A Treatise/ Manual on 3D Screening Techniques

(celluloid era cinema theaters)

1984 to 1998

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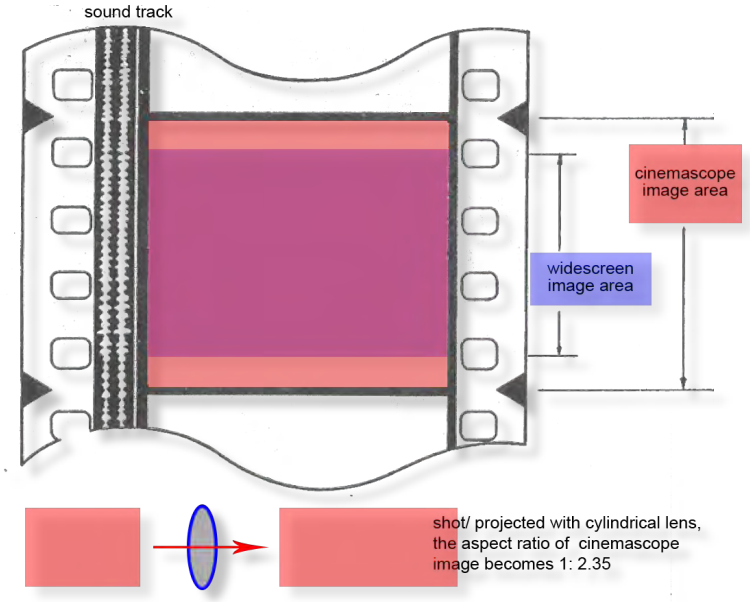
Acknowledgement

My 3D projection lessons (along with that of 3D filmmaking) started in the month of June 1983 at Burbank, L.A., California.
Chris. J. Condon took out a *stereovision box lens* and gave me a demonstration on his portable projector at the Stereovision offices. He gave me a few literatures and with wishes of good luck bade me farewell to India.
From then, through silver screen developments, small cinema installations, medium and subsequently giant installations, myself and my colleagues have come a long way with thousands of 3D screenings in India and neighboring countries. A benchmark for our achievement is Chris's own surprise when he saw a 46 feet wide image of brilliant 3D during his visit to India during the summer of 1985.

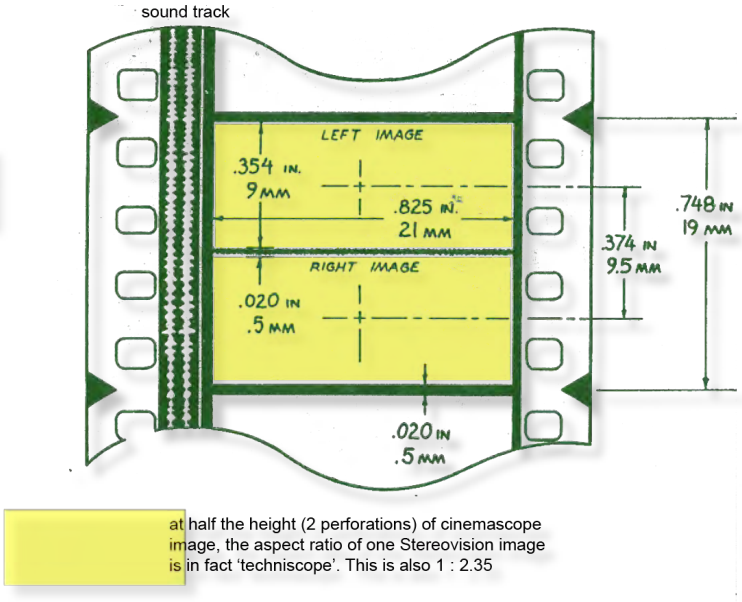
I acknowledge the contributions made by our 3D installation crew - especially the late Mr. Kurup.
In the making of these treatise, my colleague Mr. Naveen and Photophone service Engineer Mr. Balaji have also contributed much.

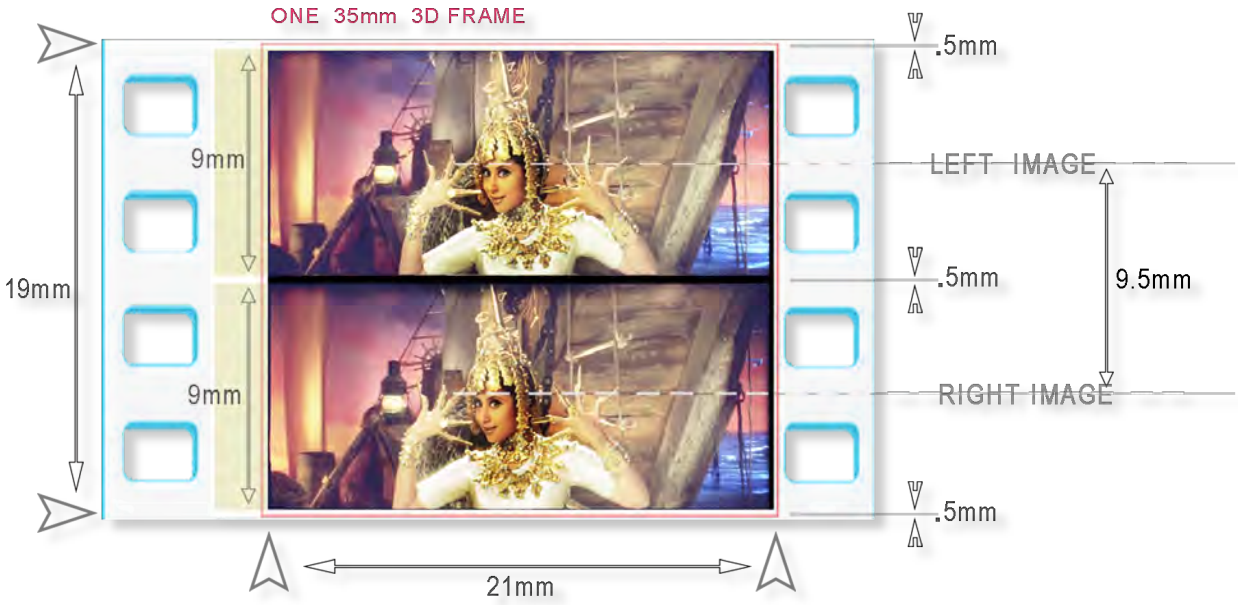
Jijo.
1998, March.
Chennai.

Standard 35mm 2D



Stereovision 35mm 3D



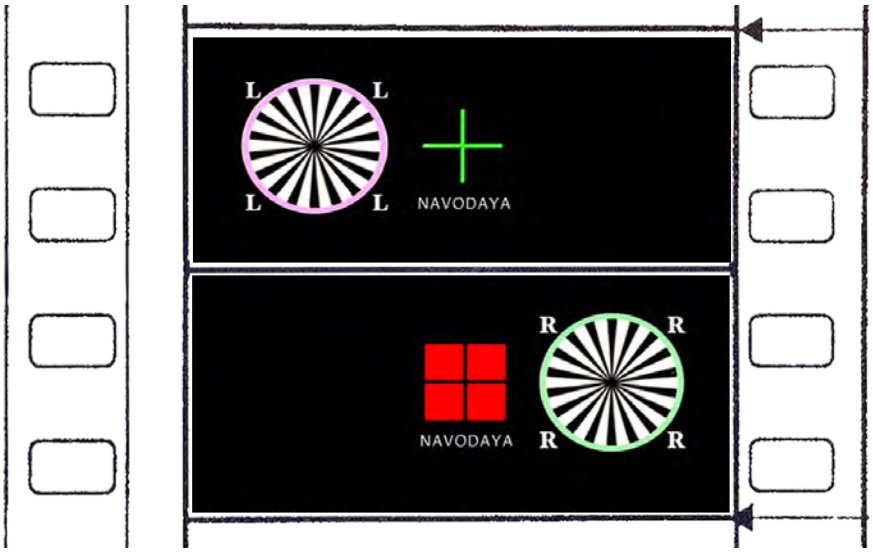


Part I

Inventory/ List of items for a 3D release

<u>A. Directly to the theatre.</u>

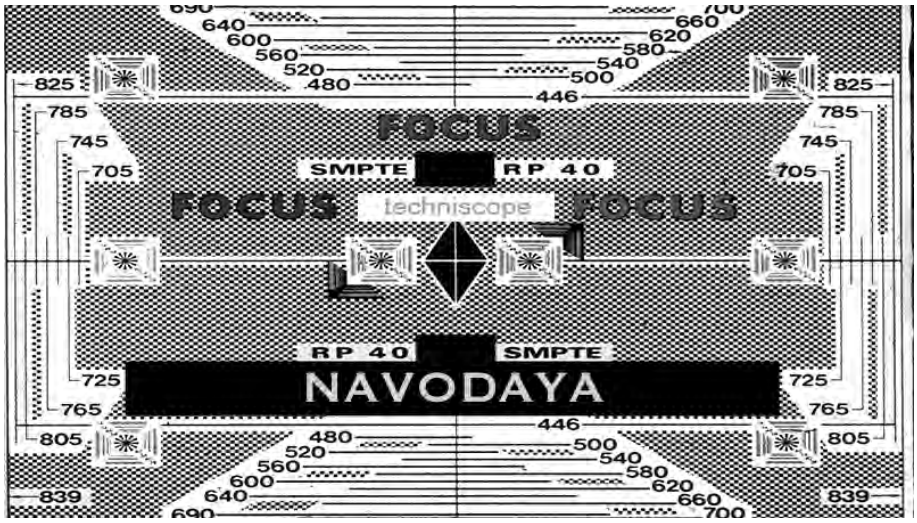
- Film Print
- DTS Disc (if included)
- Side Reel
- M.S Pipes – in some cases to mount screen
- Ladders



<u>B. To be carried by the installation team.</u>

- Lens - as per prior calculation
- A Magnifier/ Reducer – (if needed)
- 3D Alignment loop and / or Roll
- STMPE focus loop and / or Roll
- Dichroic heat filter mounted on bracket with copper wires
- Lens sleeves (with and without threading)
- Screen - size as per prior calculation
- Black clothe – for masking screens
- Nylon ropes
- Safety pins (Big)

- Johnson plaster (Wide)
- Brown packing tape (Wonder 565)
- Steel grip tape (Black)
- Matte black cardboard for port hole masking
- Candle (for cutting nylon rope). Lighter.



C. Tools

- Scissors (for slicing paper)
- Steel scale (for slicing paper), Paper knife
- Allen key set (for lens) up to 3 mm max
- File (for gate) 1/ 4''or 1/2 '' flat
- Bench vise
- Small hacksaw frame with spare blades
- Screw driver set (star, etc.)
- Nose pliers
- Adjustable spanners
- Pocket Torch (small size, 2 pen light cell types)
- To increase Magazine size for Spool to 6000'
    - 1/ 2 inch M.S. Pipe 4'', 5'', 6'' long pieces in pairs
    - 12 mm bolts of sizes 5'', 6'', 7'', 8'' and nuts

- Heavy washers
- Leather belt in roll (for take-up spool drive) with clipping stapler

- Torches / Battery
- Wireless set for communication between screen stage and projection booth
- Cabin/ Operator Instructions in appropriate language/s

Others -

Thermos flasks,
Biscuits, Hot box, etc.

