FROM CONCEPT TO CREATION

MAKING OF MICRO ALIGN PRESS

by M/s Four M Technologies Private Limited

PROBLEM STUDY

4M

- IN BORE WELL & MINING INDUSTRY “DRILLING BIT” IS THE MOST CRITICAL ELEMENT DETERMINING THE PRODUCTIVITY. THE BIT HOUSES THE CARBIDE BUTTONS WHICH ARE ACTUAL CUTTING EDGES WHILE DRILLING THE MINING BORES OR BORE WELL BORES. FOR MANY DECADES THE ASSEMBLY OF CARBIDE BUTTONS INTO BIT BODY WAS DONE ON CONVENTIONAL PRESSES WITH SOME CORSE HOLDING FIXTURES;

- DRILLING BIT LIFE: WITH THE CONVERSIONAL METHOD OF BUTTON PRESSING AS EXPLAINED ABOVE, THE BIT WAS GIVING AN AVERAGE LIFE OF 1000FT TO 1500FT BORE DEPTHS AND THE BUTTONS USED TO EITHER BREAK OR POP OUT OF THE BIT.

- GUARANTEE / WARRANTEE POLICY : WITH A NORMAL GUARANTEE/WARRANTEE POLICY OF FREE REPLACEMENT IF THE BIT DRILLING FAILS BELOW 1500’ DEPTH THE SUPPLIER HAS TO REPLACE THE BIT EITHER FREE OF COST OR PRORATE BASIS.

- COST OF REPLACEMENT : THE AVERAGE RATE OF REPLACEMENT OF BITS BEING IN THE ORDER OF 20 TO 30% IN MOST CASES AND SOME CASES GOING UP TO EVEN 40%. THE INDUSTRY WAS FORCED FOR NON-COMPETITIVE PRICING, LOSSES DUE TO REJECTION, SELL PRODUCTS AT CHEAPER RATES WITHOUT GUARANTEE, LOSS OF IMAGE DUE TO FREQUENT REJECTIONS. A STAGE HAD COME FOR THE BORE WELL INDUSTRY THAT BIT MANUFACTURING BECAME A BIG THREAT TO MANUFACTURES.

4M'S CASE STUDY

- M/S FOUR M TECHNOLOGIES HAS STUDIED THE PROBLEMS AND ANALYZED THE CAUSES OF FAILURE OF BIT MOST OF THEM BEING DUE TO IMPROPER BUTTON ASSEMBLY PROCESSES FOLLOWED.

CAUSES OF BUTTON FAILRE IN DTH BITS

- NO STANDARDIZATION: TO OVERCOME THE PROBLEM OF THE BUTTON FAILURE, MANUFACTURERS WERE EXPERIMENTING TOO MUCH WITH THE BUTTON SIZES, BORE SIZES, INTERFERENCE AND PRESSING LOADS
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- PROCESS CAUSES : CONCEPT IN PRESSING THE BUTTON INTO THE HOLE WAS TO GIVE FREEDOM TO THE BUTTON TO SELF ALIGN WHILE PRESSING. THIS WAS CAUSING BELL MOUTH FORMATION IN THE BORE AND SHEARING OF BORE, ONE OF THE MAIN CAUSES FOR BUTTON POP OFF AND BUTTON BREAKAGE IT IS FOUND THAT EXCESS LOAD APPLICATION
- WAS CAUSING MICRO CRACKS IN THE CARBIDE BUTTONS AND CAUSING PREMATURE BUTTON FAILURES.

- GEOMETRIC CAUSES :IT IS STUDIED THAT THE ENTRY ANGLES OF THE BUTTON, SURFACE FINISH OF THE BUTTON AND BORE ALSO PLAYED A VITAL ROLE IN THE FAILURE MOST CRITICAL ASPECT, FOUND DURING THE RESEARCH STUDY AND TRIALS WAS THE AXIS ALIGNMENT OF THE BUTTON TO SEATING BORES IN BIT.

