — Self-explanatory.

(2) METHOD OF FIRE — The number of rounds and type of fire.

(3) DEFL (deflection) — The command deflection(s) to fire the round(s).

(4) RANGE/CHARGE — The 4.2-inch mortar: the command charge to fire the rounds; 60-mm/81-mm/120-mm mortars: the command range used for this round(s) and the charge, if different. The range is recorded and used to determine the charge that is given to the 60-mm/81-mm/120-mm mortars (range is not given to mortars).

(5) TIME (SETTING) — The time setting needed for the mechanical-time fuze.

(6) ELEV (elevation) — The elevation used for this round(s); also, the command to fire in the absence of any fire control.

4-3. DATA SHEET

DA From 2188-R, Data Sheet (Figure 4-7), is used by the computer to record data that pertains to the mortar section or platoon and the firing data for each target engaged. (For a blank reproducible copy of DA Form 2188-R, see the back of this manual.)

DATA SHEET

For use of this form, see FM 23-91; the proponent agency is TRADOC

SETUP

TIME OUT	60
TGT PRFX	CA
TGT NO	0300-0400
ALARM	☐ ON ☑ OFF
MIN E	02
MIN N	73
QD ☑ E ☐ W	02
LAT ☑ + ☐ -	32
LISTEN	☐ ON ☑ OFF
BIT RATE	1200
KEY TONE	1-4
BLK	☑ SNG ☐ DBL
OWNER ID	B

WEAPON DATA

UNIT	B 1/29 IN
AL mm CAR	☐ YES ☐ NO
BP	B2
E	0360
N	7490
ALT	460
AZ	3136
DEF	2800
ELE	

	WPN	DIR	DIS
	B1	4800	35
	B3	1600	35
	B4	1600	70

FO DATA

FO	ALT	GRID
A69	500	0283 7417

AMMUNITION DATA

TEMPERATURE 70°

TYPE ☐ HE ☑ WP ☑ ILL ☐ CS ☐ TNG

LOT NUMBER	HE LOOB	WP B10B	ILL A00B						
WEIGHT	20	3							
ON HAND	200	100	50						
RECEIVED	100	50	25						
TOTAL	300	150	75						
ROUNDS EXPENDED	7								
ROUNDS REMAINING	293								

TARGET DATA

TARGET ID			CHART DATA		FIRING CORRECTIONS				FIRING DATA				INTELLIGENCE				ROUNDS	
TGT NO.	GRID	ALT	DEFL	RG / CHG	DEFL CORR	RANGE CORR	ALT VI	ALT CORR	DEFL	RG / CHG	FUZE TIME SETTING	ELEV	TIME FIRED	TGT DES	MET OF ENG	SUR	EXP	REM
RP1	0881 7158	540					540 +70		2817	8		0963		RP1	# 2 1 RD		7 HE	293

DA FORM 2188-R, DEC 91 REPLACES DA FORM 2188-R, MAR 77 WHICH IS OBSOLETE

Figure 4-7. Example of completed DA Form 2188-R, Data Sheet.

a. **SETUP.** FDC uses this block to record the initialization data used by the firing element.

(1) TIME OUT — Amount of time selected between switch function.

(2) TGT PRFX — Target prefix used by the firing element.

(3) TGT NO. — Target numbering block.

(4) ALARM — Alarm on and off function for messages.

(5) MIN E/MIN N — Minimum casting and northing coordinates from the map sheet.

(6) GD — East or west grid declination.

(7) LAT — Latitude from the map sheet.

(8) LISTEN — Allows message transmission and reception.

(9) BIT RATE — Message transmission rates for DMD-supported missions.

(10) KEY TONE — Length of time required for a communications device.

(11) BLK — Transmit block mode for DMD-supported missions.

(12) OWNER ID — Owner identification.

b. **WEAPON DATA.** FDC uses this block to record the weapon initialization data used by the firing element.

(1) UNIT — Unit mortar element is assigned.

(2) _mm CAR — Weapon type and indicates either mounted or dismounted.

(3) BP — Basepiece number.

(4) E — Basepiece casting map coordinate.

(5) N — Basepiece northing map coordinate.

(6) ALT — Altitude in meters of the basepiece.

(7) AZ — Mils of the basepiece direction of fire.

(8) DEF — Referred deflection used by the firing element.

(9) ELE — 107-mm requires a selected elevation.

(10) WPN/DIR/DIS — Weapon number, direction, and distance from the basepiece. FDC continues completing information until all weapons have been recorded for firing section.

c. **FO DATA.** FDC uses this block to record the forward observers' locations.

(1) FO — Call sign of the forward observer.

(2) ALT — Altitude at the forward observer's location.

(3) GRID — Grid coordinates of the forward observer's location.

d. **AMMUNITION DATA.** FDC uses this section to monitor the rounds. This information should be updated after each mission.

(1) TEMPERATURE — Current temperature.

(2) TYPE — Appropriate types of ammunition issued.

(3) LOT NUMBER — Listing of different lot numbers of the rounds and fuzes on hand.

(4) WEIGHT — Weight difference between types of projectiles.

(5) ONHAND — The number, by lot number, the firing element has on the firing position.

(6) RECEIVED — Number and type of rounds received.

(7) TOTAL — The combination of rounds on hand and those received.

(8) ROUNDS EXPENDED — The number of rounds expended for missions.

(9) ROUNDS REMAINING — The number of rounds remaining.

e. **TARGET DATA.** FDC uses this section to record previously fired targets.

(1) TARGET ID — This includes the following:

(a) TGT NO (target number) — Alphanumeric identifier assigned to a target.

(b) GRID — Six- or eight-digit coordinates of a target.

(c) ALT — Altitude of the target.

(2) CHART DATA — This includes the following:

(a) DEFL (deflection) — Chart (M16/M19) or initial (MBC) deflection to the target.

(b) RG/CHG (range/charge) — Chart (M16) or initial (MBC) range and charge for the mortars needed for a target.

(3) FIRING CORRECTIONS — For the 4.2-inch mortar, column (1) is used to record the total deflection correction used during the mission. Columns (3) and (4) are used on the modified and surveyed charts only. This section includes:

(a) DEFL CORR (deflection correction) — Direction (left/right) and number of mils to apply to the chart deflection to engage the target.

(b) RG CORR (range correction) — Number and type (+/-) of meters to apply to the chart range to engage the target.

(c) ALT (altitude) VI (vertical interval) — Altitude of the target and VI difference, UP (+) or DOWN (-) in meters, between the target and the mortar altitudes.

(d) ALT CORR (altitude correction) — For all mortars, this is the number and direction (UP/DOWN) of meters used for altitude corrections that are applied. For 4.2-inch mortars, charge correction is listed that is needed for the VI. For the 60-mm, 81-mm, and 120-mm only, corrections for deflection and range are used on the modified and surveyed charts.

(4) FIRING DATA — This is the base gun command data for the targets. This information contains all corrections (when used) plus chart data to get the firing data (command data) to the center mass of the target.

(a) DEFL (deflection) — Command deflection to hit the center mass of the target.

(b) RG/CHG (range/charge) — The command range and charge to hit the target.

(c) FUZE TIME SETT (fuze time setting) — Fuze/time setting on mechanical fuzes recorded to the nearest 0.1 second.

(d) ELEV (elevation) — Elevation used to fire the round: for 4.2-inch mortars, 800, 900, or 1065; for 60-mm/81-mm/120-mm mortars, the elevation from the firing tables for the command range.

(5) INTELLIGENCE — This includes the following:

(a) TIME FIRED — The time the call for fire was received.

(b) TARGET DESCR (target description) — What the target was (from the call for fire on the computer's record).

(c) METH OF ENGMT (method of engagement) — How the target was engaged (number of mortars, number and type of rounds fired in the FFE).

(d) SURVEILLANCE — What happened to the target.

(6) ROUNDS — Rounds expended for mission and amount remaining for future missions.

4-4. ANGLE T

Angle T (Figure 4-8) is the mil difference between the OT line and GT line. Angle T is not important to the FDC when computing. However, to the FO, it must be considered when making corrections to engage a target when the angle T exceeds 500 mils.

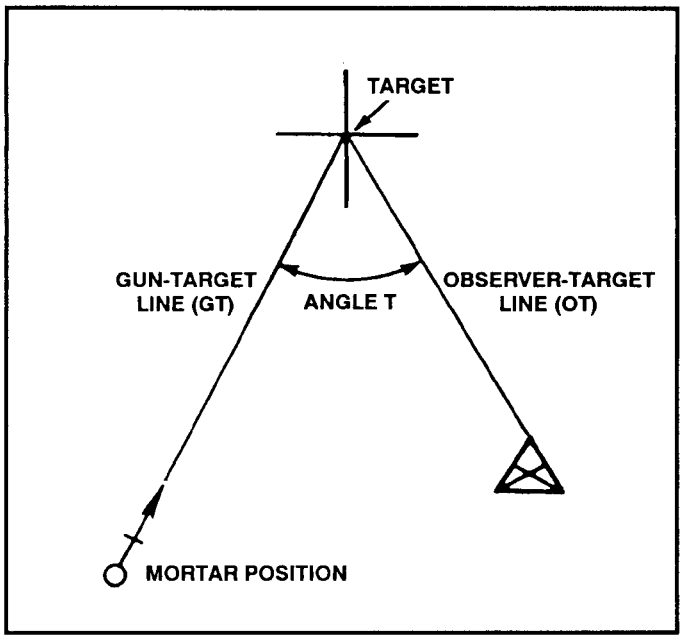


Figure 4-8. Angle T.

a. To determine angle T, the computer must compare the OT azimuth and GT azimuth, subtracting the smaller from the larger. It is determined to the nearest mil, recorded to the nearest 10 mils, and announced to the observer to the nearest 100 mils when it exceeds 500 mils. GT azimuth is the azimuth that corresponds to the initial chart deflection to the target being engaged. OT azimuth is the azimuth given in the observer's call for fire or with the first correction. If a grid mission is sent, the OT azimuth may not be given in the call for fire. However, OT azimuth must be sent before or with the first subsequent adjustment.

EXAMPLE 1

Consider OT = 2950 mils and GT = 3190 mils; then, 3190 - 2950 = 240mils (angle T).

EXAMPLE 2

Consider OT = 6210 mils and GT = 0132 mils. Because the azimuths are on either side of 6400 (0), subtracting the smaller from the larger would not yield the angle T. The computer must add 6400 to the smaller and then subtract from the larger:

0132 + 6400 = 6532
6532 - 6210 = 322, recorded as 320

NOTE: This procedure is used only when one azimuth is between 0 (6400) and 1600, and one is between 4800 and 6400.

Angle T exceeding 500 mils:

OT = 1530
GT = 810 = Angle T 720

b. Because the angle T is over 500 mils in the example above, the FDC would then send a message to the observer that the angle T exceeded 500 mils. Otherwise, there is no need to tell the FO what the angle T is unless he requests it. The observer would use this information before making any correction. When the angle T exceeds 500 mils (Figure 4-9),

the FO would continue to use the OT factor to make deviation corrections. However, if it is observed that the correction is more than asked for, the deviation corrections should be reduced proportionately during the mission. Information about the angle T is automatically given to the FO only if it exceeds 500 mils. If the FO wants to know what the angle-T-is, then the FDC would announce it to the nearest 100 mils.

EXAMPLE

The angle T is 630
FDC to FO - "Angle T 600 mils"

OR

The angle T is 320:
FO to FDC - "Request angle T"
FDC to FO - "Angle T is 300 mils"

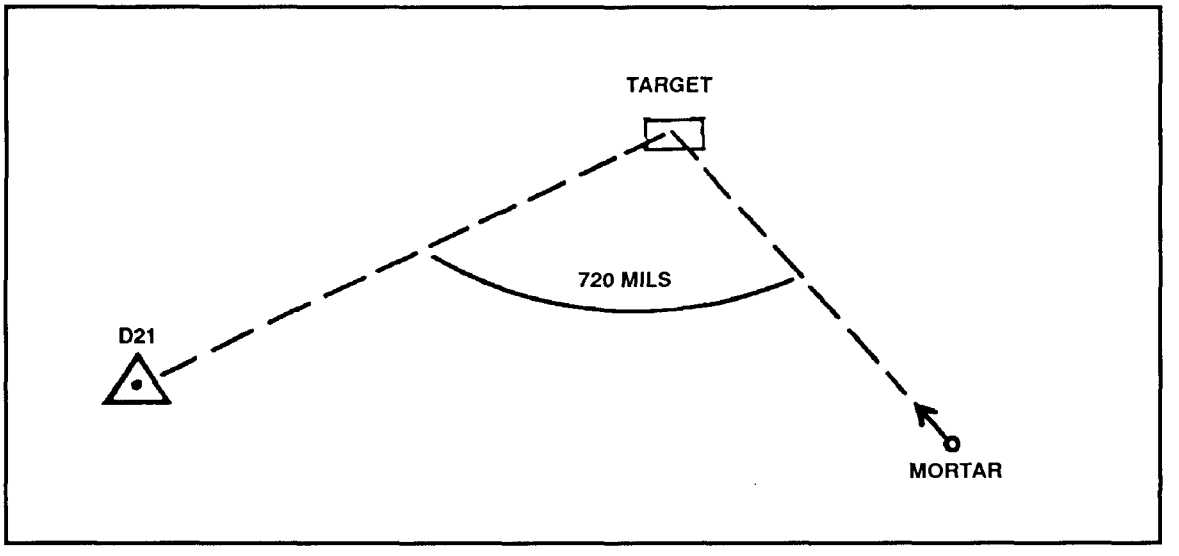


Figure 4-9. Angle T exceeding 500 mils.