PROJECTION CABIN 'ready reckon' list in Malayalam, Tamil, Telugu & Hindi >>>>

INSTRUCTIONS TO PATRONS in Telugu, Malayalam, Marathi, Kannada, Tamil, Bengala & Hindi

3D PROJECTION ഓർമ്മക്കുറിപ്പുകൾ

പ്രമാണങ്ങൾ പത്ത്

1. Framing knob-neutral ആയിട്ടു വെച്ചശേഷം ഫിലിം thread ചെയ്യുക.
2. Synch mark (☒) gate-ൽ വെച്ച് reel thread ചെയ്യുക.
3. Framing (ലിവർ) അഡ്ജസ്റ്റ് ചെയ്യുമ്പോൾ കണ്ണട വച്ചു നോക്കി 3D effect ശരിയാണോ എന്നു ശ്രദ്ധിക്കുക.
4. Screen maximum bright ആയിരിക്കുവാൻ rectifier amps maximum കൊടുക്കുക.
5. Carbon ശരിക്കും കത്തിത്തുടങ്ങിയതിനുശേഷമേ Projector സ്റ്റാർട്ടു ചെയ്യാവൂ.
6. Gate-ൽ shake ഓ shutter-ൽ ghosting ഓ ഉണ്ടോ എന്നു ശ്രദ്ധിക്കുക.
7. രണ്ടു കണ്ണുകൾക്കുമുള്ള ചിത്രങ്ങൾക്കു തുല്യ പ്രകാശമുണ്ടോ എന്നു check ചെയ്യുക. അപ്രകാരം mirrorഉം carbon focusഉം adjust ചെയ്യുക.
8. ആഡിറേറാറിയം ലൈററുകൾ അണയ്ക്കുവാൻ ശ്രദ്ധിക്കുക. കസാലയുടെ കീഴെ side lightsഉം വേഗം അണയ്ക്കുവാൻ ഓർമ്മിപ്പിക്കുക. 3D effectനെ ഇവ രണ്ടും ബാധിക്കും.
9. അനധികൃതമായി film 'splice' ചെയ്യരുത്.
10. കാണികൾ എഴുന്നേററു തുടങ്ങിയാലും സാരമില്ല, അവസാനത്തെ title ഓടിത്തീർന്നിട്ടേ പട്ടം നീർത്താവൂ.

PROJECTOR OPERATOR 3D INSTRUCTIONS
in Malayalam, Tamil, Telugu & Hindi >>>>

3D फिल्म चलानेवाले ऑपरेटर्स के लिए कुछ आवश्यक सूचनाएँ।

"किसी भी 3D फिल्म का मुख्य अंग उस फिल्म को पर्दे पर दिखाना ही है।" यह 3D फिल्म के इतिहास का अनुसंधान करनेवाले एक्स्पर्टस (विशेषज्ञ) का कहना है।

इसलिए किसी भी 3D फिल्म की सफलता और निष्फलता में उस फिल्म को मशीन पर चलानेवाले ऑपरेटर्स का भी काफ़ी हद तक हिस्सा होता है।

इसलिए सारी दुनिया में पिछले दिनों में आधुनिक तकनीक से बनायी गयी इस 3D फिल्म को अपनी मशीन पर चलानेवाले ऑपरेटर्स को हम कुछ सूचनाएँ और मार्गदर्शन देना चाहते हैं।

1. **आर्क की रोशनी**: किसी भी 3D फिल्म के लिए बेहद जरूरी है, हमेशा से ज्यादा रोशनी। दूसरी साधारण फिल्मों के लिए आर्क की रोशनी कम हो तो भी पर्दे पर चित्र देख सकते हैं और आम तौर पर दर्शक भी न उसकी परवाह करते हैं; न शिकायत। मगर 3D फिल्म के लिए ऐसा नहीं चल सकता। हमेशा से ज्यादा तेज रोशनी न हो तो 3D का असर ही नहीं दिखता। सार मज़ा ख़तम हो जाता है और 3D फिल्म देखनेवालों की आँख और सिर में दर्द भी होता है।

   3D फिल्मों के लिए हमेशा से ज्यादा रोशनी इन कारणों से जरूरी है। एक तो प्रोजेक्टर के आगे लगा हुआ 3D लेन्स कुछ हद तक रोशनी कम कर देता है। ऊपर से 3D चश्मा भी रोशनी कम करता है। इसलिए आर्क की रोशनी की मात्रा ज्यादा रखने के लिए नीचे दी गई सूचनाओं का पालन करें :

A. रेक्टीफायर (RECTIFIER) में ज्यादा से ज्यादा एमपियर (AMPERE) दें

B. 3D के जानकारों के सिफारिश किये हुए "कार्बन" (CARBON) का ही इस्तेमाल करना अति आवश्यक है। कार्बन का बचाव करने की कोशिश न करके उनको सही और ठीक तरह से जलने दें।

C. "आर्क हाऊस" (ARC HOUSE) में लगा हुआ "आईना" (Mirror) एकदम नया और चमकदार होना चाहिए और हर रोज उसकी सफाई करनी चाहिए—

D. प्रोजेक्टरों के सामने दीवार में शीशे लगे हुए हों तो उन्हें हटा देना अनिवार्य है।

E. अगर पर्दे की चौड़ाई 20 फीट हो तो कम से कम 60 एम्पस (AMPS) रोशनी, 30 फीट हो तो 90 एम्पस, और 35 फीट हो तो 110 एम्पस (AMPS) रोशनी होनी चाहिए।

2. **3D चित्र** : 3D फिल्म के लिए पर्दे पर गिरनेवाली रोशनी, पर्दे के हर कोने में एक समान होनी चाहिए। बाई आँख से देखें या दाईं आँख से, प्रकाश समान ही होना चाहिए ! अगर न हो तो प्रोजेक्टर के आईने को और दो कार्बनों के बीच के अंतर को ठीक करना जरूरी है। 3D चश्मा पहनकर बारी बारी दायीं और बायीं आँख से देखने से दोनों तरह से दिखने वाला चित्र कितना धुंधला या चमकीला है, इसकी तुलना कर सकते हैं।

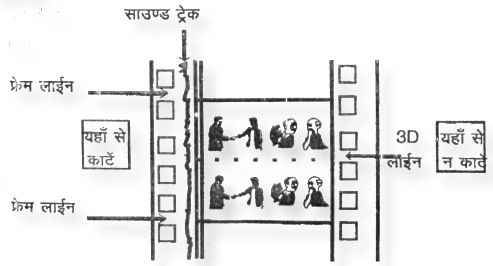
   3D फिल्म में एक ही फ्रेम (frame) में दो चित्र होते हैं। एक दायीं आँख के लिए और दूसरा बायीं आँख के लिए। अगर इस तरतीब में कोई गड़बड़ हुई या तरतीब बदल गयी तो सब कुछ चौपट हो जाएगा ऐसा न होने के लिए नीचे लिखे हुए नियमों का पालन करें।

A. प्रोजेक्टर में फिल्म को "थ्रेड" (THREAD) करते वक्त हमारे दिये हुए "फ्रेम मार्क" (FRAME MARK) को ठीक तरह से पिक्चर गेट (PICTURE GATE) में रखकर थ्रेड करें।

B. फिल्म को "थ्रेड" (THREAD) करने से पहले "फ्रेमिंग नॉब" (FRAMING KNOB) न्यूट्रल (NEUTRAL) में है या नहीं, यह जाँच करके देख लें। आपके प्रोजेक्टर में "न्यूट्रल पाईन्ट (NEUTRAL POINT) न दिया गया हो तो नॉब (KNOB)" को घुमाकर देखें और बीच में रखें।

C. हर स्पूल (SPOOL) के शुरू में रखी हुई "टेस्ट फिल्म" (TEST FILM) अर्थात् नमूने की फिल्म जब पर्दे पर दिखे तब बाई और दाईं आँख से बारी-बारी देखकर ठीक से चल रही है या नहीं इस बात का निश्चय कर लें।

D. अगर कभी फिल्म फट जाए तो उसे जोड़ने के लिये नीचे दिये हुए चित्र में का तरीका अपनाएँ—



   फिल्म को जोड़ने के लिये हमेशा मोटी दो "फ्रेम लाईन" (FRAME LINE) के ऊपर ही काटकर जोड़ना चाहिये। पतली 3D लाईन पर कभी न काटें। ऐसा काटने से दायें और बायें चित्र की तरतीब में फ़र्क आ जाएगा और फिल्म भद्दी दिखेगी। इसलिए सही जानकारी रखनेवालों को ही 3D फिल्म काटनी या जोड़नी चाहिये।

   अगर गलत तरीके से फिल्म को काटकर जोड़ देने के कारण या दूसरी वजह से फिल्म ठीक नहीं चल रही है ऐसा आपको लगे तो अपने पासवाले 3D चश्मे को उल्टा पहनकर फिल्म को देखिये। अगर अब फिल्म ठीक दिखे तो समझ लेना चाहिये कि फिल्म की दायीं बायीं तरतीब में गड़बड़ है। फौरन "फ्रेम नॉब" (FRAME KNOB) को ऊपर या नीचे दो "पर्फोरेशन" (PERFORATION) यानी दो छेद घुमाकर देखने से फिल्म ठीक दिखेगी।

3. **देखभाल**: प्रोजेक्टर में 3D लेन्स को लगाकर फिल्म चलनी शुरू हो जाने के बाद इस बात का हमेशा ध्यान रखना जरूरी है कि प्रोजेक्टर की हरकत के कारण या किसी दूसरे कारण 3D लेन्स अपनी जगह से हट न जाए। थियेटर के सफ़ेद पर्दे के चारों तरफ़ लगे हुए काले पर्दों वाले भाग में भी कोई फ़र्क नहीं आना चाहिये। प्रोजेक्टर में, 3D लेन्स में, या थियेटर के सफ़ेद पर्दे में कोई गड़बड़ लगे तो फौरन 3D विशेषज्ञ को बुलाकर दिखाना जरूरी है।

   अकसर ऑपरेटर्स प्रोजेक्टर में बिना फिल्म लगाये ही आर्क चालू करके रौशनी की तेज़ी की जाँच करते हैं। ऐसा करना मामूली लेन्सों के लिये तो हानिकारक है ही, 3D लेन्स के लिये तो बहुत ही हानिकारक है, क्योंकि रौशनी की तेज़ी में "लेन्स" के अन्दरवाले बड़े ही कीमती फिल्टर्स के जल जाने का डर है।

इसलिये किसी भी संजोग में प्रोजेक्टर में बिना फिल्म लगाए "आर्क" को चालू नहीं करना चाहिये।

भारत में पहली बार किये गये इस प्रयास में हम आपका सहयोग चाहते हैं और हृदय से आपका धन्यवाद अदा करते हैं।

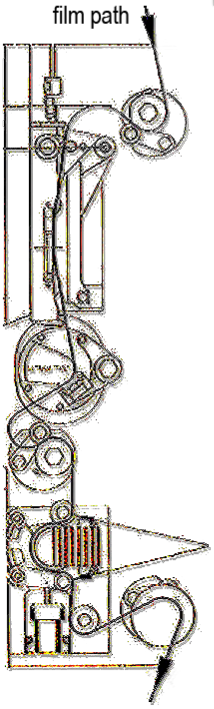
भारतीय फिल्म इतिहास में यह 3D फिल्म एक महत्वपूर्ण कदम है। आशा है कि यह फिल्म आपका तनमन आनन्द और उल्लास से भर देगी।

When you view a 35mm positive film strip, just as how the subject had originally appeared before the camera lens, then (1) you should have the film-glaze-side away from you; i.e; emulsion side (that is prone to scratch) towards you.
(2) image should be upright; which means, the sound track is to your left.