AXIS MISALIGNMENT AND FAILURES

4M

- IT IS FOUND THAT, IF THE AXIS OF BIT BORE TO BUTTON AXIS NOT ALIGNED WITHIN 0.01 MM TO 0.02 MM, THE BUTTON GETS INCLINED DURING PRESSING OPERATION WHICH CAUSE BELL MOUTH AT THE ENTRANCE AND LEAVES CLEARANCE AT TOP OF THE HOLE. CONSEQUENTLY DURING DRILLING DUE TO THE HEAVY VIBRATORY FORCES ACTING AND INSUFFICIENT BUTTON HOLDING AT THE BELL MOUTH PORTION RESULTS IN PREMATURE BUTTON FAILURE.

- THE MISALIGNMENT OR INCLINATION OF BUTTON CAUSES TEARING OF ONE SIDE OF THE HOLE DURING PRESSING , CAUSING UNEVEN DISTRIBUTION OF INTERFERENCE AROUND THE BUTTON AGAIN RESULTING IN PREMATURE FAILURE.

- THE FINISH ON ENTRY SIDE AND ON BUTTON IS VERY IMPORTANT. THE NON-FINISH BUTTONS ON ENTRY CAUSE PERIPHERY TEAR DUE TO FRICTION RESULTING IN FAILURE

- ENTRY CHAMFER HELPS IN SELF ALIGNMENT. HENCE OPTIMUM ENTRY CHAMFER WITH GOOD FINISH IS ESSENTIAL.

- IT IS CLEARLY SEEN THAT WHEN THE BUTTON TOUCHES THE BUTTON DEAD PORTION AND IF THE LOAD IS STILL APPLIED, THE EXCESS PRESSURE CAUSES MICRO CRACKS IN THE CARBIDE. HENCE LIMITING THE LOAD APPLICATION WHEN IT TOUCHES THE BUTTON DEAD PORTION IS MOST CRITICAL IN THE PROCESS.

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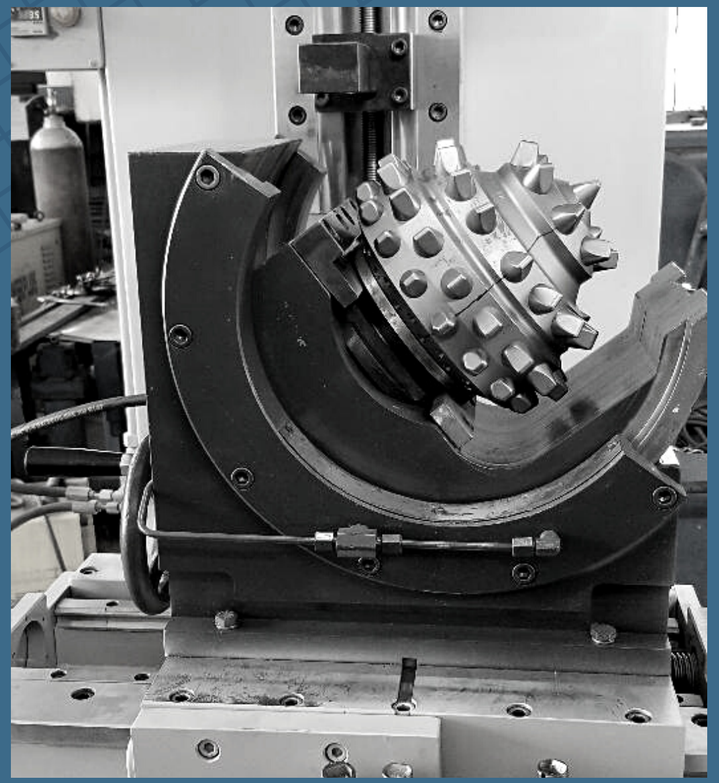

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PROCESS INNOVATION

1. MICRO ALIGNMENT OF AXES OF CARBIDE BUTTON TO BORE.
2. FLOATING FOR 6 DEGREES OF FREEDOM FOR EASY MICRO ALIGNMENT WITH IN 10 – 20 MICRON.
3. HOLD THE AXES FIRMLY AFTER ALIGNMENT & DURING PRESSING.
4. GUIDING TOOL & BUTTON TO BE COAXIAL WITH RESPECT TO BORE.
5. OPTIMUM LOAD OF PRESSING.
6. OPTIMUM SPEED FOR PRESSING
7. CUT OFF LOAD AT THE END OF PRESSING.
8. EASY INDEXING FACILITY.