4-5. FIRING TABLES

The firing tables contained in this manual include complete instructions for their use.

NOTE: Refer to appropriate firing tables for specific rounds that are not listed in this manual.

a. **The 60-mm Mortar Firing Tables** (Figure 4-10, page 4-12).

(1) Parts I, II, III, and IV of FT 60-P-1 contain firing data for various rounds that use given propelling charges. Each part contains five tables: Table A provides the components of a 1-knot wind; Table B provides air temperature and density corrections; Table C provides variations in muzzle velocity due to propellent temperature; Table D provides basic data and nonstandard correction factors; and Table E provides supplementary data.

(2) Part I includes the M720 HE round; Part II includes the M49A4 HE round; Part III includes the M302A1 WP round; and Part IV includes the M83A3 illumination round. The appendixes contain the trajectory charts for the M720 HE round.

(3) FT-6-Q-1 contains information for M49A4 HE, M50A3 training practice, M302A1 WP, and M83A3 illumination rounds for the M31 subcaliber assembly.

CHARGE 2 — TABLE D BASIC DATA — FT 60-P-1 CTG, HE, M720 FUZE, MO, M734

1	2	3	4		5	6	7
RANGE	ELEV	D ELEV PER 100 M DR	APPROX NO. OF TURNS PER 100 M DR		LINE NO.	TIME OF FLIGHT	AZIMUTH CORRECTION CW OF 1 KNOT
			US	LS			
M	MIL	MIL				SEC	MIL
1100	1314	28	3	2	3	30.2	3.2
1125	1307	28	3	2	3	30.1	3.2
1150	1300	29	3	2	3	30.1	3.1
1175	1293	29	3	2	3	30.0	3.0
1200	1286	29	3	2	3	30.0	2.9
1225	1278	29	3	2	3	29.9	2.9
1250	1271	30	3	2	3	29.9	2.8
1275	1264	30	3	2	3	29.8	2.7
1300	1256	30	3	2	3	29.7	2.7
1325	1248	31	3	2	3	29.7	2.6
1350	1241	31	3	2	3	29.6	2.6
1375	1233	31	3	2	3	29.5	2.5
1400	1225	32	3	2	3	29.5	2.5
1425	1217	32	3	2	3	29.4	2.4
1450	1209	33	3	3	3	29.3	2.4
1475	1201	33	3	3	3	29.2	2.3
1500	1192	34	4	3	3	29.1	2.3
1525	1184	34	4	3	3	29.0	2.2
1550	1175	35	4	3	3	28.9	2.2
1575	1167	35	4	3	3	28.8	2.1
1600	1158	36	4	3	3	28.7	2.1
1625	1149	37	4	3	3	28.6	2.0
1650	1139	38	4	3	3	28.5	2.0
1675	1130	38	4	3	3	28.4	2.0
1700	1120	39	4	3	3	28.3	1.9
1725	1110	40	4	3	3	28.2	1.9
1750	1100	41	4	3	3	28.0	1.9
1775	1090	43	4	3	3	27.9	1.8
1800	1079	44	5	3	3	27.7	1.8
1825	1068	46	5	4	3	27.6	1.7
1850	1056	47	5	4	3	27.4	1.7
1875	1044	49	5	4	3	27.2	1.7
1900	1031	52	5	4	3	27.0	1.6

FT 60-P-1 CTG, HE, M720 FUZE, MO, M734 — TABLE D CORRECTION FACTORS — CHARGE 2

1	8	9	10	11	12	13	14	15
RANGE	RANGE CORRECTIONS FOR							
	MUZZLE VELOCITY 1 M/S		RANGE WIND 1 KNOT		AIR TEMP 1 PCT		AIR DENSITY 1 PCT	
	DEC	INC	HEAD	TAIL	DEC	INC	DEC	INC
M	M	M	M	M	M	M	M	M
1100	10.3	-8.6	4.5	-3.5	0.0	0.0	-3.2	3.1
1125	10.6	-8.9	4.5	-3.5	0.0	0.0	-3.2	3.2
1150	10.8	-9.1	4.5	-3.6	0.0	0.0	-3.3	3.3
1175	11.0	-9.3	4.5	-3.6	0.0	0.0	-3.4	3.3
1200	11.3	-9.5	4.5	-3.6	0.0	0.0	-3.4	3.4
1225	11.5	-9.7	4.5	-3.6	0.0	0.0	-3.5	3.5
1250	11.8	-9.9	4.5	-3.6	0.0	0.0	-3.6	3.5
1275	12.0	-10.1	4.5	-3.6	0.0	0.0	-3.6	3.6
1300	12.3	-10.3	4.5	-3.6	0.0	0.0	-3.7	3.7
1325	12.5	-10.5	4.6	-3.6	0.0	0.0	-3.8	3.7
1350	12.7	-10.7	4.6	-3.6	0.0	0.0	-3.8	3.8
1375	13.0	-10.9	4.6	-3.7	0.0	0.0	-3.9	3.8
1400	13.2	-11.1	4.6	-3.7	0.0	0.0	-4.0	3.9
1425	13.5	-11.3	4.6	-3.7	0.0	0.0	-4.0	4.0
1450	13.7	-11.5	4.6	-3.7	0.0	0.0	-4.1	4.0
1475	14.0	-11.7	4.6	-3.7	0.0	0.0	-4.1	4.1
1500	14.2	-11.9	4.6	-3.7	0.0	0.0	-4.2	4.2
1525	14.5	-12.1	4.6	-3.7	0.0	0.0	-4.3	4.2
1550	14.7	-12.3	4.6	-3.8	0.0	0.0	-4.3	4.3
1575	15.0	-12.5	4.6	-3.8	0.0	0.0	-4.4	4.3
1600	15.2	-12.7	4.6	-3.8	0.0	0.0	-4.5	4.4
1625	15.5	-12.9	4.6	-3.8	0.0	0.0	-4.5	4.5
1650	15.7	-13.2	4.6	-3.8	0.0	0.0	-4.6	4.5
1675	16.0	-13.4	4.6	-3.8	0.0	0.0	-4.6	4.6
1700	16.2	-13.6	4.6	-3.8	0.0	0.0	-4.7	4.6
1725	16.5	-13.8	4.6	-3.8	0.0	0.0	-4.8	4.7
1750	16.7	-14.0	4.6	-3.9	0.0	0.0	-4.8	4.7
1775	17.0	-14.2	4.5	-3.9	0.0	0.0	-4.9	4.8
1800	17.2	-14.4	4.5	-3.9	0.0	0.0	-4.9	4.9
1825	17.5	-14.6	4.5	-3.9	0.0	0.0	-5.0	4.9
1850	17.7	-14.8	4.5	-3.9	0.0	0.0	-5.1	5.0
1875	18.0	-15.0	4.4	-3.9	0.0	0.0	-5.1	5.0
1900	18.3	-15.2	4.4	-3.9	0.0	0.0	-5.2	5.1

Figure 4-10. Sample pages from firing tables for 60-mm mortars.

b. **The 81-mm Mortar Firing Tables** (Figure 4-11).

(1) FT 81-AR-1 contains the following information:

(a) Part I contains six parts. The first of which contains data for corrections for the HE M889 cartridge. The other five parts contain firing data for a given propelling

charge using the HE M821 cartridge. Tables A, B, C, D, and E are included to provide the same data for all mortar firing tables.

(b) Part II contains four parts. It provides data for the M819 cartridge, red phosphorus. All four parts contain data for given propelling charges.

(c) The appendixes contain trajectory charts. The computer uses these charts to determine the height of a round for a given charge and the nearest 100-mil elevation the round will travel to a given range. These charts assist the computer in determining what round to use in urban combat.

(2) FT 81-AI-3 contains similar data as for the FT 81-AR-1 for the M374A2 and M374 HE, and M375A2 and M375 WP, and M301A3 illumination rounds. Also included is the section containing information on range, elevation, and maximum ordinate for the M68 training round.

(3) FT 81-AQ-1 contains similar data as for the FT 81-AR-1 for the M374A3 HE rounds.

CHARGE 2 — TABLE D — BASIC DATA — FT 60-P-1 — CTG, HE, M720 FUZE, MO, M734

1	2	3	4	5	6	7
RANGE	ELEV	D ELEV PER 100 M DR	APPROX NO. OF TURNS PER 100 M DR	LINE NO.	TIME OF FLIGHT	AZIMUTH CORRECTION CW OF 1 KNOT
M	MIL	MIL			SEC	MIL
565	1511	16	2	5	40.0	8.4
575	1509	16	2	5	40.0	8.3
600	1505	16	2	5	40.0	7.9
625	1502	16	2	5	40.0	7.6
650	1498	16	2	5	40.0	7.3
675	1494	16	2	5	40.0	7.0
700	1490	16	2	5	40.0	6.7
725	1486	16	2	5	40.0	6.5
750	1482	16	2	5	40.0	6.3
775	1478	16	2	5	40.0	6.1
800	1474	16	2	5	40.0	5.9
825	1470	16	2	5	40.0	5.7
850	1466	16	2	5	39.9	5.5
875	1462	16	2	5	39.9	5.3
900	1458	16	2	5	39.9	5.2
925	1454	16	2	5	39.9	5.0
950	1450	16	2	5	39.9	4.9
975	1446	16	2	5	39.8	4.7
1000	1442	16	2	5	39.8	4.6
1025	1438	16	2	5	39.8	4.5
1050	1434	16	2	5	39.7	4.4
1075	1430	16	2	5	39.7	4.2
1100	1426	16	2	5	39.7	4.1
1125	1422	16	2	5	39.6	4.0
1150	1418	16	2	5	39.6	3.9
1175	1414	16	2	5	39.6	3.8
1200	1410	16	2	5	39.5	3.7
1225	1406	16	2	5	39.5	3.6
1250	1402	16	2	5	39.5	3.6
1275	1398	16	2	4	39.4	3.5
1300	1394	16	2	4	39.4	3.4