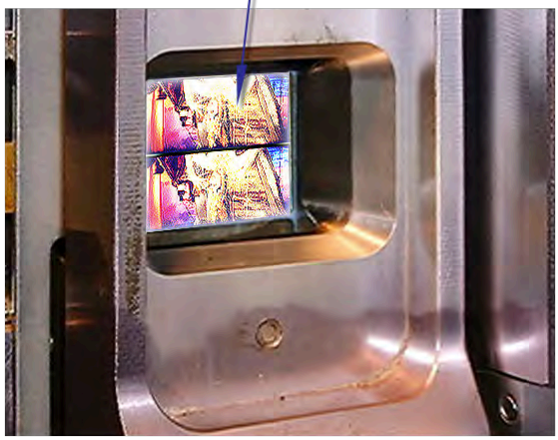
This is what you would see on screen when projecting our film (Stereovision) - with the theater's own 2D (normal) lens, aperture plate removed from projector film gate, without any masking.

The 35mm film - when seen from the archouse (i.e; seen from the back of the projector, you'd be facing the screen) - this is how it is threaded on the projector - image upside-down, emulsion side facing the carbon arcs.

The 35mm film - when seen from the lens (i.e; from the projector front, your back towards the screen) - this is how it would be threaded on the projector - image upside-down, glaze side facing the lens.



Film Threading
side view



Part II

Moving into the Theatre

Before going for a 3D installation, the following data should have been available with the installation team. (These would be available from the 3D alignment Diary Supplied by the theatre, whetted and calculated at Navodaya offices)

3D ALIGNMENT DIARY

Subject to change

I THEATRE DATA — (To be supplied by the Exhibitor)

Station: Coimbatore Theatre: Ragam A.C./70 mm

Total capacity: ~~2~~ 1200 (Seats) Balcony capacity: 50% total (seats)

Position of projection cabin — above balcony / ~~below balcony~~

Auditorium width: 68' feet. Auditorium length: 140' feet.

Throw: 140 feet. Normal 35 mm lens: 2.75 inches. Scope backlens: 3.5 inches.

Existing screen size: 65' (length x width). 35 mm wide screen picture width: 40' feet.

Scope picture width: 65' feet.

Make of projector: Westrex Model: 70mm / Water Cooled? ✓

Rectifier — 3 phase or single phase? 3 Make: G.M.

Maximum rectifier capacity: Rated 130 amps.

Size of carbon that can be used — ~~6/7, 7/8, 8/9~~, 10, ~~Higher~~

Mirror size: 16 inches. Maximum magazine capacity: 6000' feet

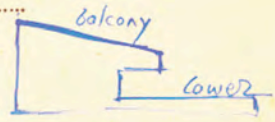
Data filled in by: Jyo

Designation: Date:

II. 3D SCREENING DATA (To be filled by the 3D technician only)

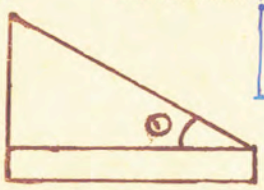
Projection pitch in degrees: Sufficient ~~32~~ 15°

Slant ht:



$\theta = \sin^{-1}$ _____

back ht:



front ht:

Screen curvature — ~~Nil~~/sufficient/~~excessive~~ Port glass — ~~Exist~~ / Removed / ~~Cutout~~

3D back lens employed: 3.25 whether aperture plate used? yes

3D lens employed: Plex A 10084-584 whether magnifier used? no

3D picture width: 36' Projection ampere: Restrictor Coupled // for 90 amps

Mirror — Brand | already existing / ~~old~~ mirror New | existing | mirror Screen illumination — good / ~~fair~~ / ~~poor~~

Carbon employed — ~~7/8, 8/9~~, 10, ~~11, 12.5, 13.6~~, rotating ✓ Dichroic filter: Square

3D print condition and density: One point bright

Problems incurred — Overheating / lens ghosting / lens shading / poor screen painting / inadequate

the Cabin for the 3D Projection Program

1. 3 spools
2. point
3. Silver Screen
4. dichroic filter
5. Ragam Reel
6. 3D instruction slides
7. proposed instruction
8. Stereoflex lens

Theatre aligned by: Kurup

Date: 16th Nov. 84

SPECIMEN

NAVODAYA

Data	Purpose
1. The dimensions and the seating capacity in various parts of the auditorium	For the general understanding of the nature of the installation with regards to its size and complexity.
2. The throw and the existing screen size	For the 3D technician to decide on the lens. For the screening installing team to decide on screen size and quantum of black clothe.
3. Position of the balcony with respect to projection cabin	To get an understanding of the projection pitch (slope of the projector angle).
4. Projector make, size. Rectifier capacity. Carbon size. Water cooled gate	This would decide on the efficiency of the light output and hence the screen illumination. For a 3D technician, this should help to anticipate problems if the projector is of a non-standard make or of a dated design.
5. Existing 35 mm (academy) lens and scope backlens and the picture sizes	This would help to decide what the desirable 3D picture size should be. Remember! The comparison people make would always be with the existing picture size. Also, knowing the throw, existing size of their lens and their picture size, it could be ascertained whether the data supplied from the theatre is correct.

6. Existing size of spools, magazine.

This would help to anticipate problems in torque/ film tension once the magazine is converted to 6000.

With all the above available data, the installation team should have the possible 3D lens sizes computed and kept ready. The adequate screen size, standby carbon and mirror also should be readied.

It should be noted that much before your arrival at the station, on having studied the theatre data when fixing the particular theatre, somebody from our offices, would have insisted on some 'commitments' to be met by the theatre or the distributor.

Usually it would be

- one brand new mirror (Y.K.K. brand)
- servicing the theatre equipment for some particular problem noticed by our advance party
- 6000 feet magazine capability
- higher rating of carbon
- adequate ladders.

As a member of the 3D installation team, you should collect this information from our offices before reaching the station.

Once you reach the station of release, immediately visit the theatre and the projection cabin. This is to ascertain the accuracy of the data supplied to you and to grasp the complexity of the installation. Make sure the needed consignments from our offices had reached. This would

- help in organizing the men and material better ... and avoiding unpleasant surprises.
- make sure that the theatre party has kept their commitment of ladders, glass cleaning room, 6000' magazine and spools, carbons of recommended size, brand new Y.K.K. mirror etc.

Remember that your work starts much before the closure of the last show at the cinema. Getting prepared to accomplish the job in the shortest time requires much planning. This should start as soon as you reach the release station.

The following are the stages of 3D installation. Some of them can start as soon as you are at the station.

Stages of Activity	**Anticipated duration**
1. Cross checking the items you carry whether is as per the list. 2. Checking the print, spooling. 3. Checking the projector turret and lens mount for compatibility with your 3D lens.	Prior to actual 3D installation
======	
4. Checking the projector arc house for light output. Correcting the arc centering (if needed) to increase light efficiency. 5. Projection of test loop and the decision of 3D picture size.	1/2 hour
=======	
6. Removal of theatre's existing screen and putting up silver screen. 7. **Meanwhile,** adaptations and rectification on projector trouble shootings, gate marking, port hole glass removal, magazine enlargement, rectifier tapping change, dichroic heat filter installation, etc.	2 to 5 hours
========	
8. Projection of 3D alignment chart on the silver screen (as the screen is being tightened). Centering the projector focus, 3D alignment, refocus. Optimizing light by fine-tuning the carbon arc centering. **Meanwhile** masking the picture size ***on the screen***.	1/ 2 to 1 hour
========	
9. Masking the screen with black clothe. 10. Putting up projector operator's instructions on the cabin wall.	1/ 2 hour
========	

11. Running the print. Final check on the light and the sound.
12. Finally, lens masking.
13.Write a log of all the items supplied and serial number of items supplied.

1/ 2 to 1 hour

==========

The job of the 3D installation team is to extract the best 3D experience for the audience with every resource at your disposal. This cannot be accomplished solely by the machinery and the theatre system. The personnel at the theatre also count in achieving our goal and the continued 'Quality 3D Screening' even after you have left. Hence, it is equally important that you deal with them on friendly terms so as to obtain their full co-operation.

You have to take it for granted that the chief projector operator *reigns* the projection cabin. He considers it as his kingdom. He seldom gives away his rights even when the service engineer or even the theatre manager intrudes into his area of work. We, as outsiders, should keep this fact in mind and respect these sentiments even if we are entering his kingdom with superior knowledge. Also it is important to keep in mind that the cabin crew has an emotional attachment to their projector equipments. This has to be respected always. One fundamental truth in man & machine interaction .... an operator of *any* equipment, if he/she is of at least average intelligence, would know about his equipments behavior, its faults and efficiency **even better than the Engineers who had designed and constructed it in the first place**. This is a universal truth. So, take it as a doctrine that the first expert on the projector you are going to adopt for 3D screening is the operator himself. We require the oerson to have our job done. Also, considering the fact that the operator has an emotional attachment to his machinery, it would be better if he handles all the projector adjustments while you put forward your “requests” of things to be done to it. Consider yourself a 3D expert and the operator the expert on his equipment ... and, make this known to him. You can do this by asking humble questions on the projector and making him feel important as soon as you walk into the projection cabin.

Part III –
Elaboration of the stages in 3D installation

1. Check all the LIST OF ITEMS which your team has to have at the release station / cinema. Check all the items which were requested to be met by the theatre / distributor.

2. Check whether THE PRINT (COPY) is the one of adequate density and copy number as previously informed. Check whether the DTS discs are in place. The side reel and the sponsor's advertisement is in place. Check whether the copy has been packed correctly into the cans and the leader end tightly taped into place.
SPOOLING - Check whether the copy's own 3D alignment charts in the appropriate reel-beginnings are in place. (Any variance from any of the above, you have to report in your log). Load each reel onto the spool as designated. The reel-to-reel joint has to be in 3D framing.

3. Check whether for the OTHER PROJECTOR to run the side reel, there is a long focus lens. This is because the 35 mm side reel images should be accommodated in your 3D screen within its black masks. In 99% of the case the back lens used for their (the theaters') scope projection would suffice.