4M'S PRODUCT INNOVATION

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TO MEET THE CONCEPT DERIVED AFTER THE RESEARCH STUDY AND TRIALS ON SEVERAL ASPECTS SUCH AS BIT HOLE CONFIGURATION, BIT PROFILE, SURFACE FINISH, MACHINES USED AND FIXTURES USED CONVENTIONALLY, WE AT 4M DESIGNED AND DEVELOPED A MACHINE TO MEET ALL THE REQUIREMENTS OF THE CONCEPTS DERIVED.

MICRO ALIGN PRESS

- TO MEET THE CONCEPT OF MICRO ALIGNMENT OF BUTTON AXIS TO BIT HOLE, THE MACHINE WAS DESIGNED WITH FLOATING COMPOUND TABLE MOVING ON ANTI FRICTION LINEAR MOTION GUIDE WAYS IN THE X AND Y AXIS.

- THE FIXTURE ALONG WITH THE JOB NAMELY THE BIT TO BE ASSEMBLED WITH THE CARBIDE BUTTON IS TO BE MOUNTED ON THE FLOATING TABLE.

- THE MOVING PLATEN OF THE MACHINE IS ACCURATELY GUIDED WITHIN 2 GUIDE PILLARS, MOVES PARALLEL UP/DOWN WITHIN 10 TO 20 MICRONS. A PRESSING TOOL CALLED THE PUSHER PIN ALONG WITH A SLIDE BUSH IS MOUNTED ON IT WHICH MOVES UP/DOWN WITH HIGH PRECISION PARALLELISM

- THE COMPONENT DTH BIT HAS BUTTON MOUNTING HOLES ON THE FACE AND AS WELL AS ON THE PERIPHERY FOR CARBIDE BUTTONS TO BE PRESSED. M/S 4M DESIGNED AND DEVELOPED PRECISION HYDRAULIC FIXTURES, FOR CARBIDE BUTTON PRESSING ON THE MACHINE.

MICRO ALIGN PRESS

4M

- .FOR THE FACE HOLE CARBIDE BUTTON PRESSING THE FACE HOLE HYDRAULIC FIXTURE HOLDS THE BIT IN EXACTLY VERTICAL POSITION TO MAKE THE BUTTON MOUNTING HOLES EXACTLY VERTICAL IS MOUNTED ON THE TABLE TO ENSURE COAXIAL CONCEPT.

- THE FLOATING TABLE, WHICH MOVES MANUALLY WITH FEATHER TOUCH OF HAND TO GET AXIS ALIGNMENT OF HOLES ON BIT TO THE PUSHER PIN WHICH LOCATES THE HOLE DIRECTLY WITH A CLEARANCE OF 0.01 TO 0.012 MM TO TOTAL CLEARANCE, WHICH ENSURES THE AXIS ALIGNMENT. THIS IS ENSURING THE FLOATING CONCEPT OF THE JOB IN 6 DEGREES OF FREEDOM.

- THE MACHINE IS DESIGNED TO HOLD THE BIT COAXIALLY IN POSITION WITH HYDRAULIC SYSTEM PROVIDED TO CLAMP THE TABLE AND THE FIXTURE. THIS ENSURES THE CONCEPT OF RIGID HOLDING IN MICRO-ALIGNED CONDITION.

- FOR GAUGE HOLES A SEPARATE FIXTURE WHICH HOLDS THE BIT IN ANGLE 30 OR 35 DEGREES AS DESIRED TO MAKE THE GAUGE HOLES EXACTLY VERTICAL. THE FIXTURE IS DESIGNED TO HOLD THE BIT IN ANGLE AND HAS PROVISION TO FREELY ROTATE ON BEARINGS TO ENSURE THE CONCEPT OF 6 DEGREE FREE MOTION TO BIT.

- ALSO IN THE FIXTURE, THERE IS A FACILITY TO FIRMLY CLAMP THE BIT IN POSITION HYDRAULICALLY TO ENSURE THE CONCEPT OF RIGID HOLDING IN COAXIAL POSITION WHILE PRESSING

MICRO ALIGN PRESS

4M

- THE CONCEPT OF GUIDING THE TOOL NAMELY THE PUSHER PIN AND THE CARBIDE BUTTON IS ENSURED WITH THE EXTERNAL SLIDE BUSH PROVIDED ON THE PUSHER PIN ENSURES EXTERNAL ENVELOPING , FIRM GUIDANCE AND EXACT COAXIALLY OF THE CARBIDE BUTTON TO THE BORE WHILE PRESSING INTO THE BIT. ENSURES THE CONCEPT OF EQUAL DISTRIBUTION OF INTERFERENCE ZONE ENVELOPING THE BUTTON.