FT 60-P-1 — TABLE D — BASIC DATA — CHARGE 2 — CTG, HE, M720 FUZE, MO, M734

1	8	9	10	11	12	13	14	15
RANGE	RANGE CORRECTIONS FOR							
	MUZZLE VELOCITY 1 M/S		RANGE WIND 1 KNOT		AIR TEMP 1 PCT		AIR DENSITY 1 PCT	
	DEC	INC	HEAD	TAIL	DEC	INC	DEC	INC
M	M	M	M	M	M	M	M	M
565	4.4		4.2		0.1			1.5
575	4.4		4.2		0.1	0.0		1.5
600	4.6		4.2		0.1	0.0	-1.6	1.6
625	4.8	-4.2	4.2		0.1	0.0	-1.6	1.6
650	5.0	-4.4	4.2		0.1	0.0	-1.7	1.7
675	5.2	-4.5	4.2		0.1	-0.1	-1.8	1.8
700	5.4	-4.7	4.2		0.1	-0.1	-1.8	1.8
725	5.6	-4.9	4.2		0.1	-0.1	-1.9	1.9
750	5.8	-5.0	4.2	-3.7	0.1	-0.1	-2.0	1.9
775	6.0	-5.2	4.2	-3.7	0.1	-0.1	-2.0	2.0
800	6.2	-5.4	4.3	-3.6	0.1	-0.1	-2.1	2.1
825	6.4	-5.5	4.3	-3.6	0.1	-0.1	-2.1	2.1
850	6.6	-5.7	4.3	-3.6	0.1	-0.1	-2.2	2.2
875	6.8	-5.9	4.3	-3.6	0.1	-0.1	-2.3	2.2
900	7.0	-6.1	4.3	-3.6	0.1	-0.1	-2.3	2.3
925	7.2	-6.2	4.3	-3.6	0.1	-0.1	-2.4	2.4
950	7.4	-6.4	4.3	-3.6	0.1	-0.1	-2.4	2.4
975	7.6	-6.6	4.3	-3.6	0.1	-0.1	-2.5	2.5
1000	7.8	-6.7	4.3	-3.6	0.1	-0.1	-2.6	2.5
1025	8.0	-6.9	4.4	-3.6	0.1	-0.1	-2.6	2.6
1050	8.2	-7.1	4.4	-3.6	0.1	-0.1	-2.7	2.7
1075	8.4	-7.3	4.4	-3.6	0.1	-0.1	-2.7	2.7
1100	8.6	-7.4	4.4	-3.6	0.1	-0.1	-2.8	2.8
1125	8.8	-7.6	4.4	-3.6	0.1	-0.1	-2.9	2.8
1150	9.0	-7.8	4.4	-3.7	0.1	-0.1	-2.9	2.9
1175	9.2	-8.0	4.4	-3.7	0.1	-0.1	-3.0	3.0
1200	9.4	-8.1	4.4	-3.7	0.1	-0.1	-3.0	3.0
1225	9.6	-8.3	4.5	-3.7	0.1	-0.1	-3.1	3.1
1250	9.8	-8.5	4.5	-3.7	0.1	-0.1	-3.2	3.1
1275	10.0	-8.6	4.5	-3.7	0.1	-0.1	-3.2	3.2
1300	10.2	-8.8	4.5	-3.7	0.1	-0.1	-3.3	3.3

Figure 4-11. Sample pages from firing tables for 81-mm mortars.

c. **The 4.2-Inch Mortar Firing Tables** (Figure 4-12).

(1) For the 4.2-inch mortar, FT 4.2-H-2 applies to the M329A1 HE, M328A1 WP, XM630 chemical, and M335A1 and M335A2 illumination rounds. FT 4.2-K-2 applies to the M329A2 HE rounds.

900 MILS TABLE D FT 4.2-K-2

BASIC DATA CTG, HE, M329A2 FUZE, PD, M557

1	2	3	4	5	6	7	8	9
RANGE	CHARGE	D CHG PER 100 M DR	FS FOR GRAZE BURST FUZE M564	DR PER 1/8 INC D CHG	LINE NO.	TIME OF FLIGHT	AZIMUTH CORRECTIONS	
							DRIFT (CORR TO L)	CW OF 1 KNOT
M	INC	INC		M		SEC	MIL	MIL
2520	14	4/8	25.6	23	3	25.8	21.9	0.6
2540	14 1/8	4/8	25.7	23	3	25.9	21.9	0.6
2560	14 2/8	4/8	25.8	23	3	26.1	21.9	0.6
2590	14 3/8	4/8	25.9	23	3	26.2	21.9	0.6
2610	14 4/8	4/8	26.1	23	3	26.3	21.9	0.6
2630	14 5/8	4/8	26.2	23	3	26.4	21.9	0.6
2660	14 6/8	4/8	26.3	23	3	26.6	21.9	0.6
2680	14 7/8	4/8	26.4	23	3	26.7	21.9	0.6
2700	15	4/8	26.6	23	3	26.8	21.9	0.6
2730	15 1/8	4/8	26.7	23	3	26.9	21.9	0.6
2750	15 2/8	4/8	26.8	23	3	27.0	21.9	0.6
2770	15 3/8	4/8	26.9	23	3	27.2	21.9	0.6
2790	15 4/8	4/8	27.0	23	3	27.3	21.9	0.6
2820	15 5/8	4/8	27.2	23	3	27.4	21.9	0.6
2840	15 6/8	4/8	27.3	23	3	27.5	21.9	0.6
2860	15 7/8	4/8	27.4	23	3	27.6	21.9	0.6
2890	16	4/8	27.5	23	3	27.8	21.9	0.6
2910	16 1/8	4/8	27.6	23	3	27.9	21.9	0.6
2930	16 2/8	4/8	27.8	23	3	28.0	21.9	0.6
2950	16 3/8	4/8	27.9	23	3	28.1	21.9	0.6
2980	16 4/8	4/8	28.0	23	3	28.2	21.9	0.6
3000	16 5/8	4/8	28.1	23	3	28.3	21.9	0.6
3020	16 6/8	4/8	28.2	23	3	28.5	21.9	0.6
3050	16 7/8	4/8	28.3	23	3	28.6	21.9	0.6
3070	17	4/8	28.4	23	3	28.7	21.9	0.6
3090	17 1/8	4/8	28.6	23	3	28.8	21.9	0.6
3110	17 2/8	4/8	28.7	23	3	28.9	21.9	0.6
3140	17 3/8	4/8	28.8	23	3	29.0	21.9	0.6
3160	17 4/8	4/8	28.9	23	3	29.1	21.9	0.6
3180	17 5/8	4/8	29.0	23	3	29.2	21.9	0.6
3200	17 6/8	4/8	29.1	22	3	29.4	21.9	0.6
3230	17 7/8	4/8	29.2	22	3	29.5	21.9	0.6
3250	18	4/8	29.3	22	3	29.6	21.9	0.6
3270	18 1/8	4/8	29.5	22	3	29.7	21.9	0.6
3290	18 2/8	4/8	29.6	22	3	29.8	21.9	0.6
3320	18 3/8	4/8	29.7	22	3	29.9	21.9	0.6
3340	18 4/8	4/8	29.8	22	3	30.0	21.9	0.6

FT 4.2-K-2 TABLE D 900 MILS

CTG, HE, M329A2 FUZE, PD, M557 CORRECTION FACTORS

1	10	11	12	13	14	15	16	17	18	19
RANGE	RANGE CORRECTIONS FOR									
	MUZZLE VELOCITY 1 M/S		RANGE WIND 1 KNOT		AIR TEMP 1 PCT		AIR DENSITY 1 PCT		PROJ WT	
	DEC	INC	HEAD	TAIL	DEC	INC	DEC	INC	DEC	INC
M	M	M	M	M	M	M	M	M	M	M
2520	25.9	-25.2	2.8	-2.0	0.0	0.0	-3.4	3.5		
2540	26.0	-25.2	2.8	-2.0	0.0	0.0	-3.5	3.5		
2560	26.0	-25.3	2.8	-2.0	0.0	0.0	-3.5	3.6		
2590	26.1	-25.4	2.9	-2.1	0.0	0.0	-3.6	3.7		
2610	26.2	-25.4	2.9	-2.1	0.0	0.0	-3.6	3.7		
2630	26.2	-25.5	2.9	-2.1	0.0	0.0	-3.7	3.8		
2660	26.3	-25.6	3.0	-2.1	0.0	0.0	-3.8	3.9		
2680	26.4	-25.7	3.0	-2.2	0.0	0.0	-3.8	3.9		
2700	26.4	-25.7	3.0	-2.2	0.0	0.0	-3.9	4.0		
2730	26.5	-25.8	3.1	-2.2	0.0	0.0	-4.0	4.1		
2750	26.5	-25.8	3.1	-2.3	0.0	0.0	-4.0	4.1		
2770	26.6	-25.9	3.1	-2.3	0.0	0.0	-4.1	4.2		
2790	26.6	-26.0	3.2	-2.3	0.0	0.0	-4.1	4.2		
2820	26.7	-26.0	3.2	-2.4	0.0	0.0	-4.2	4.3		
2840	26.8	-26.1	3.2	-2.4	0.0	0.0	-4.3	4.4		
2860	26.8	-26.1	3.3	-2.4	0.0	0.0	-4.3	4.4		
2890	26.9	-26.2	3.3	-2.4	0.0	0.0	-4.4	4.5		
2910	26.9	-26.3	3.4	-2.5	0.0	0.0	-4.5	4.6		
2930	27.0	-26.3	3.4	-2.5	0.0	0.0	-4.5	4.6		
2950	27.0	-26.4	3.4	-2.5	0.0	0.0	-4.6	4.7		
2980	27.1	-26.5	3.5	-2.6	0.0	0.0	-4.7	4.8		
3000	27.1	-26.5	3.5	-2.6	0.0	0.0	-4.7	4.9		
3020	27.2	-26.6	3.5	-2.6	0.0	0.0	-4.8	4.9		
3050	27.2	-26.6	3.6	-2.6	0.0	0.0	-4.9	5.0		
3070	27.3	-26.7	3.6	-2.7	0.0	0.0	-4.9	5.1		
3090	27.3	-26.7	3.6	-2.7	0.0	0.0	-5.0	5.1		
3110	27.4	-26.8	3.7	-2.7	0.0	0.0	-5.1	5.2		
3140	27.4	-26.8	3.7	-2.8	0.0	0.0	-5.2	5.3		
3160	27.5	-26.9	3.8	-2.8	0.0	0.0	-5.2	5.4		
3180	27.5	-26.9	3.8	-2.8	0.0	0.0	-5.3	5.4		
3200	27.6	-27.0	3.8	-2.8	0.0	0.0	-5.4	5.5		
3230	27.6	-27.0	3.9	-2.9	0.0	0.0	-5.4	5.6		
3250	27.7	-27.1	3.9	-2.9	0.0	0.0	-5.5	5.7		
3270	27.7	-27.1	3.9	-2.9	0.0	0.0	-5.6	5.7		
3290	27.7	-27.2	4.0	-3.0	0.0	0.0	-5.6	5.8		
3320	27.8	-27.2	4.0	-3.0	0.0	0.0	-5.7	5.9		
3340	27.8	-27.3	4.0	-3.0	0.0	0.0	-5.8	6.0		

Figure 4-12. Sample pages from firing tables for 4.2-inch mortars.

NOTE: The M329A1E1 has been type-classified as M329A2.

(2) Parts I, II, III, and IV of FT 4.2-H-2 give details on the different elevations that can be used with the 4.2-inch mortar, with and without extension, for various rounds and charges. These parts also provide Tables A, B, C, D, and E, which provide the same information as in all firing tables. Part I includes the M329A1 HE round and the M328A1 WP round;

Part II includes the XM630 round; Part III includes the M335A1 round; and Part IV includes the M335A2 illumination round. The appendixes contain the trajectory charts.

(3) Parts 1-1, 1-2, and 1-3 of FT 4.2-K-2 provide details of the different elevations that can be used with the 4.2-inch mortar for the M329A2 round. These parts also provide Tables A, B, C, D, and E that reflect the same information as in all firing tables. The appendixes contain the trajectory charts.

4-6. BALLISTIC MET MESSAGE

The Ballistic MET Message (DA Form 3675) provides the means to determine the corrections needed to the firing data so that the section has better accuracy and target effect without reregistering every two to four hours. The MET message corrections are valid until a subsequent MET message is received. It provides the information to compensate for all nonstandard conditions, such as changes in powder temperatures, projectile weight, air temperature and density, and the speed and direction of the wind between the mortar platoon and the targets.

a. **Use of MET Message.** To be valid, the MET message must be received along with the initial registration mission. The FDC should request a MET message as soon as possible after setting up the surveyed firing chart to ensure that the first MET message will be current. This message alone is not adequate to determine firing corrections. However, it can inform the FDC of how much of the registration corrections are due to weather. After the first MET message is received and computed, a second MET message should be received within four hours. This message is computed, the two are compared, and the data are determined for updating the firing equipment.

b. **Source of MET Message.** The MET message is received from the corps FA target acquisition battalion and is usually transmitted by FM radio to battalion. Battalion headquarters then sends the message down to the FDC. Prior coordination with the target acquisition battalion will ensure that the FDC receives the MET in ballistic format instead of computerized format.

c. **Receipt of MET Message.** The MET message is broadcast in six-character groups. These groups of characters are shown in Figure 4-13, page 4-16, for ease of explanation. An example of a completed DA Form 3675 is given in Figure 4-14, page 4-17, using the same six-character groups to show how they are entered into the form. The message has two parts: the *introduction* and the *body*.

(1) *Introduction.* The first four groups of six characters in the MET message are the introduction, identifying the type of message and the MET station transmitting the message. This is what the character groups mean:

(a) GROUP 1: MET B 31.

MET - indicates that the transmission is a MET message.

B - (type of fire) indicates that the message is a ballistic MET message.

3 - indicates that the message is for surface-to-surface fire. For use with mortars, the number 3 must appear.