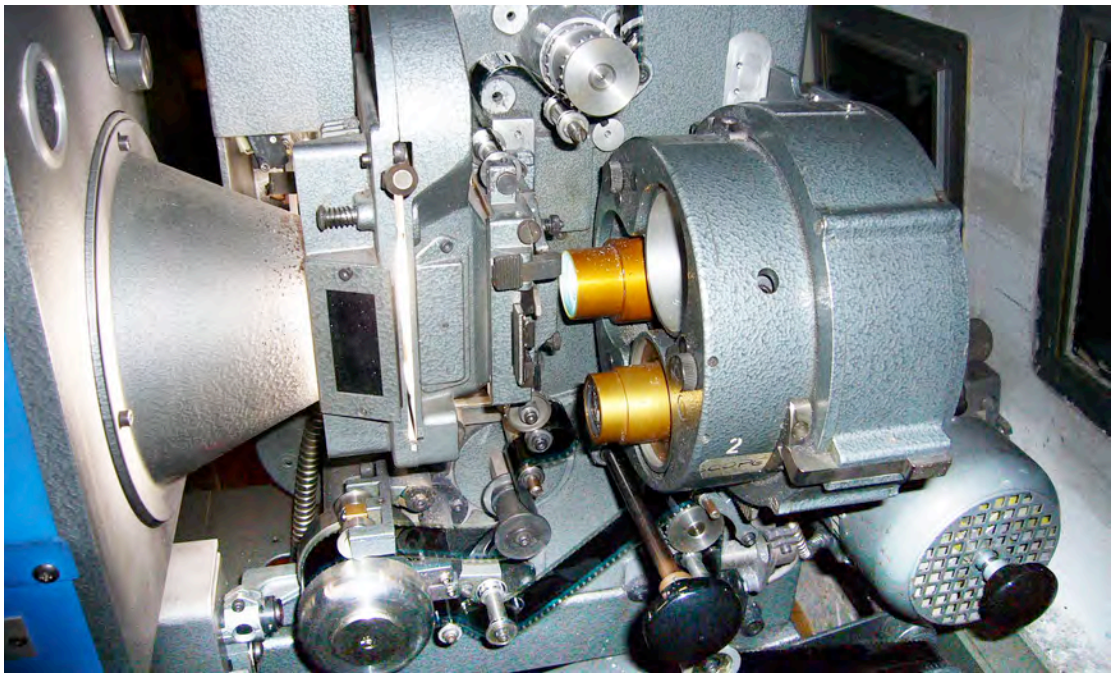
Now to the 3D PROJECTOR.

If there has been an advance party to this cinema, they would have (in consultation with the service engineer or operator at this place) recommended the projector (either A or B) for 3D lens installation. Or you could get the operator's opinion. Select the better projector in the cabin after giving consideration to

- Light (Rectifier efficiency, arc house centering, smooth carbon feeding)
- Picture (gate steadiness for jitter free image, ghosting which occurs due to shutter timing)

You have to discount their opinion on lens sharpness because we shall not be using their lens. Disregard audio (wow, flutter) in deciding on the projector. Check the lens turret. In some projectors the lens turret would be rotating type to accommodate scope, academy, wide-angle lenses. It is to be kept in mind that your 3D alignment is a very delicate adjustment (which can even be rendered useless by excessive vibration of the projector). Impress this on the operator/ servicing engineer. The rotating mechanism has to be disabled or strongly arrested after 3D lens installation. This is to prevent anybody from even accidentally shifting the lens turret and thus causing a disastrous 3D

screening. Even most modern electronically operated projectors have this problem. There have been instances when after our 3D alignment, the cabin crew unwittingly touched the remote lens control (which automatically shifts lenses in its turret and adjusts the gate masking) and thus caused misaligned 3D during some shows. Such controls have to be either disabled / locked off / screwed shut / or at least taped off with a warning sign.



Check the LENS MOUNT.
Find out whether the lens has to move forward every time the film is threaded on the gate. Most projectors have a sliding arrangement by which the lens mount locks-back exactly to the alignment point. But some old projectors do not have this. There is a reason behind this. Till three decades back the screen size in the cinema halls were not very large. The picture size being small, lenses shorter than 4 inch or 3.5 inches were quite rare. Hence projectors were designed for such lenses. Cinemascope also was not there and hence no need to change lenses between shows. When the trend became large screen, wide screen and scope, it called for shorter lenses. Today 2.5 to 3 inches is the norm. But the problem is that as the focal length becomes shorter, the lens has to come very near the film plane. Which means that if the lens mount is fixed, the lens would get into the way of the gate while threading the film. For this, in subsequent designs, the lens mount was made to slide. Now, we use still shorter (than normal) focal lengths for 3D screening. 50 mm (about 2 inch); 60 mm (about 2.4 inch); 70 mm (about 2 3/ 4 inch). This is because one 3D image is half the size of ordinary 35 mm and a quarter that of cinemascope. Hence to blow-up to wide screen, shorter focal lengths have to be used. This means that while projection takes place, the lens is very close to the film plane. If the

operator can thread the film without sliding the lens mount (even with some difficulty), then request him to do so. If not, you would have to consider the following options.

* *Is the sliding mechanism fool proof?*

In some cases there shall be backlash error or shift or shake in the 3D alignment - once the lens is slided forward for film gate adjustments and then brought back. This variance (which would affect convergence and the focus also) is of negligible nature for 2D films. But in 3D, it can cause broken chairs and window-panes for the cinema. It is impossible to realign convergence and focus every time during a show. Hence, can you make sure the lens mount sliding mechanism is of zero error? Some Photophone projector designs give absolute re-locking. Some Devi projectors are notorious. In some cases tightening the existing mechanism to factory alignment can give satisfactory results. Some Bauer and Russian projectors do not have the sliding mechanism at all. Ascertain that the sliding or swinging mechanism is reasonably safe before you decide to commit this operation to the operator's hand. Request them to execute this carefully.

In extreme cases where this sliding mechanism does not work/ it may happen that you have to resort to desperate measures to give a show. Some practical references of our past experiences are given below.

In one cinema (Our first ever, at Dhanya, Trivandrum, Onam day 1984) we removed the swinging turret altogether. (It was a Devi where the lens housing itself was inside a swing door square box and the lens could not be accessed at all.) We used a longer lens than desirable (which unfortunately resulted in a smaller picture) to accommodate the film gate opening. A lens tube was made quickly at a nearby machine shop lathe. To hold the lens in it, tightening screws were ‘drill-tapped’ and positioned along the tube circumference. And to fix the lens tube onto the projector, bolts that went to the turret fastening holes on the projector were used. The lens was slowly shifted by hand to arrive at a fairly good focus and convergence, and then the screws locked and tightened.

In a most modern projector (at PVR Cinema, Anupam, Saket, Delhi. May 1998) the side of the film gate protruded to block the 3D lens from coming to the desirable focal plane. The solution was to unscrew and remove the back element on the 3D lens. (This back element holds the primary heat filter.) This brought the lens further back to the desired focal plane. And to compensate for the removed heat filter, an extra heat filter was put in front of the arc.

Some Westrex and Bauer projectors require narrow hind side for the lens to go near the gate. To accommodate this, the aluminum casing that mounts the heat filter to the lens (what was mentioned above) had to be unscrewed and filed.

Such extreme measures as above are rarely done. But there would arise some such unforeseen situations were your ingenuity and ability for quick alternative solutions would be put to test.

While on LENS MOUNT, it is to be checked whether the mount is long enough to grip your 3D lens. In some cases 'lens sleeve' have to be used to give adequate grip on the lens. This can be screwed in. If the screw thread does not match, first hold the sleeve close to the lens ***co-axial to it***. Then, Band-tape it around with Johnson plaster so as both the sleeve and lens hold together.

Here at this instance you have to check the FILM APERTURE PLATE in the film gate so as to ascertain no problems arise. Projectors generally have aperture plates that are removable and interchangeable (for 35 mm, wide screen, scope - as per the film's format). Since 3D uses the total available area in a film frame, and since even the smallest amount of gate masking which enters into the available area can cause eye strain for the audience, *we generally do remove the aperture plate from the gate absolutely*.

[If time permits, it is our practice to fine tune a spare aperture plate by slowly filing away the metal piece to the 3D dimensions. This is a detailed task which needs great precision. The benefit being you can totally eliminate spill image. Yet, if this cannot be achieved properly it is safe to screen your 3D film without any aperture plate in the gate].

Now there are gates which cannot run the film without this plate. If identified in advance, spare plate to suit 3D frame on this projector would be arranged. If not, the only method shall be to painstakingly file the cinema's own plate to our standard - so that it does not shade the image area. Here, we may have to get the distributor to buy an extra plate. At any case no 3D screening is to be done if the aperture plate does not meet the exact standards. And under no circumstances the operator should change the plate configuration from what you would leave after making the 3D alignment. i.e. It is your job to remind them not to put an aperture plate unwittingly back into the projector if you, for 3D's sake, had removed it absolutely.

4. ARC HOUSE

It is assumed that you know how to align a 3D lens. (Read Appendix D & F). At this stage you have started work on the projector. Run your 3D alignment chart on the projector. Mount your 3D lens (with a rough convergence and focus) to throw the image *on their screen* (plastic, non-silver). With experience you would know from the screen brightness what light output you can expect from that arc. Bear in mind the cleanliness of their existing screen and also the fact whether you have your polarizer filter already in the lens or not, and note the rectifier setting before you judge the light output.

It is again from experience that you can understand whether the arc is properly set for maximum light. Even a slightly misaligned arc house would mean poor light output ... a very dull yellowish light. You can judge this when their regular 2D film is running. But it may depend on the density of the print - about which, you may have no idea. So when you run your own known 3D alignment film you should be able to say (from experience) whether the arc house alignment is right or not. Prolonged projector vibration would have rendered the arc centering on the axis of the concave mirror (which ought ideally be normal to screen plane) go out of the ideal alignment.

In case the arc house is misaligned, it would have to be properly brought to focus so that maximum light is brought to be borne on the film plane. A quick

method to optimize light is to first check visually along the positive carbon's axis that the axis of the mirror is along the center of the film gate. It could have happened that with years of vibration the bolts and packing which hold the arc house in place, would have settled to one side. If adjustments to this nature are possible, the quickest way to bring the light to optimum is to remove the lens and film from projector and run the projector 'dry'. Open the dowser and defeat the gravity shutter so that the arc is thrown directly onto screen. Only the film-timing shutter would be cutting the light path. **You would be able to see the image of the arc flame and the shadow of the carbon on the screen.** This image is made by the mirror and would appear upside down on the screen. By carefully shifting the arc house with respect to the film transport assembly, you would be able to come to a position where the image is centered and the light reaches the maximum onto the screen. This should normally help to get maximum light. In case the projector / arc house centering is completely misaligned and that it has to be setup from basics, it is a long process. Refer separate literature for this.

5. THE SCREEN AND THE PICTURE SIZE would have been decided by the time you reach this stage. It needs only the first projection of a 3D alignment loop *[with the intended 3D lens on their existing screen]* (previous stage 4) for the screen crew to mark the silver screen's position and the image's approximate size and position with respect to the existing screen. They can switch-on the auditorium light and start taking down the existing screen and then put up the silver screen. Unless of course, the '3D lens crew' has other ideas for a size change. Before deciding on the size and mobilizing the screen crew, make certain that you have seen the entire image on the screen. If portions of the image are being blocked-off by port hole shading or any such obstruction you would face difficulties later.

(In one case where the balcony was above the projection cabin, the balcony's edge blocked off the top of the image. This came to be noticed only when the aperture plate was removed out of the theater's standard projection setup. By this time the silver screen which was already put up had to be raised further).