- TO SET THE OPTIMAL LOAD FOR PRESSING THE BUTTON, THE MACHINE IS EQUIPPED WITH A HYDRAULIC PRESSURE VARIATION MECHANISM WITH DIGITAL DISPLAY OF SET PRESSURE.

- 12. THE MACHINE IS ALSO EQUIPPED WITH A SET PRESSURE REACHED CUTOFF TO AVOID OVER PRESSING OF THE BUTTON AFTER IT TOUCHES THE DEAD BOTTOM SURFACE. THIS MECHANISM HELPS ENSURE NO EXTRA LOAD IS EXERTED ON THE CARBIDE BUTTON, ENSURING THE CONCEPT OF NO MICRO CRACKS IN THE CARBIDE BUTTON.

MAKING OF MICRO ALIGN PRESS

FROM CONCEPT TO CREATION

Four M Technologies Pvt. Ltd., INDIA

4M

DESIGN OBJECTIVES

- EASY AND FREE MOVEMENT OF ALL AXES TO FACILITATE SELF ALIGNMENT WHEN THE LOCATOR PIN ENTERS THE BUTTON HOLE.
- PICKING OF THE AXIS OF BUTTON TO BUTTON HOLE IN THE BIT IS ENSURED WITHIN 10 TO 20 MICRONS.
- RIGID AND FIRM CLAMPING OF ALL AXIS AND COMPONENT IN POSITION TO ENSURE COAXIALLY OF BUTTON TO BUTTON HOLE
- GUIDING THE CARBIDE BUTTON PRECISELY WHILE PRESSING INTO THE BUTTON HOLE IN THE BIT TO ENSURE EQUAL DISTRIBUTION OF INTERFERENCE ZONE AROUND THE BUTTON AND ELIMINATING THE CAUSE FOR BELL MOUTH FORMATION IN BORE.
- FAST AND CONTROLLED PRESSING OF BUTTON ENSURING EQUAL PRESSING LOADS AND ELIMINATING CAUSES FOR MICRO CRACKS ON BUTTON.
- ERGONOMICALLY DESIGNED TO ENSURE EASY OPERATION, LOW FATIGUE

MICRO ALIGN PRESS

DESCRIPTION :	MICRO ALIGN PRESS	: MICRO ALIGN PRESS
• MODEL :	MAP-20	: MAP-10
• MAKE :	4M	: 4M
• CAPACITY :	20 TONS MAX.	: 10 TONS MAX.
• TABLE SIZE :	400MM X 400MM	: 400MM X 400MM
• RAM TRAVEL :	250 MM	: 200 MM
• CONSTRUCTION :	4 PILLARS	: 2 GUIDE
• TABLE CLAMPING :	HYDRAULIC	: HYDRAULIC
• COMPONENT CLAMPING:	HYDRAULIC	: HYDRAULIC

- TOOLING SYSTEM — A POSILOCK HOLDER TO MOUNT THE TOOLS , A PUSHER PIN TO LOCATE BUTTON HOLE. A GUIDE BUSH TO GUIDE CARBIDE BUTTON
- HYDRAULIC SYSTEM : — FACILITATE RAM MOVEMENT FOR BUTTON PRESSING, TABLE CLAMPING, COMPONENT CLAMPING AND FIXTURE CLAMPING.
- ELECTRICAL SYSTEM : — SUITABLE ELECTRICAL CONTROL CABINET AND PANEL WITH PUSH BUTTONS .