1 - indicates the octant of the globe in which the MET message applies. When code 9 is sent for the octant, the area is in code and not in numbers — for example, MIF MIF.

NOTE: Octants are further defined in the firing tables.

(b) GROUP 2:344985.

344 - indicates the latitude of the center of the area, expressed to the nearest tenth of a degree.

985 - indicates the longitude of the center of the area, expressed to the nearest tenth of a degree.

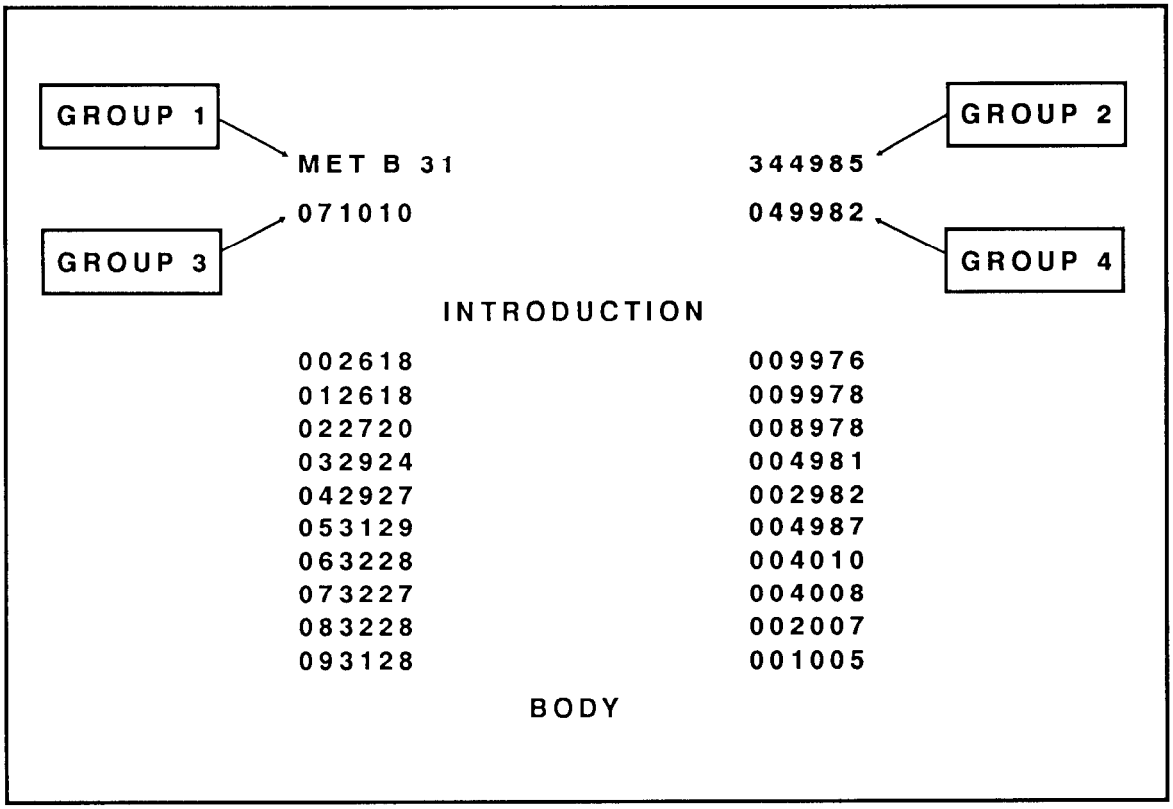


Figure 4-13. Six-character groups.

(c) GROUP 3: 071010.

07 - indicates the day of the month.

101 - indicates, to the nearest tenth of an hour, Greenwich mean time (GMT), the hour the period of validity begins.

NOTE: To convert GMT to the standard time, see FM 6-15.

0 - indicates the duration of the MET message. For US armed forces, the MET data are presumed valid until a later message is received.

(d) GROUP 4: 049982.

049 - indicates, in tens of meters, the altitude of the MET station above sea level.

982 - indicates the atmospheric pressure at the MET datum plane (MDP). This value is rounded to the nearest one-tenth of a percent of standard atmospheric pressure at sea level. When this value is 100 or greater, the initial digit 1 is omitted.

BALLISTIC MET MESSAGE

For use of this form, see FM 6-15, the proponent agency is TRADOC.

IDENTIFICATION METB	TYPE MSG K	OCTANT Q	LOCATION $L_aL_aL_a$ or xxx	LOCATION $L_oL_oL_o$ or xxx	DATE YY	TIME (GMT) $G_oG_oG_o$	DURATION (HOURS) G	STATION HEIGHT (10's M) hhh	MDP PRESSURE % OF STD PPP
METB	3	1	344985		07	101	0	049	982

ZONE HEIGHT (METERS)	LINE NUMBER	BALLISTIC WINDS DIRECTION (100's MILS) dd	BALLISTIC WINDS SPEED (KNOTS) FF	BALLISTIC AIR TEMPERATURE (% OF STD) TTT	BALLISTIC AIR DENSITY (% OF STD)
SURFACE	00	26	18	009	976
200	01	26	18	009	978
500	02	27	20	008	978
1000	03	29	24	004	981
1500	04	29	27	002	982
2000	05	31	29	004	987
3000	06	32	28	004	010
4000	07	32	27	004	008
5000	08	32	28	002	007
6000	09	31	28	001	005
8000	10				
10000	11				
12000	12				
14000	13				
16000	14				
18000	15				

REMARKS

DELIVERED TO: RECEIVED FROM	TIME (GMT)	TIME (LST)

MESSAGE NUMBER	DATE

RECORDER	CHECKED

DA FORM 1 JAN 71 3675 REPLACES DA FORM 6-57, 1 MAR 62, WHICH IS OBSOLETE.

Figure 4-14. Example of completed DA Form 3675, Ballistic MET Message.

(2) *Body*. The next group of six-character blocks is the body, containing the MET data listed by line number. The relationship of the line numbers and zone heights to the meteorological datum plane is shown in Figure 4-15. The remaining 16 lines of the body are the same form and contain the same information. The use of all 16 lines is not applicable for mortars, because of the height that the mortars can fire. Only the first seven lines (00-006) need be recorded (Figure 4-16, page 4-19). The character groups that compose the body (Figure 4-13, page 4-16) are interpreted as follows:

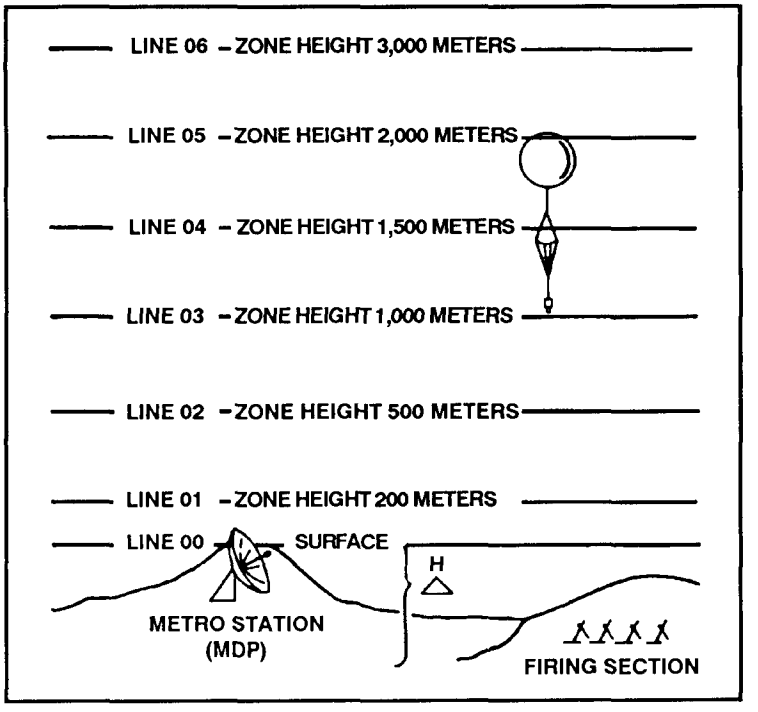


Figure 4-15. Line number and zone height relative to meteorological data plane.

(a) **002618: 00** - the line number indicating the standard height relative to the MDP.

26 - the direction from which the ballistic wind is blowing (measured clockwise from north). This is in hundreds of mils; that is, 2600 mils.

18 - the ballistic wind speed to the nearest knot, that is 18 knots.

(b) **009976: 009** - the ballistic air temperature to the nearest 0.1 percent of standard. The initial digit 1 is omitted when the value is 100 or greater.

976 - the ballistic air density to the nearest 0.1 percent of standard. As with temperature, the initial 1 is omitted when the value is 100 or greater.

d. **Recording of the MET Message.** As the MET message is sent, it is recorded on DA Form 3675 (Ballistic MET Message) (Figure 4-14). If, during the transmission, something is missed or recorded wrong, the format of the form allows the computer to ask for that portion of the message to be repeated.

e. **MET Message Computation.** Using DA Form 2601-1 (MET Data Correction Sheet for Mortars) (Figure 4-17, page 4-20) after the MET message has been recorded, the FDC computes the MET and determines the corrections to apply for updating the firing equipment. Known data are recorded in the proper spaces on the form. These are data available at the mortar platoon or section (obtained from the data sheet or section sergeant) and are interpreted as follows:

(1) CHARGE — the command charge used to hit the RP. This charge is used to determine the line number to be used for computing the message.

(2) CHART RANGE — the command range from the mortar platoon or section to the RP.

NOTE: The reason for using the command charge and range is that this puts the round at its highest ordinate for that range, which is where the round is affected most.

BALLISTIC MET MESSAGE

For use of this form, see FM 6-15, the proponent agency is TRADOC.

IDENTIFICATION	TYPE MSG	OCTANT	LOCATION		DATE	TIME (GMT)	DURATION (HOURS)	STATION HEIGHT (10's M)	MDP PRESSURE % OF STD
METB	K	Q	$L_aL_aL_a$ or xxx	$L_oL_oL_o$ or xxx	YY	$G_oG_oG_o$	G	hhh	PPP
METB	3	1	356	321	08	1030	0	040	996

ZONE HEIGHT (METERS)	LINE NUMBER	BALLISTIC WINDS		BALLISTIC AIR	
		DIRECTION (100's MILS) dd	SPEED (KNOTS) FF	TEMPERATURE (% OF STD) TTT	DENSITY (% OF STD) △△△
SURFACE	00	19	19	000	996
200	01	20	18	989	995
500	02	21	20	000	999
1000	03	20	20	001	002
1500	04	18	19	997	982
2000	05	20	21	001	983
3000	06	17	18	987	987
	07				
16000					
18000	15				