6. The SCREEN removal and silver screen erection techniques - refer to Appendix K.

7. PROJECTOR ADAPTATIONS

The gate masking is ideal if done with a right size aperture plate.
TO CHECK - If you keep the aperture plate over a 3D frame, it is to be of the exact dimension of the two pictures in the frame. No more. No less. It has to mask-off the sound track also exactly. Generally for 2D projection, the plate

would be slightly smaller than the frame. This is a safety margin. But this kind of aperture plate if used for 3D screening,

- it would cut into the precious areas of our 3D images.
- it would cause ***unequal shading*** to the left and right eye images and thus would give rise to eye strain.

If aperture plate masking can be done right; then do it. If not, leave it. Remove the plate absolutely.

Port hole glass **has to be removed** for 3D projection. Port glass gives multiple reflections and hence affects 3D. In case of large glasses used in posh cinemas, our practice is to replace it with inexpensive glass for the duration 3D is screened. Buy inexpensive glass of the same size and cut out the area where the light passes through.

We usually come across problems where the port window is too small. Once you put a wide angle 3D lens, and once you remove the aperture plate and give accommodation for left eye rays going more to the right and right eye rays going more to the left, you would find that the light path has totally changed from that of their 2D projection. A narrow port hole would obstruct your new light path and hence cut into the image.

CAUTION HERE - it would be cutting into one of the images only. Since the other image compliments, you won't notice the problem until it is too late.

The problem can be rectified by either

- removing the wooden frame on the port hole window or
- shifting the projector (in total) slightly if the shading happens to be only on one side or
- chipping away the masonry at the port hole to make it wider or
- lifting or lowering the projector by the arc house mounting wheel or the base bolts or
- as a last resort - using a longer 3D lens.

In case you have to shift the projector to guide your rays through the port hole, bear in mind that the screen crew have to position **the final image area after this adjustment.**
[There was an instance where the projector rays were shaded at the bottom by the obstruction at the port hole bottom. It was solved by first raising the front of

the projector with wooden reaper packing and then lowering the projection angle down by raising the hind wheel. Strong manpower and tools like crowbar are needed when you attempt these heavy tasks].

For dichroic heat filter installation refer Appendix E.
For magazine enlargement for 6000 spools refer to Appendix J.

RECTIFIER - Sometimes by increasing the rectifier button alone you would not get enough light output. This means that the rectifier transformer's secondary coil voltage tapping has to be changed. It is generally safe to keep this in medium tapping. (You can also try the high voltage tapping and study the results). Keep in mind that during *the midnight hours of your installation*, the primary line voltage will be high. It is during the 6.00 P.M. show (when the grid is at its peak) that the poorest conditions manifest.

If the carbon burns very fast without much output in light, it means that the internal voltage tapping is on too much a high. Keep the rectifier ampere button high but reduce the internal voltage tapping. If the carbon burns sluggishly, resort to the opposite.

Carbon consumption has to be optimized because one full carbon may not last an entire spool if you over-burn it. This optimization is possible only after one or two shows.

8. For 3D lens adjustments and final alignment refer to Appendix F and Appendix D.

9. For screen masking, refer to Appendix H.

10. For lens masking, refer to Appendix I.

3D PROJECTION തത്വങ്ങൾ

'ഒരു 3D ചിത്രത്തിന്റെ ഏറ്റവും പ്രധാനപ്പെട്ട ഘട്ടം അതിന്റെ പ്രദർശനവേളയാണ്'– എന്നാണ് ലോകമെമ്പാടും ഇന്നോളം സംഭവിച്ച 3D ചരിത്രത്തിൽ നിന്നും വിദഗ്ദർ പൂണ്ടി കാണിച്ചിട്ടുള്ളത്.

അതുകൊണ്ടുതന്നെ 3D യുടെ ജയവും പരാജയവും നിർണ്ണയിക്കുന്നതിൽ ഒരു പ്രധാനപങ്ക് പ്രൊജക്ടർ ഓപ്പറേറ്റർക്കുണ്ട്. ഇൻഡ്യയിലാദ്യമായി നവീന 3D കൈകാര്യം ചെയ്യാൻപോകുന്ന കേരളത്തിലെ പ്രദർശനശാലകളിലെ ഓപ്പറേറ്റർ സുഹൃത്തുക്കളുടെ ശ്രദ്ധക്കായി ഏതാനും മാർഗ്ഗനിർദ്ദേശങ്ങൾ നവോദയാ നൽകുന്നു....

1. **Picture brightness:** Maximum bright ആയ ചിത്രം കാണുക എന്നതാണ് 3D യുടെ ഏറ്റവും വലിയ ആവശ്യകത. ഇതു് എത്ര തന്നെ ഊന്നിപ്പറഞ്ഞാലും അധികമാവില്ല. നിങ്ങൾക്കറിയാമല്ലോ, ഒരു സാധാരണ ചിത്രത്തിന് വെളിച്ചം എത്രതന്നെ കുറഞ്ഞാലും കാണികൾ പരാതിപ്പെടുന്നവരില്ല. പക്ഷെ വെളിച്ചം അൽപമെങ്കിലും കുറഞ്ഞാൽ 3 Dimension effect കിട്ടുകയില്ല. മാത്രമല്ല കാണികൾക്ക് കണ്ണുകഴയ്ക്കുകയും തലവേദന എടുക്കുകയും ചെയ്യും. Arc house ൽ maximum light നൽകേണ്ടുന്നതിന്റെ പ്രധാന കാരണം വെളിച്ചത്തിന്റെ മുക്കാൽ പങ്കും 3D Lens ലും കാണികളുടെ കണ്ണടയിലും നഷ്ടപ്പെടുന്നു എന്ന വസ്തുതയാണ്.

   ഇതിനു ചെയ്യേണ്ടതു്.

   a) Rectifier ൽ maximum safe ampere നൽകുക.
   b) Reflector Mirror എത്രത്തോളം പൂതിയതും clean ഉം ആകാമോ അത്രയും നന്നു്.
   c) Projection booth നും auditorium ത്തിനും ഇടയിലുള്ള കണ്ണാടി (Port glass) മാറ്റാമെങ്കിൽ നന്നു്.

   അൽപമെങ്കിലും വെളിച്ചം കൂടുതൽ കിട്ടുവാൻ നിങ്ങളാൽ ആവുന്നതു ചെയ്യുക. 3D യുടെ വിജയത്തിനു തീർച്ചയായും അതു സഹായിക്കും.

ഓർമ്മിക്കുക– 3D Screen ന്റെ ഓരോ square foot നും .2 ampere rectifier current വേണം. അതായതു് ഒരു 30 അടി Screen ന കുറഞ്ഞതു് 90 amps!

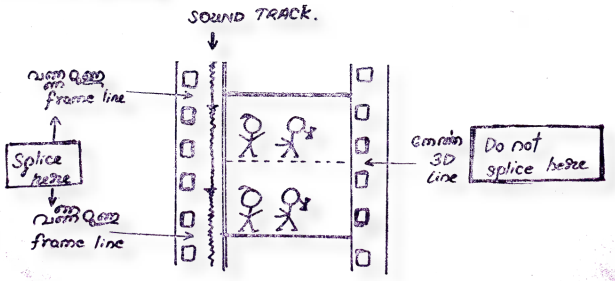
2. **Image :** Screen ഉടനീളം (Centre and Sides) തുല്യ brightness ആയിരിക്കണം. കൂടാതെ രണ്ടു കണ്ണുകൾക്കുമുള്ള images നും ഒരേ brightness വേണം. ഇതു് mirror ന്റെ adjustment കൊണ്ടു് സാധിക്കാവുന്നതാണ്. 3D കണ്ണട ധരിച്ച ശേഷം ഓരോ കണ്ണിലൂടെയും മാറിമാറി വീക്ഷിച്ചു് brightness താരതമ്യപ്പെടുത്താവുതാണ്.

   ഇടത്തേക്കണ്ണിനും വലത്തേക്കണ്ണിനും പ്രത്യേകം images ഉള്ളതായി നിങ്ങൾ ഇതിനകം മനസ്സിലാക്കിക്കാണുമല്ലോ. ഇവതമ്മിൽ മാറിയാൽ സംഗതി കുഴയും. 3D യുടെ കഥതന്നെ കുഴിയും.

   1) Thread ചെയ്യുമ്പോൾ Synch mark (⊠) gate ൽ വെച്ചു thread ചെയ്യുക.
   2) Thread ചെയ്യുമ്പോൾ framing Knob neutral position ൽ ആയിരിക്കണം. (ഇതുകൊണ്ടുള്ള പ്രയോജനം എന്തെങ്കിലും അത്യാവശ്യം നേരിട്ടാൽ നിങ്ങൾക്കു് രണ്ടുവശത്തേക്കും– up and down ഒരേ correction range കിട്ടും.) neutral position projector ൽ അടയാളപ്പെടുത്തിയിട്ടില്ലെങ്കിൽ Knob രണ്ടു വശത്തേക്കും തിരിച്ചുനോക്കി പാതിയിൽ നിർത്തുക.
   3) Film splice ചെയ്യേണ്ട അത്യാവശ്യം വന്നാൽ (ഫിലിം മുറിച്ചു ഒട്ടിക്കുകയോ, പൊട്ടിപ്പോയ ഭാഗം ചേർക്കേണ്ടിവരികയോ ചെയ്യാൽ) ഉടനെ തന്നെ representative നേയും Navodaya അധികൃതരേയും വിവരം അറിയിക്കുക. 3D film എങ്ങനെ splice ചെയ്യണം എന്ന ഭാഗം വ്യക്തമായി പഠിക്കാതെ ഒരു കാരണവശാലും 3D film join ചെയ്യരുതു് എന്നു് പ്രത്യേകം ഓർമ്മപ്പെടുത്തുന്നു.

ഓർമ്മിക്കുക– തെററായ splicing കൊണ്ടു show അലങ്കോലപ്പെടാവുന്നതാണ്.

3D Film Splicing



ഒരു frame ൽ രണ്ടു ചിത്രങ്ങൾ ഉള്ളതായി ശ്രദ്ധിച്ചിരിക്കുമല്ലോ.
(അതായതു് മുകളിലത്തെ രണ്ടു Perforation നു് ഒരു ചിത്രം. താഴത്തെ രണ്ടു Perforation നു് മറ്റൊരു ചിത്രം)

PROJECTOR OPERATOR 3D INSTRUCTIONS
in Malayalam, Tamil, Telugu & Hindi.

Splice ചെയ്യുമ്പോൾ വണ്ണമുള്ള frame line ലേ മുറിക്കാവൂള്ളു. നേർത്ത 3D line ൽ മുറിച്ചു join ചെയ്താൽ, left / right ചിത്രങ്ങൾ തമ്മിൽ മാറുകയും കാണികളുടെ അപ്രീതിക്കു് പാത്രമാവുകയും ചെയ്യും. കഴിയുന്നതും Splicing ഒഴിവാക്കുവാൻ ശ്രദ്ധിക്കുക.

എന്തെങ്കിലും കാരണവശാൽ (Reel ന്റെ തുടക്കത്തിൽ Framing ശരിയാകാത്തതു മൂലമോ; തെററായ Splicing കൊണ്ടോ മറ്റോ) 3D images ഇടത്തേതും വലത്തേതും തമ്മിൽ മാറിപ്പോയതായി നിങ്ങൾക്കു് യാദൃശ്ചയാ തോന്നുകയാണെങ്കിൽ (images തമ്മിൽ മാറിയിട്ടുണ്ടെങ്കിൽ ചിത്രം കാണുമ്പോൾ കണ്ണുകൾക്കു വല്ലായ്മ അനുഭവപ്പെടും) അതു എളുപ്പത്തിൽ Check ചെയ്യാൻ ഒരു മാർഗ്ഗം...