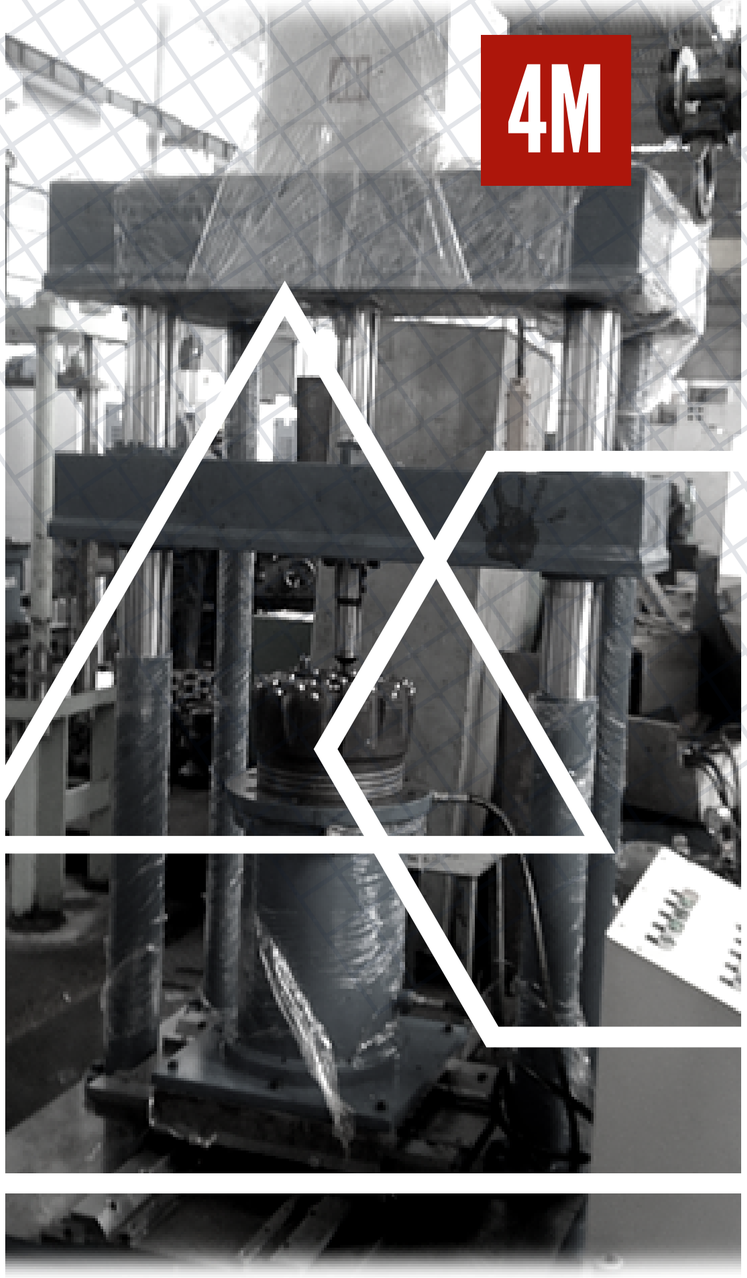
MICRO ALIGN PRESS

DESCRIPTION : MICRO ALIGN PRESS

- MODEL : MAP-N120 (FLOOR TYPE)
- MAKE : 4M
- CAPACITY : 20 TONS MAX.
- TABLE SIZE : 500MM X 500MM
- RAM TRAVEL : 250 MM
- CONSTRUCTION : 4 PILLARS
- TABLE CLAMPING : HYDRAULIC
- COMPONENT CLAMPING: HYDRAULIC

- TOOLING SYSTEM A POSILOCK HOLDER TO MOUNT THE TOOLS , A PUSHER PIN TO LOCATE BUTTON HOLE. A GUIDE BUSH TO GUIDE CARBIDE BUTTON

- HYDRAULIC SYSTEM : FACILITATE RAM MOVEMENT FOR BUTTON PRESSING, TABLE CLAMPING, COMPONENT CLAMPING AND FIXTURE CLAMPING.
- ELECTRICAL SYSTEM : SUITABLE ELECTRICAL CONTROL CABINET AND PANEL WITH PUSH BUTTONS .