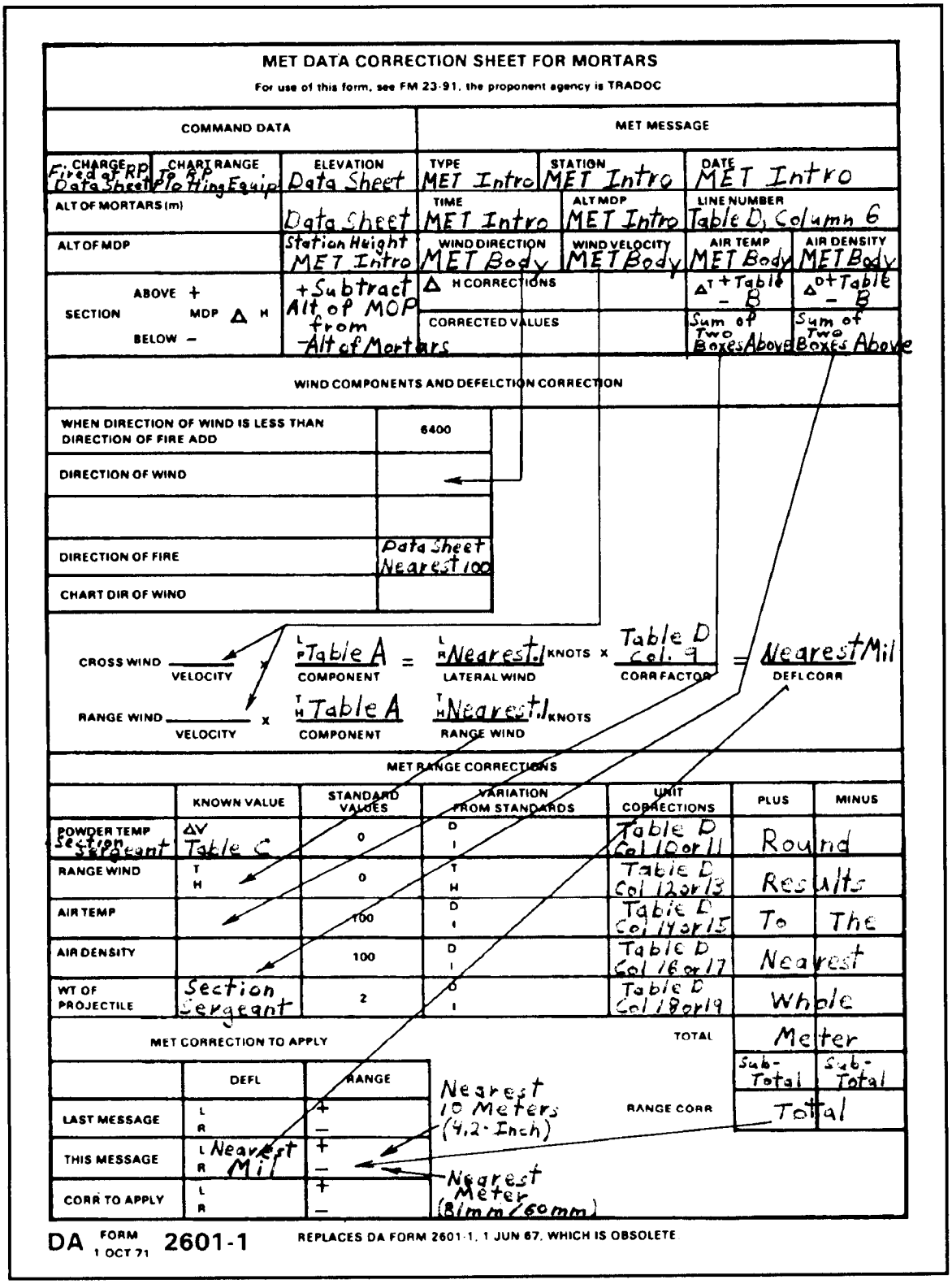
REMARKS

DELIVERED TO: RECEIVED FROM:	TIME (GMT)	TIME (LST)

MESSAGE NUMBER	DATE
RECORDER	CHECKED

DA FORM 1 JAN 71 3675 REPLACES DA FORM 6-57, 1 MAR 62, WHICH IS OBSOLETE.

Figure 4-16. Example of completed first seven lines for DA Form 3675.



MET DATA CORRECTION SHEET FOR MORTARS

For use of this form, see FM 23-91, the proponent agency is TRADOC

COMMAND DATA			MET MESSAGE			
CHARGE: Fired at RP, Data Sheet	CHART RANGE: To AP, Plotting Equip	ELEVATION: Data Sheet	TYPE: MET Intro	STATION: MET Intro	DATE: MET Intro	
ALT OF MORTARS (m)		Data Sheet	TIME: MET Intro	ALT MDP: MET Intro	LINE NUMBER: Table D, Column 6	
ALT OF MDP		Station Height MET Intro	WIND DIRECTION: MET Body	WIND VELOCITY: MET Body	AIR TEMP: MET Body	AIR DENSITY: MET Body
SECTION: ABOVE + / MDP Δ H / BELOW −		+Subtract Alt of MDP from −Alt of Mortars	Δ H CORRECTIONS		Δ^T +Table B	Δ^D +Table B
			CORRECTED VALUES		Sum of Two Boxes Above	Sum of Two Boxes Above

WIND COMPONENTS AND DEFELCTION CORRECTION

WHEN DIRECTION OF WIND IS LESS THAN DIRECTION OF FIRE ADD	6400
DIRECTION OF WIND	
DIRECTION OF FIRE	Data Sheet Nearest 100
CHART DIR OF WIND	

CROSS WIND ____ VELOCITY × $^{L}_{R}$ Table A COMPONENT = $^{L}_{R}$ Nearest 1 KNOTS LATERAL WIND × Table D Col. 9 CORR FACTOR = Nearest Mil DEFL CORR

RANGE WIND ____ VELOCITY × $^{T}_{H}$ Table A COMPONENT = $^{T}_{H}$ Nearest 1 KNOTS RANGE WIND

MET RANGE CORRECTIONS

	KNOWN VALUE	STANDARD VALUES	VARIATION FROM STANDARDS	UNIT CORRECTIONS	PLUS	MINUS
POWDER TEMP Section Sergeant	ΔV Table C	0	D I	Table D Col 10 or 11	Round	
RANGE WIND	$^{T}_{H}$	0	$^{T}_{H}$	Table D Col 12 or 13	Results	
AIR TEMP		100	D I	Table D Col 14 or 15	To	The
AIR DENSITY		100	D I	Table D Col 16 or 17	Nearest	
WT OF PROJECTILE	Section Sergeant	2	D I	Table D Col 18 or 19	Whole	
MET CORRECTION TO APPLY				TOTAL	Meter	
					Sub-Total	Sub-Total
				RANGE CORR	Total	

	DEFL	RANGE
LAST MESSAGE	$^{L}_{R}$	+ / −
THIS MESSAGE	$^{L}_{R}$ Nearest Mil	+ / −
CORR TO APPLY	$^{L}_{R}$	+ / −

Nearest 10 Meters (4.2-Inch)

Nearest Meter (81mm/60mm)

DA FORM 1 OCT 71 2601-1 REPLACES DA FORM 2601-1, 1 JUN 67, WHICH IS OBSOLETE

Figure 4-17. Example of completed DA Form 2601-1, MET Data Correction Sheet for Mortars.

(3) ELEVATION OF MORTARS — the elevation used to hit the RP.

(4) ALT OF MORTARS — the altitude of the mortar platoon or section to the nearest 10 meters.

(5) LINE NUMBER — used for the MET and can also be recorded before the MET message is received. To do so, the computer enters the firing tables as follows:

(6) DIRECTION OF FIRE — the azimuth to the RP to the nearest 100 mils.

(7) POWDER TEMP — the temperature of the propellants. If the temperature of the powder cannot be determined, air temperature at the platoon or section can be used.

(8) WT (weight) OF PROJECTILE (4.2-inch mortar) — the weight of the ammunition used during the registration mission. The weight is expressed in squares, and two squares (2 □) has been set as the standard. If the section has different types of ammunition, the same weight projectile must be used during the registration.

(a) For the 4.2-inch mortar, at the elevation used during the registration: go to column 2 and find the command charge, then go to column 6. The number at that charge in column 6 is the line number.

(b) For the 60-mm, 81-mm, or 120-mm mortars, at the command charge: go to column 1 (range) and find the command range, then go to column 5. The number at that range in column 5 is the line number.

(c) Once the MET message has been received and recorded, record the introduction and information from the line number being used on DA Form 2601-1 (Figure 4-17).

(d) Since the altitude of the MDP is in tens of meters and the wind direction is in hundreds of mils, change them to read their actual values. Once this is done, determine the MET values (the corrections for this MET).

f. Air Temperature and Air Density Corrections. To determine the corrected values for air temperature and air density, the computer must first determine where the platoon or section is in relationship to the MDP (difference in DH correction). To do so, the altitude of the section and the MDP are compared, and the smaller is subtracted from the larger. The remainder is the height of the platoon or section above or below the MDP.

NOTE: If the altitude of the section is above the MDP, the sign is plus (+); if below, the sign is minus (-).

(1) Once the distance above or below the MDP is known, the computer can enter Table B (Figure 4-18, page 4-22), which shows the correction that must be applied on the MET data correction sheet (Figure 4-17) to the ballistic AIR TEMP AIR DENSITY. This compensates for the difference in altitude between the platoon or section and the MDP, and determines the corrections for AIR TEMP (difference in DT) and AIR DENSITY (difference in DD). Those corrections modify the values of AIR TEMP and AIR DENSITY determined at the MDP to what the would be at the mortar platoon or section. Corrections for difference in DT and difference in DD are arranged in four double rows in the table.

CHARGE 2

TABLE B

FT 81-AR-1

TEMPERATURE AND DENSITY CORRECTIONS

CTG, HE, M821
FUZE, MO M734

CORRECTIONS TO TEMPERATURE (DT) AND DENSITY (DD), IN PERCENT, TO COMPENSATE FOR THE DIFFERENCE IN ALTITUDE, IN METERS, BETWEEN THE BATTERY AND THE MDP

DH		0	+10-	+20-	+30-	+40-	+50-	+60-	+70-	+80-	+90-
0	DT	0.0	0.0	0.0	-0.1+	-0.1+	-0.1+	-0.1+	-0.2+	-0.2+	-0.2+
	DD	0.0	-0.1+	-0.2+	-0.3+	-0.4+	-0.5+	-0.6+	-0.7+	-0.8+	-0.9+
+100-	DT	-0.2+	-0.2+	-0.2+	-0.3+	-0.3+	-0.3+	-0.3+	-0.4+	-0.4+	-0.4+
	DD	-1.0+	-1.1+	-1.2+	-1.3+	-1.4+	-1.5+	-1.6+	-1.7+	-1.8+	-1.9+
+200-	DT	-0.5+	-0.5+	-0.5+	-0.6+	-0.6+	-0.6+	-0.6+	-0.7+	-0.7+	-0.7+
	DD	-2.0+	-2.1+	-2.2+	-2.3+	-2.4+	-2.5+	-2.6+	-2.7+	-2.8+	-2.9+
+300-	DT	-0.7+	-0.7+	-0.7+	-0.8+	-0.8+	-0.8+	-0.8+	-0.9+	-0.9+	-0.9+
	DD	-3.0+	-3.1+	-3.2+	-3.3+	-3.4+	-3.5+	-3.6+	-3.7+	-3.8+	-3.9+

NOTES – 1. DH IS BATTERY HEIGHT ABOVE OR BELOW THE MDP.
2. IF ABOVE THE MDP, USE THE SIGN BEFORE THE NUMBER.
3. IF BELOW THE MDP, USE THE SIGN AFTER THE NUMBER.

Figure 4-18. Sample page from firing tables for 81-mm mortars for temperature and density corrections.

(2) The numbers 0, +100–, +200–, and +300– in the left column of the table represent difference in H expressed in hundreds of meters. The numbers 0 and +10– through +90– across the top represent difference in DH in tens of meters. The corrections can be found where the proper hundreds row crosses the proper tens column. The numerical sign of the corrections is opposite of the difference in DH sign.

EXAMPLE

Assume that the difference in DH is -30, the corrected value for the difference in DH is + 0.1, and the difference in DD is + 0.3 (enter a 0 in hundreds column, go across to +30-column). Those corrections entered on DA Form 2601-1 and the corrected values can then be determined and recorded in the proper spaces (Figure 4-17).

g. **Wind Component Corrections.** To determine the corrections for wind components, the computer compares the DIRECTION OF WIND (MET) and the DOF (Figure 4-17). If the direction of wind is less than the DOF, he adds 6400 mils and then subtracts the DOF.

EXAMPLE

DOF 4300, DIRECTION OF WIND (MET) 2900: 2900 + 6400 = 9300 – 4300 = 5000 mils (chart direction of wind).

The remainder (CHART DIRECTION OF WIND) is then used to enter Table A (Figure 4-19, page 2-23) at the CHART DIRECTION OF WIND. Table A divides a 1-knot wind into crosswind and range wind components to show the effect on a round in flight. The chart direction of wind is the angle formed by the DOF and direction of wind. The computer reads across that row to find the crosswind and range wind components. Those are recorded in the proper spaces in DA Form 2601-1. Once the wind components have been determined, the computer determines crosswind and range wind corrections.