3D കണ്ണട തലകീഴായ്വെച്ചു് നോക്കുക. ചിത്രം normal ആയി കാണപ്പെടുന്നെങ്കിൽ അതിന്റെ അർത്ഥം ഇടത്തേതും വലത്തേതും images തമ്മിൽ മാറിയിട്ടുണ്ടെന്നാണ്. അതായതു് 2 Perforation മാറിയാണ് ചിത്രം gate ൽഓടുന്നതെന്നു് സാരം. ഈ അവസ്ഥയിൽ Framing knob തിരിച്ചു് 2 Perforation (½ Frame) Shift ചെയ്താൽ ചിത്രം normal ആകും. ഇതിന്റെ ആവശ്യകതയിലേക്കാണ് എപ്പോഴും Picture thread ചെയ്യുമ്പോൾ Framing knob neutral Position ൽ വയ്ക്കേണ്ടതു്. (ഇനി മറ്റൊരു കൂടി; Screen ൽ ചിത്രം non Frame ൽ ആണ് നിൽക്കുന്നതെങ്കിൽ Frame ഏതു direction ൽ നീക്കണം എന്നു മുകളിലും താഴെയുമുള്ള ചിത്രങ്ങൾ കണ്ണടവച്ചു ശ്രദ്ധിച്ചാൽ മനസ്സിലാകും. ഒരു direction ൽ നീക്കിയാലേ ശരിയാകൂ, മറ്റേ direction തെററായിരിക്കും.)

ചിത്രം ഓടുന്നതു ശരിയായിട്ടാണോ എന്നു് ഇടക്കിടയ്ക്കു് കണ്ണടവച്ചു Check ചെയ്യുന്നതു നന്നായിരിക്കും.

ഓർമ്മിക്കുക– Projection Cabin ൽ നിന്നും 3D ചിത്രം ഉടനീളം കാണുന്നതു് നല്ലതല്ല. മറ്റുള്ളവരെ അതിൽ നിന്നും പിന്തിരിപ്പിക്കുകയാണ് ഉചിതം.

3. **Maintenance :** Stereovision എന്ന ഈ System ന്റെ ഒരു മെച്ചം ഒരിക്കൽ fix ചെയ്താൽ പിന്നെ 3D Lenses ഉം മറ്റും പ്രത്യേകമായ adjustments ഒന്നും കൂടാതെ തന്നെ പ്രവർത്തിക്കപ്പെടാം എന്നതാണ്. നിങ്ങളുടെ lens ന്റെ കൂടെയുള്ള 3D alignment loop ഇട്ട്, ഇടയ്ക്കിടെ Check ചെയ്യുന്നതു് നന്നായിരിക്കും. Projector Running ന്റെ Vibration lens ൽ വരുന്നുണ്ടോയെന്നു് Check ചെയ്യുന്നതു് നന്നായിരിക്കും. ചിത്രത്തിന്റെ പ്രദർശനം തീരുന്നതുവരെ യാതൊരു വിധത്തിലും 3D lens arrangement ഓ Screen ന്റെ black border ഓ മാററാവുന്നതല്ല. ഏതെങ്കിലും കാരണവശാൽ lens ലോ മറ്റോ വ്യത്യാസം വന്നിട്ടുണ്ടെങ്കിൽ ഉടനെ Representative നേയും നവോദയാ അധികൃതരേയും വിവരം അറിയിക്കുക.

Projector gate ൽ film ഇല്ലാതെ arc on ചെയ്തു Screen ലേക്കു light throw ചെയ്യുന്നതു തെററായ ഒരു പ്രവർത്തിയാണെന്നു് നിങ്ങൾക്കറിയാമല്ലോ. ഏതു Projector ലെൻസിനും അതു കേടാണ്. Gate ൽ film ഓടിക്കാതെ light throw ചെയ്താൽ 3D lens നു് അതു വളരെ ഹാനികരമാണ് എന്നു് ഓർമ്മിപ്പിക്കുന്നു. അതിനുള്ളിലുള്ള വിലയേറിയ ഫിൽടറുകൾ ഉടനടി കത്തിപ്പോകാൻ ഇതു കാരണമാകും.

ഇൻഡ്യയിലാദ്യമായി നടത്തപ്പെടുന്ന ഈ പരീക്ഷണത്തിനു ഞങ്ങളുടെ പങ്കാളികളാവുന്ന, ഇതിന്റെ വിജയത്തിനു വേണ്ടി യത്നിക്കുന്ന നിങ്ങൾക്കെല്ലാം നവോദയായുടെ അകമഴിഞ്ഞ നന്ദി നേർന്നുകൊള്ളുന്നു. Cinemascope ഉം 70 mm ഉം പ്രായോഗികമാക്കാൻ Cabin room ൽ നിന്നു് പോരാടിയ നിങ്ങൾക്കു് 3D രസകരമായ ഒരനുഭവം നൽകട്ടെ എന്നു് ആശംസിക്കുന്നു.

3D Instructions by
CHRIS CONDON
Stereovision

Text Prepared by
JIJO PUNNOOSE
Navodaya, Kakkanad

Shown here is one of Navodaya's four ASHCRAFT High Intensity Arclamps - with matched High Capacity Rectifiers, specially installed at theaters with huge capacity cinema halls of seats above 1100.

These were used by us during pan-India 3D releases.

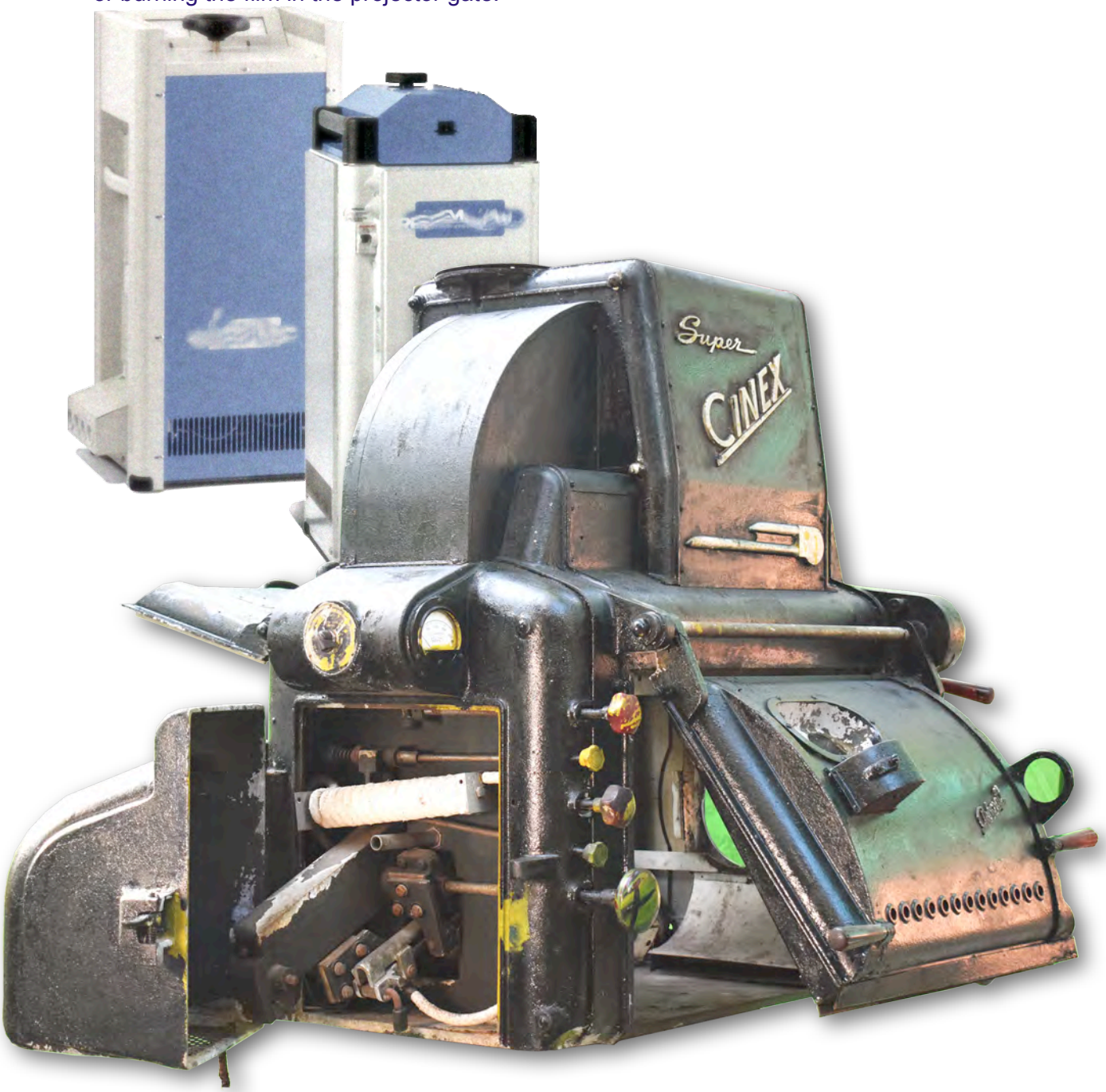
In 1984; at Satyam 70mm, Madras. Vishal 70mm, Delhi. Metro Cinema, Bombay. Ambar Cinema, Andheri.

In 1998; at Saritha 70mm, Kochi. Regal Cinema, Mumbai.

Other cinemas such as Ramakrishna 70mm Hyderabad, Amrapali 70mm Ahmedabad, Ragam 70mm Coimbatore, Shiela 70mm Delhi, had similar STRONG archouses already installed.

Most powerful among all the light sources of those times, these exquisitely engineered machines burned 13.6 mm carbon rods and had to be cooled with water continuously pumped along its innards through inlaid copper tubes. For the best of electrical conductivity, the carbon holders (jaws) were made of solid silver blocks. For uniform burning of the thick 13.6mm carbon electrode, a rotating mechanism is there along with the electric motor, which inches the carbon forward, as the electrode burns away.

Its 18 inches concave reflector is a Bauch & Lamb pyrex glass mirror. Called a ‘cold mirror’, it is dichroic coated and hence reflects only light. The infrared heat, the glass transmits through - thus preventing excessive heat from falling on the film transport or burning the film in the projector gate.



APPENDIX

A. EXCESSIVE PROJECTION PITCH - Problems and some Solutions

We have straight projection in most of the theaters. Projection light falls normal to the screen when the cabin in below the balcony. But then we also have slightly steep projection pitch. This is when the projection cabin is located above the balcony. (This has its advantage in climates where smoke sustains and vapour condenses.) Negative projection pitch where the projector is below the screen level is very very rare. Here in this chapter we discuss steep, positive projection angles.

When steep projection angle occurs, it gives rise to

- unequal dispersion of light when the screen reflects it.
- key-stoning - The image becomes wider towards the bottom (like a keystone in an arch), since the bottom of the screen is farther away from the lens than the top.
- variation in sharpness - as the point of focus on the screen would always be a compromise.