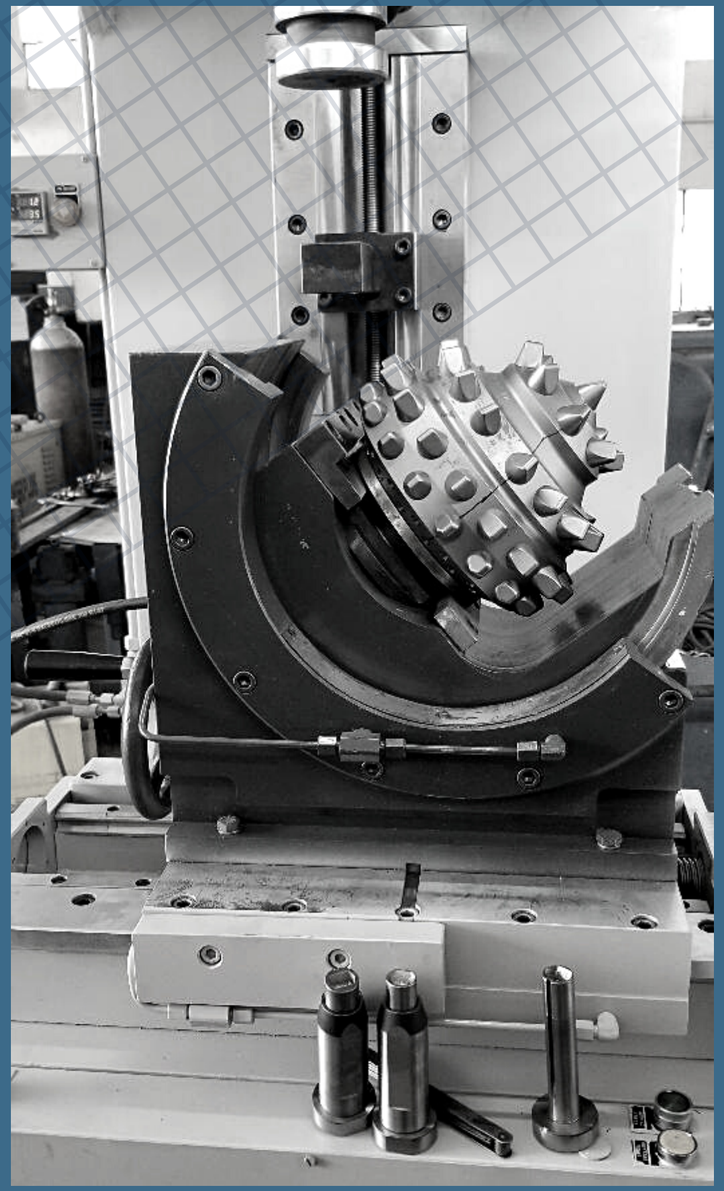
MICRO ALIGN PRESS

DESCRIPTION : MICRO ALIGN PRESS

- MODEL : MAP-RRB
- MAKE : 4M
- CAPACITY : 20 TONS MAX.
- TABLE SIZE : 400MM X 400MM
- RAM TRAVEL : 250 MM
- CONSTRUCTION : C TYPE
- TABLE CLAMPING : HYDRAULIC
- COMPONENT CLAMPING: HYDRAULIC

- TOOLING SYSTEM AN ADJUSTABLE ARM TO MOUNT THE TOOLS , A PUSHER PIN TO LOCATE BUTTON HOLE. A GUIDE BUSH TO GUIDE CARBIDE BUTTON

- HYDRAULIC SYSTEM : FACILITATE RAM MOVEMENT FOR BUTTON PRESSING, TABLE CLAMPING, COMPONENT CLAMPING AND FIXTURE CLAMPING.
- ELECTRICAL SYSTEM : SUITABLE ELECTRICAL CONTROL CABINET AND PANEL WITH PUSH BUTTONS .



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IMPROVEMENTS

- THE LIFE OF DTH BIT / BUTTON LIFE INCREASED BY 300% TO 500% WHEN COMPARED TO EARLIER CONVENTIONAL METHODS. THE DTH BIT IN FIELD TRIALS HAS BORED UPTO4000 TO 5000 FT IN THE FIELD TRIALS
- REJECTION OF BITS DUE TO BUTTON FAILURE DRASTICALLY REDUCED.
- RELIABILITY OF BIT INCREASED.
- PREFERRED FOR DEEP DRILLING MORE THAN 1500 FT WHERE BIT FAILURE CAUSES MAXIMUM LOSS.
- IMAGE OF THE ORGANIZATION MANUFACTURING DTH BITS HAS WELL ESTABLISHED AS A QUALITY SUPPLIER.

OUR ESTEEMED CUSTOMERS

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