FT 81-AR-1 TABLE A CHARGE 2

CTG, HE, M821
FUZE, MO M734

WIND COMPONENTS

COMPONENTS OF A ONE KNOT WIND

CHART DIRECTION OF WIND MIL	CROSS WIND KNOT	RANGE WIND KNOT	CHART DIRECTION OF WIND MIL	CROSS WIND KNOT	RANGE WIND KNOT
0	0	H1.00	3200	0	T1.00
100	R.10	H.99	3300	L.10	T.99
200	R.20	H.98	3400	L.20	T.98
300	R.29	H.96	3500	L.29	T.96
400	R.38	H.92	3600	L.38	T.92
500	R.47	H.88	3700	L.47	T.88
600	R.56	H.83	3800	L.56	T.83
700	R.63	H.77	3900	L.63	T.77
800	R.71	H.71	4000	L.71	T.71
900	R.77	H.63	4100	L.77	T.63
1000	R.83	H.56	4200	L.83	T.56
1100	R.88	H.47	4300	L.88	T.47
1200	R.92	H.38	4400	L.92	T.38
1300	R.96	H.29	4500	L.96	T.29
1400	R.98	H.20	4600	L.98	T.20
1500	R.99	H.10	4700	L.99	T.10
1600	R1.00	0	4800	L1.00	0
1700	R.99	T.10	4900	L.99	H.10
1800	R.98	T.20	5000	L.98	H.20
1900	R.96	T.29	5100	L.96	H.29
2000	R.92	T.38	5200	L.92	H.38
2100	R.88	T.47	5300	L.88	H.47
2200	R.83	T.56	5400	L.83	H.56
2300	R.77	T.63	5500	L.77	H.63
2400	R.71	T.71	5600	L.71	H.71
2500	R.63	T.77	5700	L.63	H.77
2600	R.56	T.83	5800	L.56	H.83
2700	R.47	T.88	5900	L.47	H.88
2800	R.38	T.92	6000	L.38	H.92
2900	R.29	T.96	6100	L.29	H.96
3000	R.20	T.98	6200	L.20	H.98
3100	R.10	T.99	6300	L.10	H.99
3200	0	T1.00	6400	0	H1.00

Figure 4-19. Sample page from firing tables for 81-mm mortars for wind components.

(1) *Crosswind (deflection correction).* Multiply the component of the wind speed (Table A) by the wind velocity (MET). This yields the lateral wind. Once the lateral wind is determined, enter Table D (Figure 4-20, page 4-24), go to column 7 (60-mm/81-mm/120-mm mortars) or column 9 (4.2-inch mortar), and find the correction factor. Record the correction factor in the proper space. Then, multiply the correction factor by the lateral wind, carry the sign of the component (left/right), and determine the product to the nearest mil. That is the deflection correction for this MET. Record it in the proper space on DA Form 2601-1.

(2) *Range Wind.* Multiply the component by the wind speed. Carry the sign of the component (H or T from Table D), determine to the nearest 0.1 mil, and record it in the proper space on DA Form 2601-1.

h. *Range Corrections.* All values should be recorded in the proper spaces except DV, which is found as follows: The computer enters Table C (Figure 4-21, page 4-25), which shows the corrections to muzzle velocity for various temperatures of the propellent charges. He finds the temperature closest to that recorded for the propellent; DV appears in the center column on the same line as the temperature. The computer records that value in the proper space. Then he determines the amount by which all the known values vary from the standard values upon which the firing tables are based.

NOTE: Within the firing tables: D = decrease from standard, I = increase from standard.

900 MILS TABLE D FT 4.2-K-2
BASIC DATA CTG, HE, M329A2
FUZE, PD, M557

1	2	3	4	5	6	7	8	9
RANGE	CHARGE	D CHG PER 100 M DR	FS FOR GRAZE BURST FUZE M564	DR PER 1/8 INC D CHG	LINE NO.	TIME OF FLIGHT	AZIMUTH CORRECTIONS	
							DRIFT (CORR TO L)	CW OF 1 KNOT
M	INC	INC		M		SEC	MIL	MIL
880	5	5/8	14.8	20	1	15.0	22.4	0.4
910	5 1/8	5/8	15.0	21	1	15.2	22.4	0.4
930	5 2/8	5/8	15.2	21	1	15.4	22.4	0.4
950	5 3/8	5/8	15.3	21	1	15.5	22.3	0.4
970	5 4/8	5/8	15.5	21	1	15.7	22.3	0.4
990	5 5/8	5/8	15.7	21	1	15.9	22.3	0.4
1010	5 6/8	5/8	15.8	21	1	16.1	22.3	0.4
1030	5 7/8	5/8	16.0	21	1	16.2	22.3	0.4
1050	6	5/8	16.2	21	1	16.4	22.2	0.4
1070	6 1/8	5/8	16.4	21	1	16.6	22.2	0.4
1100	6 2/8	5/8	16.5	22	1	16.7	22.2	0.4
1120	6 3/8	5/8	16.7	22	2	16.9	22.2	0.4
1140	6 4/8	5/8	16.9	22	2	17.1	22.2	0.4
1160	6 5/8	5/8	17.0	22	2	17.2	22.2	0.4
1180	6 6/8	5/8	17.2	22	2	17.4	22.2	0.4
1200	6 7/8	5/8	17.3	22	2	17.6	22.1	0.4
1230	7	5/8	17.5	22	2	17.7	22.1	0.4
1250	7 1/8	5/8	17.7	22	2	17.9	22.1	0.4
1270	7 2/8	5/8	17.8	22	2	18.1	22.1	0.4
1290	7 3/8	4/8	18.0	22	2	18.2	22.1	0.4
1320	7 4/8	4/8	18.2	22	2	18.4	22.1	0.4
1340	7 5/8	4/8	18.3	22	2	18.6	22.1	0.4
1360	7 6/8	4/8	18.5	22	2	18.7	22.1	0.4
1380	7 7/8	4/8	18.6	23	2	18.9	22.1	0.5
1410	8	4/8	18.8	23	2	19.0	22.1	0.5
1430	8 1/8	4/8	19.0	23	2	19.2	22.1	0.5
1450	8 2/8	4/8	19.1	23	2	19.3	22.1	0.5
1470	8 3/8	4/8	19.3	23	2	19.5	22.1	0.5
1500	8 4/8	4/8	19.4	23	2	19.7	22.1	0.5
1520	8 5/8	4/8	19.6	23	2	19.8	22.0	0.5
1540	8 6/8	4/8	19.7	23	2	20.0	22.0	0.5
1560	8 7/8	4/8	19.9	23	2	20.1	22.0	0.5
1590	9	4/8	20.0	23	2	20.3	22.0	0.5
1610	9 1/8	4/8	20.2	23	2	20.4	22.0	0.5
1630	9 2/8	4/8	20.3	23	2	20.6	22.0	0.5
1660	9 3/8	4/8	20.5	23	2	20.7	22.0	0.5
1680	9 4/8	4/8	20.6	23	2	20.9	22.0	0.5

CHARGE 2 TABLE D FT 81-AR-1
BASIC DATA CTG, HE, M821
FUZE, MO, M734

1	2	3	4	5	6	7
RANGE	ELEV	D ELEV PER 100 M DR	APPROX NO. OF TURNS PER 100 M DR	LINE NO.	TIME OF FLIGHT	AZIMUTH CORRECTION CW OF 1 KNOT
M	MIL	MIL			SEC	MIL
565	1511	16	2	5	40.0	8.4
575	1509	16	2	5	40.0	8.3
600	1505	16	2	5	40.0	7.9
625	1502	16	2	5	40.0	7.6
650	1498	16	2	5	40.0	7.3
675	1494	16	2	5	40.0	7.0
700	1490	16	2	5	40.0	6.7
725	1486	16	2	5	40.0	6.6
750	1482	16	2	5	40.0	6.3
775	1478	16	2	5	40.0	6.1
800	1474	16	2	5	40.0	5.9
825	1470	16	2	5	40.0	5.7
850	1466	16	2	5	39.9	5.5
875	1462	16	2	5	39.9	5.3
900	1458	16	2	5	39.9	5.2
925	1454	16	2	5	39.9	5.0
950	1450	16	2	5	39.9	4.9
975	1446	16	2	5	39.8	4.7
1000	1442	16	2	5	39.8	4.6
1025	1438	16	2	5	39.8	4.5
1050	1434	16	2	5	39.7	4.4
1075	1430	16	2	5	39.7	4.2
1100	1426	16	2	5	39.7	4.1
1125	1422	16	2	5	39.6	4.0
1150	1418	16	2	5	39.6	3.9
1175	1414	16	2	5	39.6	3.8
1200	1410	16	2	5	39.5	3.7
1225	1406	16	2	5	39.5	3.6
1250	1402	16	2	5	39.5	3.6
1275	1398	16	2	4	39.4	3.5
1300	1394	16	2	4	39.4	3.4

Figure 4-20. Sample pages from firing tables for 4.2-inch /81-mm mortars for correction factors.

(1) Once those variations are determined, enter the firing table at Table D (Figure 4-20) (command charge and elevation, 4.2-inch mortars; command charge and range, 60-mm / 81-mm / 120-mm mortar), go to columns 8 to 15 (60-mm, 81-mm, and 120-mm) or 10 to 17 (4.2-inch mortar) and record the unit corrections for each variation.

NOTE: The sign of the unit correction must be recorded; numbers without a sign are a plus (+). If the column ends, the last listed numbers are considered to continue.

(2) Once the variations have been recorded, multiply the variations from standard by the unit corrections and place the result (rounded to the nearest whole meter) in the column with the same sign as the unit correction. Once all corrections have been multiplied, compare the minus (–) and plus (+), subtract the smaller

from the larger, and use the sign of the larger. Determine the result to the nearest meter for 60-mm/81-mm/120-mm mortars, or to the nearest 10 meters for 4.2-inch mortars, and record in the proper space.

FT 81-AR-1 TABLE C CHARGE 2
CTG, HE, M821 PROPELLANT TEMPERATURE
FUZE, MO, M734

VARIATIONS IN MUZZLE VELOCITY DUE TO PROPELLANT TEMPERATURE

TEMPERATURE OF PROPELLANT	VARIATION IN VELOCITY	TEMPERATURE OF PROPELLANT
DEGREES F	M/S	DEGREES C
-40	-4.9	-40.0
-35	-4.8	-37.2
-30	-4.6	-34.4
-25	-4.4	-31.7
-20	-4.2	-28.9
-15	-4.0	-26.1
-10	-3.8	-23.3
-5	-3.6	-20.6
0	-3.4	-17.8
5	-3.2	-15.0
10	-2.9	-12.2
15	-2.7	-9.4
20	-2.5	-6.7
25	-2.3	-3.9
30	-2.0	-1.1
35	-1.8	1.7
40	-1.5	4.4
45	-1.3	7.2
50	-1.0	10.0
55	-.8	12.8
60	-.5	15.6
65	-.3	18.3
70	0.0	21.1
75	.3	23.9
80	.5	26.7
85	.8	29.4
90	1.1	32.2
95	1.4	35.0
100	1.7	37.8
105	2.0	40.6
110	2.3	43.3
115	2.6	46.1
120	2.9	48.9
125	3.2	51.7
130	3.5	54.4

Figure 4-21. Sample page from firing tables for 81-mm mortars for propellant temperature.

4-7. THE 6400-MIL MET MESSAGE

The target area is usually larger than the transfer limits of the RP, and yet time, ammunition, and the tactical situation will permit firing only one registration.

a. By assuming negligible error in surveyor maps, lay of the weapons, and preparation of the plotting boards or MBC computer, the FDC can divide the registration corrections for the RP into two parts. The first part is a correction that is only a function of the range fired, and it is constant for a given range, regardless of direction. The second part is a function of the direction fired.

b. If the amount of the concurrent MET computed for the RP is subtracted from the total registration correction, the result is an absolute registration correction that does not change with the direction fired or the weather. The FDC can then plot an imaginary RP at the same range as the original RP, but in other directions (usually 800 mils apart), compute a MET correction for each of those directions, and, by adding the different MET corrections to the absolute registration correction, determine different firing corrections for each of the imaginary RPs. The firing corrections determined for the imaginary RPs can then be applied when engaging targets within their transfer limits.

4-8. COMPUTATION OF MET CORRECTIONS FOR LARGE SECTOR CAPABILITY

A special worksheet, such as DA Form 2601-2-R, MET Data Correction Sheet 6400 Mils (Mortars) (Figures 4-22 and 4-23), is needed to compute multiple MET from single registration. The supplemental (imaginary) RPs are spaced 800 mils apart, extending to the right and left of the RP as far as needed to cover the sector of responsibility. DA Form 2601-2-R shows a full 6400-mil capacity. On the firing chart, all of the imaginary RPs are plotted at the same range from the mortar position as the real RP. Computation of the MET corrections are described herein. (For a blank reproducible copy of DA Form 2601-2-R, see the back of this publication.)

MET DATA CORRECTION SHEET 6400 MILS(MORTARS)

For use of this form, see FM 23-91; the proponent agency is TRADOC.