For 3D, this is very bad. It is worse than what a steep pitch does to 2D. This is because the silver screen reflects more and hence disperses less light than ordinary screen. As far as possible like very wide auditoriums we avoid steep theaters too. But sometimes we do not have a choice.
Two points to be noted in erecting the silver screen when the theater has a steep pitch are:

- Tying the screen as high up on the stage as possible.
- Tilting the screen to face the projector.

This can be done only by adding extra pipe frames. By fixing the screen higher, you are countering the pitch. By tilting the screen you are making it normal to the projector's rays so that the balcony area (which would otherwise receive less screen illumination) is compensated. Now the degree of tilt is again a compromise. The angle would be about quarter to half the projection pitch. With a trigonometric table (or a scientific calculator) you can work this out.

As the focus varies through the height of the screen (or put differently, along the height of the film frame), it becomes all the more important that the individual left and right images are separately focused with precision. Sometimes it may happen that the particular 3D lens **cannot converge or focus** for that steep projection pitch. (The turn screws would stop short of target). In such cases the only solution is to take out the lens and recut the threading for

higher slide between left eye / right eye elements. Hence, on confronting a very steep pitch, *it would be advisable to try out the 3D lens on the projector much earlier than the release*.

One other problem faced with extreme pitch is that you may not be able to frame the film frame correctly on the screen. The framing knob when turned would fall short of target. Then it would require adjustment of projector leveling wheel to raise or lower the projection rays.

B. IMAGE SHADING – How to locate it and to solve it

It is assumed here that the reader understands the basics and realizes the gravity of the problem an image shading causes in a 3D projection. The absolute way to avoid shading is to keep looking for it at every stage of 3D installation. If one does not look for it, one does not see it - till of course, one faces an eye straining image too late into the projection. The most healthy way to keep one's final image 'shade-free' is to follow a constant process of elimination at every stage of the 3D installation.

The very first time 3D alignment chart is projected onto the screen (may it be the theater's ordinary screen) through the prospective 3D lens, it would be worthwhile to keep a lookout for image shading. Of course, at this stage left eye / right eye distinction is not possible. But any primary projector shifting needed in case of image shading would manifest itself at this stage. The time silver screen is finally up is the time to eliminate image shading.

APERTURE PLATE

The process of elimination requires that you first study the image without any obstacle. Which means

- make sure the aperture plate is removed
- port hole is **open** (even if glass has not been removed yet)

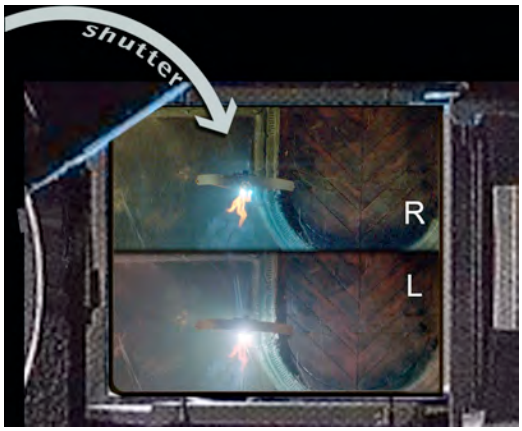
- no screen black masking (of course this is supposed to be the last-but-one stage in the 3D installation)
- and no lens masking yet (which is the last stage).

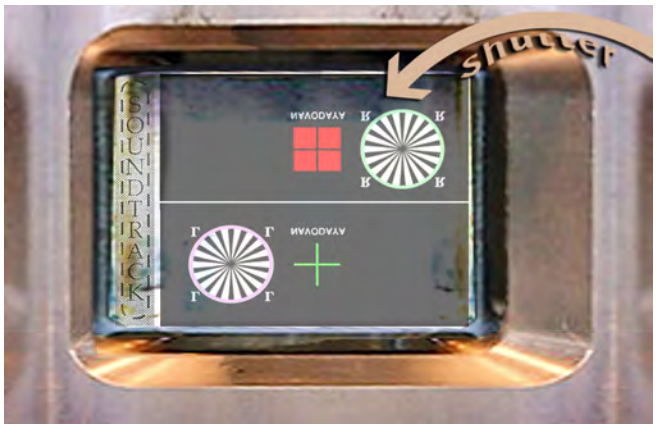
With such a wide berth from all obstacles you have to study the 3D images LEFT, RIGHT discreetly.

Sometimes it can happen that your shading is behind the film itself. This you can find by looking at the illuminated film while it is running in the gate. (For this you may have to sometimes remove the lens and look through the turret axis). If both the images inside the 3D frame is not illuminated by the arc uniformly, then there is something obstructing the light between the film and the flame. Bellows housing or dowser edge or gravity shutter edge are possible culprits. There have been some peculiar instances of shading as quoted below. It has happened that the frame was not centered inside the illuminated area of the gate. Hence a part of the one eye image is shaded. This of course you can rectify by bringing the framing lever into action and thus centering the frame inside the full illuminated part of the gate. But then it was found that on the screen picture was misframed. This obviously had happened because **the axis of the lens was not same as the center of the film gate!** It was originally **misaligned**.

Now to tackle shading in front of the gate

Study carefully the left eye image and right eye image separately. (You can do that only when the polarizing filter is in and viewed separately through the right filter and left filter of the 3D polarizing spectacles). All <u>four sides</u> should be shade free in <u>both</u> the images. If not, start locating the source of the shading by studying the diagram which says what eye image comes through what path.





CAMERA SHUTTER

PROJECTOR SHUTTER

Some common shadings occur due to the following

- port hole sides - 85% of the cases
- part of the balcony structure which juts out from top and shading the right eye image's top side
- portion of the lens turret - like the scope lens mounting rod
- unnecessarily long lens sleeve

You would always come across a new cause. Please log it for others' reference.

If without eliminating all possible reasons for image shading, you execute

- screen masking
- lens masking to cut off spill image
- aperture plate sizing

then you would not be able to trace back a cause if an image shading is noticed subsequently.

C. TROUBLESHOOTING

* Convergence and / or Focus varies after it is set.

Possible reasons

- Projector vibration. The levers would not have been locked.
- When setting convergence, your left eye and right eye would have been interchanged and slightly off. When you set it correctly later, you would find the error as cumulative.
- If lens is new, heat makes some variation. Recalibrate after few minutes of projection.

* The framing knob (lever) turning falls short of centering the 3D image on the screen.

Possible reasons

- Lever was not 'neutralized' before film was threaded.
- Projector was not centered by activating wheel during alignment.
- Lens axis is not along the center of the film gate.
- Wrong threading.

* Variation in left eye right eye illumination

Possible reasons

- The arc focus was not fixed and marked.

- Mirror up / down tilt mechanism was not adjusted to give equal illumination. (If right eye image needs more light, tilt mirror knob up. For more light to left eye image, tilt mirror down.)
- The carbon feeding mechanism is faulty. Hence the flame position varies.

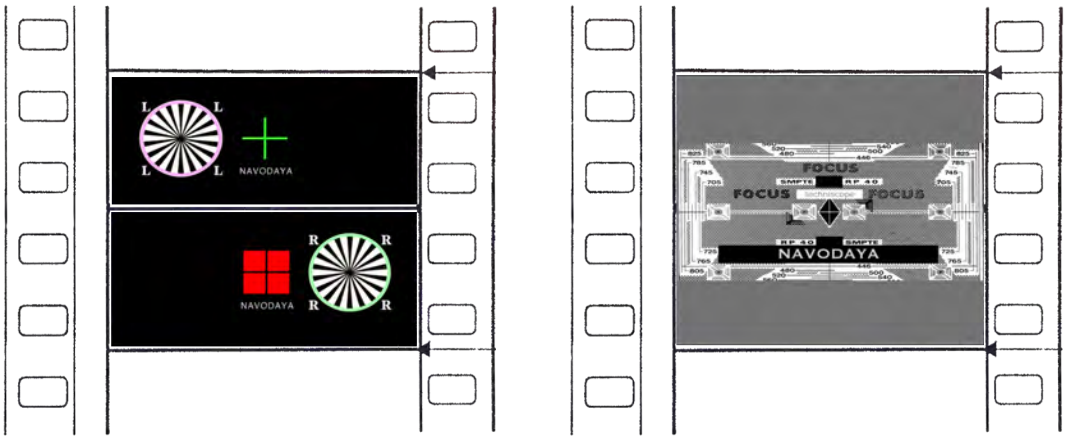
* Leak between left eye right eye image

Possible reasons are given below in the most likely order. Apply process of elimination.

- The polarizing filters in your glasses are the suspects. It could be it's wrong dye punch angle or discoloration with age or you are viewing with your head tilted.
- The port glass is depolarizing light or it is giving multiple reflections.
- The polarizing filters in the lens are the suspects. One or both would have burned due to wrong-doings. Or it would have aged. Or as in the case of Isco polarizers (which employ split polarizers) the cutting and slotting angle is wrong. Or the lens is mounted wrong (with a tilt).
- Screen paint is the suspect. It is depolarizing light.

D. HOW TO 3D ALIGN THE LENS

- Firstly, run on the projector the 3D alignment chart (supplied in roll or as a loop) for convergence setting the 3D lens. In case the roll runs out, rewind and run again. Care should be taken so as to keep the framing knob in neutral position **before** threading the film and that the film is threaded with the start mark frame set perfectly at the projector gate.



Once the convergence is set, remove 3D alignment chart roll.

- Secondly, run the SMPTE focus chart (supplied in 500 ft roll or as a loop) on the projector. This is a **single eye image** chart. By turning the framing knob, you can bring the SMPTE image to any of the lens halves (either the left eye half of the 3D lens or the right eye half of the 3D lens) depending on which image you are focusing. Once the SMPTE chart starts running in the projector, bring it to the fixed focus lens half of your 3D lens. (Note: In Isco lens, the fixed focus lens half is the top half through which the right eye image comes. In Stereovision lens, the fixed focus lens half is the bottom half through which the left eye image comes.)

  If the lens is Isco, bring SMPTE chart image to top half of film gate i.e., bring SMPTE chart as the right eye image. If the lens is Stereovision, bring SMPTE to bottom half i.e., bring SMPTE chart as left eye image. Once done so, focus the chart on screen to the sharpest using **projector's focus knob**. (This you can do without wearing glasses or even after taking out the polarizer filter in the 3D lens for better visibility). Once the focus is done, **lock** the projector's lens focus.

  Now bring the SMPTE chart to the other eye image by turning the framing knob. Focus the chart on the screen to its sharpest using the **focus screw on your 3D lens**.

Now both the eye's images are in focus for screening this particular positive stock (Gevaert).

- Use the 3D alignment chart or the print itself to black mask the screen size.