FIRING DATA		MET MESSAGE			
CHARGE 4 / CHART RANGE 11811 / ELEVATION 4498		TYPE 3	STATION 344983	DATE 12	
ALTITUDE OF MORTARS (M)	460	TIME	ALT MDP 370	LINE NUMBER 3	
ALTITUDE OF MDP	370	WIND DIRECTION 2400	WIND VELOCITY 19	AIR TEMP 103.9	AIR DENSITY 97.4
SECTION / ABOVE + / BELOW − / MDP / Δ H	⊕ −90	Δ H CORRECTIONS		Δ T ⊕ .2	Δ D ⊖ .9
		CORRECTED VALUES		103.7	96.5

WIND COMPONENTS

	(RP) I	II	III	IV	V	VI	VII	VIII
WHEN DIRECTION OF WIND IS LESS THAN DIRECTION OF FIRE ADD 6400								
DIRECTION OF WIND 2400								
TOTAL 8800								
DIRECTION OF FIRE 4800								
CHART DIRECTION OF WIND (6400 IS LESS THAN CORRESPONDING DIRECTIONAL VARIATION TO CHECK POINTS) 4000	4000	4000	4000	4000	4000	4000	4000	4000
DIRECTIONAL VARIATION TO CHECK POINTS	Ø	0800	1600	2400	3200	4000	4800	5600
CHART WIND TO CHECK POINTS	4000	3200	2400	1600	0800	Ø	5600	4800

DEFLECTION CORRECTIONS

	I	II	III	IV	V	VI	VII	VIII
WIND VELOCITY (KNOTS)	19	19	19	19	19	19	19	19
CROSS WIND COMPONENT	R .71	L Ø	⊕ .71	⊕ 1	⊕ .71	L Ø	R .71	R 1
CROSS WIND	R 13.5	L Ø	⊕ 13.5	⊕ 19	⊕ 13.5	L Ø	R 13.5	R 19
CROSS WIND CORRECTION FACTOR	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
DEFLECTION CORRECTION	R 19	L Ø	⊕ 19	⊕ 27	⊕ 19	L Ø	R 19	R 27

RANGE CORRECTIONS

	I	II	III	IV	V	VI	VII	VIII
WIND VELOCITY (KNOTS)	19	19	19	19	19	19	19	19
RANGE WIND COMPONENT	H .71	H 1	H .71	H Ø	H .71	H 1	H .71	H Ø
RANGE WIND	H 13.5	H 19	H 13.5	H Ø	H 13.5	H 19	H 13.5	H Ø
RANGE WIND UNIT CORRECTION	−2.9	−2.9	−2.9	Ø	3.8	3.8	3.8	Ø
RANGE WIND CORRECTION	⊕ 39	⊕ 55	⊕ 39	± Ø	⊖ 51	⊖ 72	⊖ 51	± Ø

	KNOWN VALUE	STANDARD VALUES	VARIATION FROM STANDARD	UNIT CORRECTIONS	PLUS	MINUS
POWDER TEMP 77°F	ΔV = −.3	0	D ⊕ .3	−15.3		5
AIR TEMP	103.7	100	D ⊕ 3.7	−0.3	-0-	
AIR DENSITY	96.5	100	D ⊖ 3.5	−37		13
PROJECTILE WT	NOT COMPUTED FOR 81MM MORTARS					
						18
BALLISTIC RANGE CORR.						−18

ABSOLUTE REGISTRATION CORRECTIONS

REGISTRATION CORRECTION	⊖ 125	⊕ R 11
RP MET CORRECTION	⊕ 60	⊕ R 19
ABSOLUTE REG. CORRECTION	⊖ 65	⊕ R 30

DIRECTIONAL CORRECTIONS

	I (RP)	II	III	IV	V	VI	VII	VIII
BALLISTIC RANGE CORR.	⊕ 18	⊕ 18	⊕ 18	⊕ 18	⊕ 18	⊕ 18	⊕ 18	⊕ 18
RANGE WIND CORRECTION	⊕ 39	⊕ 55	⊕ 39	± Ø	⊖ 51	⊖ 72	⊖ 51	± Ø
TOTAL RANGE CORRECTION	⊕ 60	⊕ 70	⊕ 60	⊕ 20	⊖ 30	⊖ 50	⊖ 30	⊕ 20
MET CORRECTION	⊕ 60 R 19	⊕ 70 R Ø	⊕ 60 L 19	⊕ 20 L Ø	⊖ 30 L 19	⊖ 50 L Ø	⊖ 30 R 19	⊕ 20 R 27
ABSOLUTE REG. CORRECTION	⊖ 65 R 30	⊖ 65 L 30	⊕ 65 R 30	⊖ 65 R 30	⊖ 65 L 30	⊖ 65 R 30	⊖ 65 R 30	⊖ 65 R 30
CORRECTIONS TO APPLY	⊖ 5 R 39	⊖ 5 L 30	⊕ 5 R 11	⊖ 45 R 30	⊖ 95 L 11	⊖ 115 R 30	⊖ 95 R 49	⊖ 45 R 57

DA Form 2601-2-R, 1 OCT 71

Figure 4-22. Example of completed DA Form 2601-2-R, MET Data Correction Sheet 6400 Mils (Mortars).

a. Complete the top section of the sheet. Compute the difference in DH corrections and the corrected values for AIR TEMP and AIR DENSITY in the usual way.

b. Determine the CHART DIRECTION OF WIND as on a normal MET. Copy the result into the box marked I (RP) and as many others as there are imaginary RPs (II is 800 mils clockwise from the RP, and the numbers increase in a clockwise direction to VIII, which is 800 mils counterclockwise from the RP).

c. Add the directional variations to the CHART DIRECTION OF WIND,

d. Copy the wind velocity into the first row of boxes under DEFLECTION CORRECTIONS and RANGE CORRECTIONS. Do not use any column that does not have the CHART DIRECTION OF WIND written on top.

e. From Table A (Figure 4-19), extract the appropriate crosswind component (record it in the DEFLECTION CORRECTIONS section) and range wind component (record it in the RANGE CORRECTIONS section) for each value of chart wind to checkpoints.

f. Multiply the velocity by the components to get values for crosswind and range wind.

g. Find the crosswind correction factor in Table D, (column 7, 60-mm/81-mm/120-mm mortars; column 9, 4.2-inch mortar) corresponding to the adjusted RP charge. Multiply it by the crosswind to get the MET DEFLECTION CORRECTION.

h. Find the proper range wind unit correction in Table D, (columns 10 and 11, 60-mm/81-mm mortars; columns 12 and 13, 4.2-inch mortar). Multiply it by the range wind to get the RANGE WIND CORRECTION.

i. Compute the MET RANGE CORRECTIONS for POWDER TEMP, AIR

MET DATA CORRECTION SHEET 6400 MILS(MORTARS)

For use of this form, see FM 23-91; the proponent agency is TRADOC.

FIRING DATA			MET MESSAGE			
CHARGE 1 4/8	CHART RANGE 2910	ELEVATION 900	TYPE 53	STATION 344985	DATE 07	
ALTITUDE OF MORTARS (M)		460	TIME	ALT MDP 490	LINE NUMBER 03	
ALTITUDE OF MDP			WIND DIRECTION 2900	WIND VELOCITY 24	AIR TEMP 100.4	AIR DENSITY 98.1
SECTION ABOVE + / BELOW − MDP Δ H		+ ⊖30	Δ H CORRECTIONS		Δ T ± .1	Δ D + .3
			CORRECTED VALUES		100.5	98.4

WIND COMPONENTS

		(RP) I	II	III	IV	V	VI	VII	VIII
WHEN DIRECTION OF WIND IS LESS THAN DIRECTION OF FIRE ADD	6400								
DIRECTION OF WIND	2900								
TOTAL	9300								
DIRECTION OF FIRE	−4300								
CHART DIRECTION OF WIND (6400 IS LESS THAN CORRESPONDING DIRECTIONAL VARIATION TO CHECK POINTS)	5000	5000	5000	5000	5000	5000	5000	5000	5000
DIRECTIONAL VARIATION TO CHECK POINTS		-0	-800	-1600	-2400	-3200	-4000	-4800	-5600
CHART WIND TO CHECK POINTS		5000	4200	3400	2600	1800	1000	200	5800

DEFLECTION CORRECTIONS

WIND VELOCITY (KNOTS)	24	24	24	24	24	24	24	24
CROSS WIND COMPONENT	L 98	L 83	L 20	R 56	R 98	R 83	R 20	L 56
CROSS WIND	L 23.5	L 19.9	L 4.8	R 13.4	R 23.5	R 19.9	R 4.8	L 13.4
CROSS WIND CORRECTION FACTOR	.9	.9	.9	.9	.9	.9	.9	.9
DEFLECTION CORRECTION	L 21	L 18	L 4	R 12	R 21	R 18	R 4	L 12

RANGE CORRECTIONS

WIND VELOCITY (KNOTS)	24	24	24	24	24	24	24	24
RANGE WIND COMPONENT	H .20 T	H 98	T .83	T .20	H .56	H 98	T .83	T .56
RANGE WIND	H 4.8	T 13.4	H 23.5	T 19.9	T 4.8	H 13.4	H 23.5	T 19.9
RANGE WIND UNIT CORRECTION	5.1	-3.7	-3.7	-3.7	-3.7	5.1	5.1	5.1
RANGE WIND CORRECTION	+ 24	− 50	− 77	− 74	− 18	+ 68	+ 120	+ 101

	KNOWN VALUE	STANDARD VALUES	VARIATION FROM STANDARD	UNIT CORRECTIONS	PLUS	MINUS
POWDER TEMP 60°F	ΔV = −0.5	0	0.5	23.9	12	
AIR TEMP	100.5	100	0.5	0		
AIR DENSITY	98.4	100	1.6	−6.7		11
PROJECTILE WT	3 □	2 □	1 □	11	11	
					23	11

ABSOLUTE REGISTRATION CORRECTIONS

REGISTRATION CORRECTION	+ 60	+ 23	BALLISTIC RANGE CORR.	12
RP MET CORRECTION	+ 40	+ 21		
ABSOLUTE REG. CORRECTION	+ 20	+ 2		

DIRECTIONAL CORRECTIONS

	I (RP)	II	III	IV	V	VI	VII	VIII
BALLISTIC RANGE CORR.	± 12	± 12	± 12	± 12	± 12	± 12	± 12	± 12
RANGE WIND CORRECTION	+ 24	+ 50	+ 77	+ 74	+ 18	+ 68	+ 120	+ 101
TOTAL RANGE CORRECTION	+ 40	+ 40	+ 70	+ 60	+ 10	+ 80	+ 130	+ 110
MET CORRECTION	+ 40 R 21	+ 40 R 18	+ 70 L 4	+ 60 L 12	+ 10 L 21	− 80 L 19	− 130 L 4	− 110 R 12
ABSOLUTE REG CORRECTION	+ 20 R 2	+ 20 R 2	+ 20 R 2	+ 20 R 2	+ 20 R 2	+ 20 R 2	+ 20 R 2	+ 20 R 2
CORRECTIONS TO APPLY	+ 60 R 23	+ 60 R 20	+ 50 L 6	+ 40 L 10	+ 10 L 19	− 100 L 16	− 150 L 24	− 130 R 14

DA Form 2601-2-R, 1 OCT 71

Figure 4-23. Example of completed DA Form 2601-2-R for a full 6400-mil capacity.

TEMP, AIR DENSITY, and PROJECTILE WT in the usual manner. The net of the four is the ballistic range correction.

j. Combine the ballistic range correction with the various range wind corrections to obtain the total range corrections.

k. Obtain the total MET corrections by bringing together the MET RANGE CORRECTION and the MET DEFLECTION CORRECTION for each of the points.

l. Determine the absolute registration correction. First, calculate the registration correction. The registration range correction is the difference between the chart range to the RP and the range corresponding to the initial range at the RP; it is plus if the chart range is smaller. The DEFLECTION CORRECTION is the LARS (left, add; right, subtract) correction, which must be applied to the initial deflection read at the RP to get the firing deflection that hit it. The RP MET correction, which has been recorded under I (RP), is then subtracted from the registration correction; the result is the absolute registration correction.

m. Add the absolute registration correction to each point MET correction to obtain the corrections to apply at the points.

4-9. METEOROLOGICAL (MET) CORRECTIONS

To place fire on a target without adjustment, the FDC must know the exact location of the target. He must be able to compensate for all nonstandard conditions. Registration and reregistration are the most accurate methods for determining and maintaining firing corrections, but reregistration is not always practical. The ballistic MET message helps to determine corrections due to changes in conditions that affect the flight of rounds during the periods between registrations. Those conditions include changes in powder temperature, air temperature, air density, and the speed and direction of the wind. The FDC assumes that all other factors remain relatively constant until the section displaces.

a. Corrections computed from the MET message are not adequate firing corrections alone. To be of value to the FDC, a valid MET message must be received along with (or within four hours) the registration. The registration corrects for all nonstandard conditions. A MET message received and computed along with the registration tells the FDC how much of the total registration correction is due to weather. By comparing the corrections from a later MET message, the FDC can modify the registration corrections to account for changes in weather. Therefore, the use of MET corrections eliminates the need for reregistration.

b. For MET corrections to be of use, the FDC must receive two MET messages. The corrections from the two are compared to determine the current corrections to update the firing corrections determined from the registration. Once the two messages are computed, the correcting areas (deflection correction and range correction) are compared, and the product is used to update the registration corrections.

EXAMPLE
(Figure 4-24)

Assume that —

MET 1: Deflection correction L20
Range correction -100

MET 2: Deflection correction R10
Range correction +25

Place the correction from the MET messages on a MET cross.

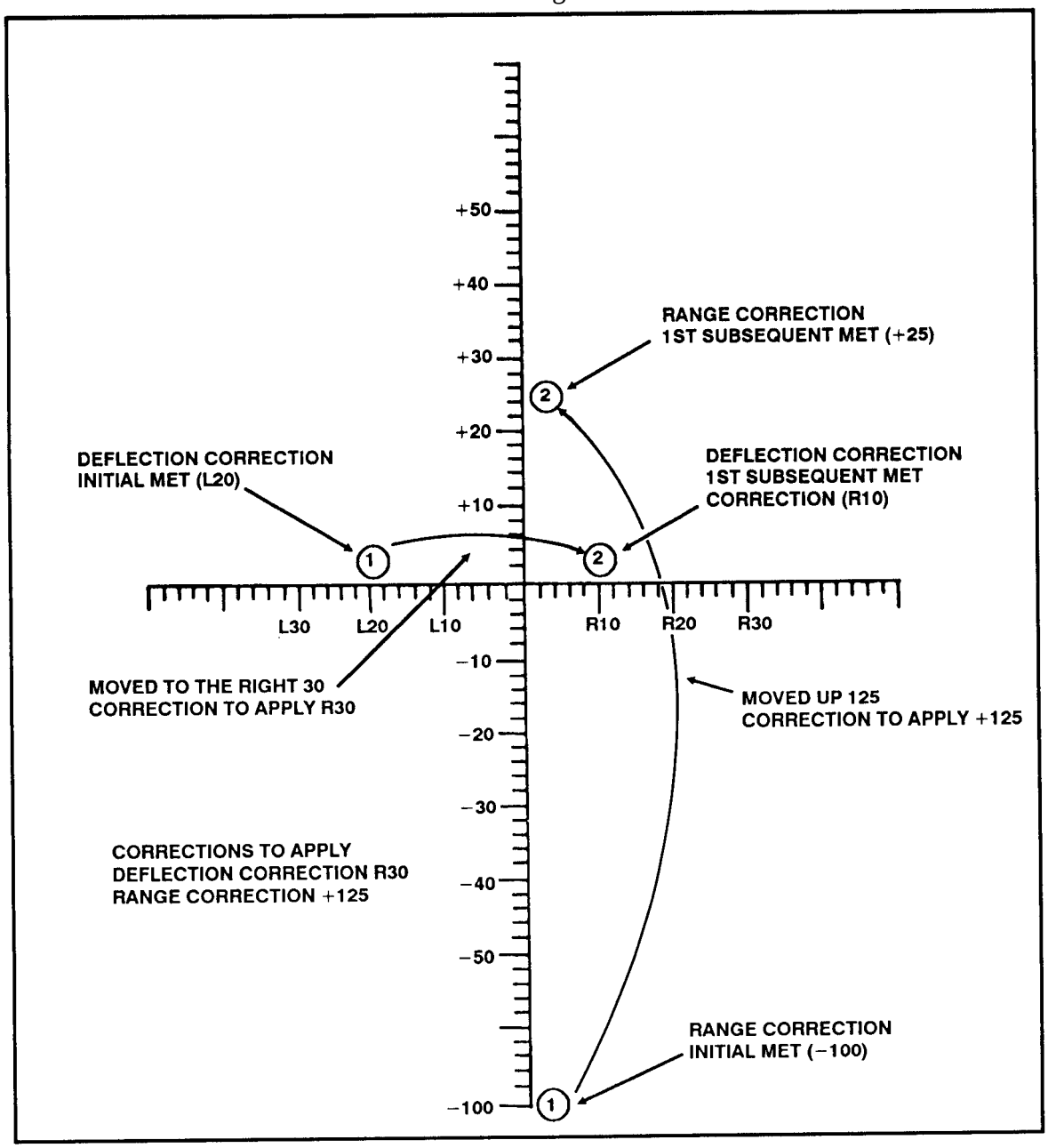


Figure 4-24. Updated registration corrections.

c. The MET cross helps answer three key questions:

- Where are you? *L20 – 100 (MET 1)*
- Where are you going? *R10 + 25 (MET 2)*
- What is required to get there?

(1) *Deflection correction.* To get from L20 to an R10, first go from L20 to 0, then right to R10; in doing so, you went R20 then R10 for a total of R30.

(2) *Range correction.* To get from a –100 to a +25, first go from –100 to 0, then up the scale to +25; in doing so, you went +100 then +25 for a total correction of +125.

EXAMPLE
(Figure 4-25)

MET messages on the same side of the MET cross. Assume —

MET 1: Deflection correction L30
Range correction +50

MET 2: Deflection correction L40
Range correction +75

Deflection correction L30 + L40 = L10
Range correction +50 + +75 = +25

Use the same procedure – "Where am I?" "Where am I going?" "What is required to get there?" each time to determine the corrections. Remember, MET 1 is compared to MET 2, MET 2, to MET 3. This procedure continues as long as MET messages are received and as long as the unit remains in the same position.

d. Once the MET corrections have been determined, the FDC can then determine the corrections to use for updating. MET is based on the RP, and therefore the corrections from the MET messages are applied to corrections determined from the registration.

(1) *Range correction.* Compare the range correction from the RP and the MET range correction. For difference signs, subtract the smaller from the larger and use the sign of the larger for the new range correction for the RP. If signs are the same, add the values.

EXAMPLE

Range correction from the registration + 150.
Range correction from the MET +50.

+ 150 + 50 = +200 range correction

(2) *Range correction factor.* Once the range correction has been determined, to determine the RCF, divide the initial chart range (rounded to the nearest hundred and expressed in thousandths) into the range correction.

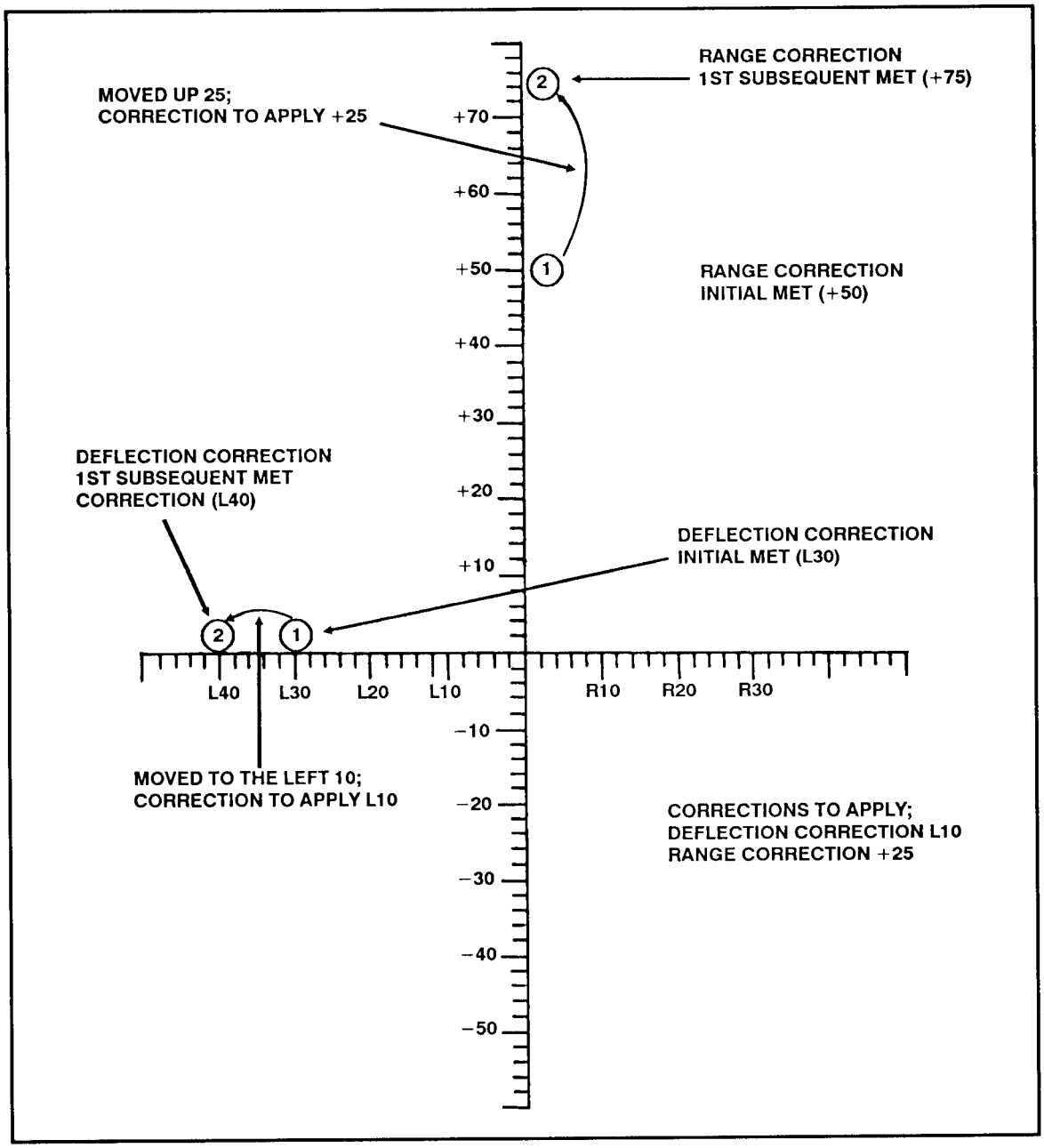


Figure 4-25. Deflection and range corrections.

EXAMPLE

New range correction: +200
Initial charge range: 3,050
(100's = 3100; 1000's = 3.1)

$$+3.1 \overline{)+200.0} \quad +64.5 = +65 \text{ RCF}$$

Deflection correction from registration L12
Deflection correction from METs R10
L2 = DEFL CORR

(a) Once the new corrections have been determined, the FDC can update the data sheet (RP and previously fired targets). Because the chart is based on the RP, the first target to update is the RP.

(b) Chart data remain the same because the known points have not moved. The MET message only told the FDC what is needed because of the weather changes. Apply the new corrections to the chart to obtain the new command data (Figure 4-26).

(c) For previously fired targets, chart data remain the same. Apply the new corrections to obtain the new command data. To obtain the range correction, multiply the new RCF by the range (rounded to the nearest hundred and expressed in thousandths) (Figure 4-26). (For a blank reproducible copy of DA Form 2188-R, see the back of this manual.)

(d) For new targets within the transfer limits of the RP, apply the new corrections the same as the previous registration corrections.

TARGET DATA

TARGET ID			CHART DATA		FIRING CORRECTIONS				FIRING DATA				INTELLIGENCE				ROUNDS	
TGT NO	GRID	ALT	DEFL	RG / CHG	DEFL CORR	RANGE CORR	ALT VI	ALT CORR	DEFL	RG / CHG	FUZE TIME SETTING	ELEV	TIME FIRED	TGT DES	MET OF ENG	SUR	EXP	REM
RP1	4953 5804	470	2790	3050	L12	+150	470 -50	-25	2802	3125 / 6		0958		RP1	1 RD	R/C S/D		
BP 0001		470	2715	2925	L12	+144	470 -50	-25	2727	3109 / 6		0991						
				MET	1	L20		MET	2	L10	=	R10	+50	CORR	TO APPLY			
						-100												
								+	150	+	+50	=	+200	NEW	RANGE CORR			
RP1			2790	3050	L2	+200	470 -50	-25	2792	3225 / 6		0933			L12+R10=	L2	L2	DEF
																	=765	RCF
															3.1	646 200.00		

DA FORM 2188-R, DEC 91 REPLACES DA FORM 2188-R, MAR 77 WHICH IS OBSOLETE

Figure 4-26. Example for updating target data.