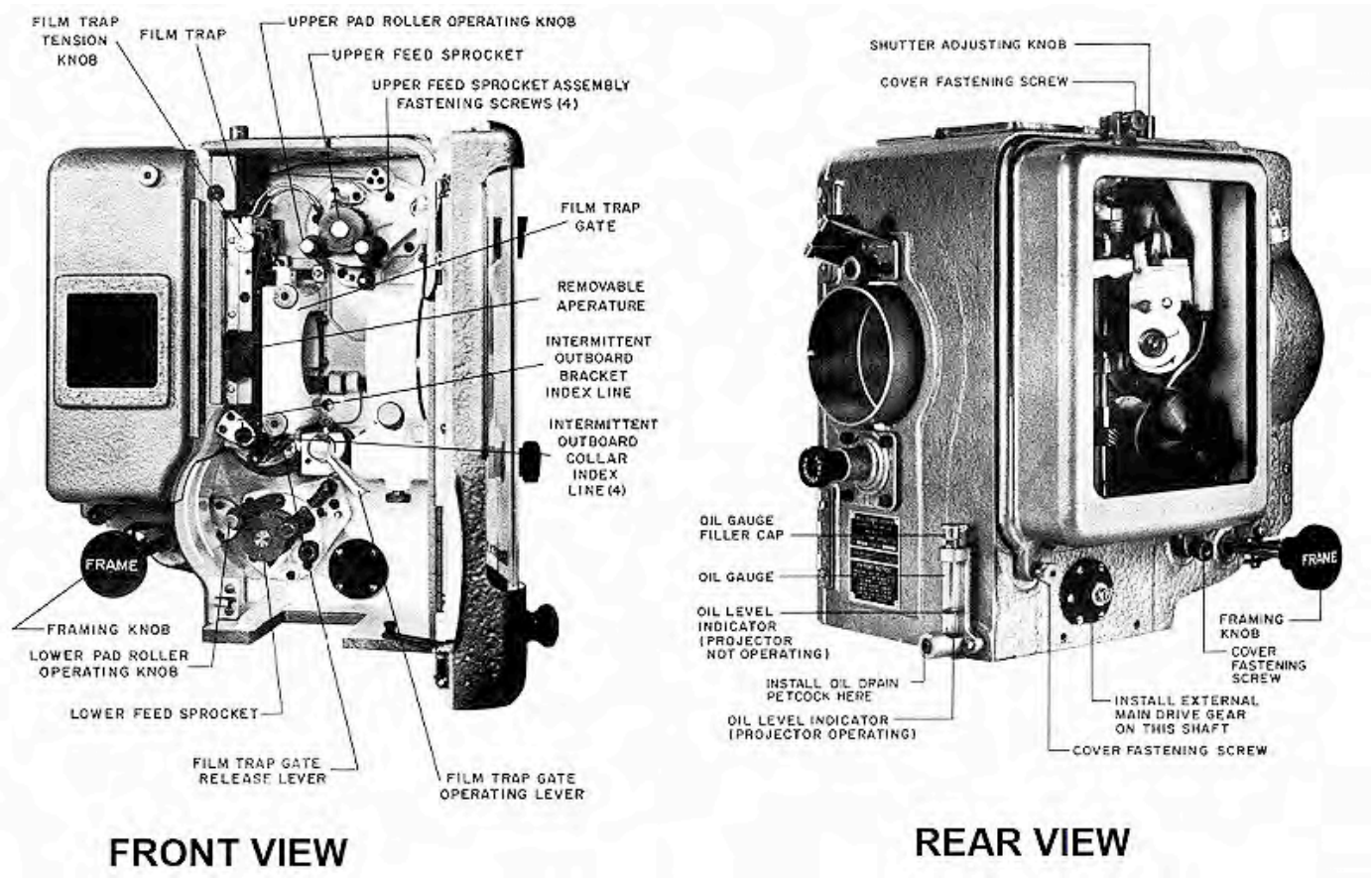
Note: SMPTE chart roll should be threaded with the beginning leader start mark in gate and sound track towards the gate outside. In this position the words SMPTE RNP will come mirror image on the screen.

The sound track will come on the screen left. This is the correct threading. Do not change this configuration by threading from roll end *or threading with sound track on screen right. (BEWARE : The position of film emulsion side would affect lens focus)*

3D alignment steps (for quick remembrance)

- Set framing knob to neutral position.

- Thread the 3D alignment chart roll with the beginning leader start mark set property into gate; sound track towards gate outside.
- Set the 3D lens convergence (vertical and horizontal) while the alignment chart is projected on screen.
- Thread SMPTE chart roll. The beginning leader start mark should be set properly into gate. Sound track side towards gate outside.
- Project the SMPTE chart. Make sure SMPTE RNP letters appear mirror image on screen. Bring the image to the fixed half of the lens. (ISCO - Top half, Right eye image. STEREOVISION - Bottom half, Left eye image.)
- Set the focus to maximum sharpness by turning projector's focus knob. Arrest and lock the focus control.
- Bring the image to the other half of the lens (ISCO - Bottom half, Left eye image. STEREOVISION - Top half, Right eye image.) Focus image on screen to sharpest with the len's own focus screw.
- Project 3D alignment chart on screen. Check for shadings. Deploy screen crew to mark and black mask screen.
- Mask the lens to cut image spill.

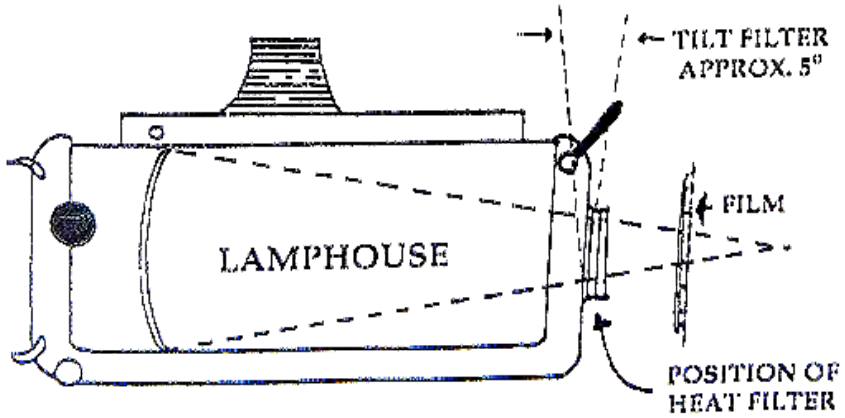


E. INSTRUCTIONS FOR INSTALLING DICHROIC HEAT FILTERS -

Stereovision Copyright

***NOTE**: If your projector lamp housing does not have a "cold" light system, dichroic heat filters must be used to avoid damage to the polarizer elements in 3D projection systems. An alternative to dichroic heat filters is "cold" mirrors, (transparent glass reflectors such as Balcod, Tufcold, Tippo, Fretto, balzer etc.)*

It is essential that the dichroic heat filters be installed **BEFORE** installing the 3D projection lenses. SERIOUS DAMAGE CAN RESULT to the polarizing elements in the lenses otherwise.

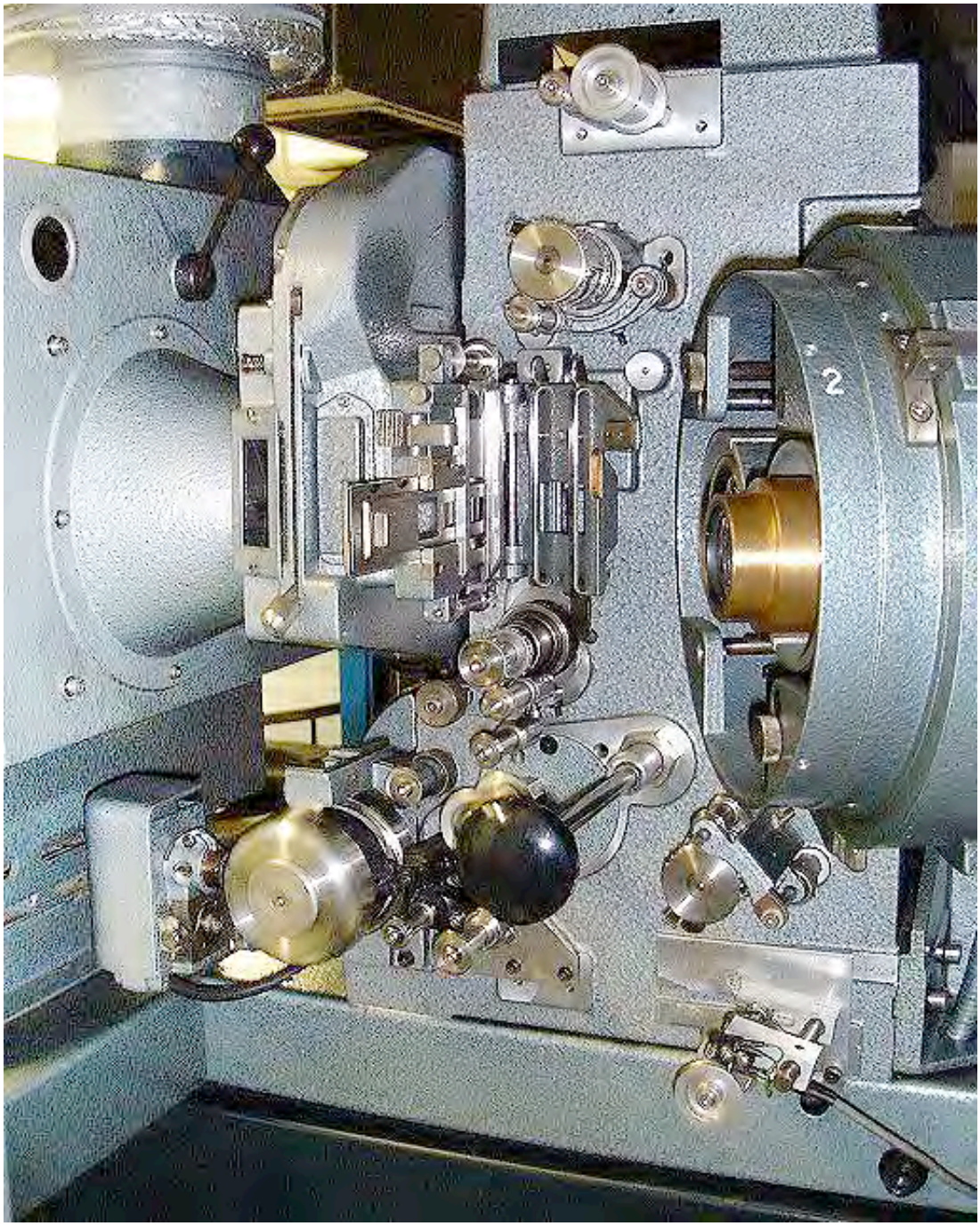


1. The dichroic heat filters should be installed in the position usually occupied by the (U.V.) draft filters, near the end of the lamp house, nearest the projector head. If there is no slot, the filter can be fastened in place by a wire or by three metal clips. It is sometimes possible to tape the filters into the filter area. **Be certain that the filter is facing in the correct position as marked on the label**. By convention, we keep the crimped metal side faced away from the arc (Navodaya).

2. The dichroic filter will be most effective when positioned where the beam of light is at least 3" in diameter.
3. In cold weather or cool morning start-up be careful to avoid thermal shock. If the filters are cold and you are running very high amperage or wattage, turn power on "low" for a few minutes to warm the filter and avoid thermal shock.

4. To clean the filters, use mineral solvent, lighter fluid or original lens cleaner. Avoid touching the dichroic filter with your finger tips, and remove all fingerprints as soon as possible, using the above solvents. You will damage the filter if touched by hand. Use gloves. Remove any organic deposit such as

finger prints sweat or oil as soon as it occurs. Cleaning has to be done only by lens cleaner solution.



F. ISCO LENS INSTRUCTIONS *- ISCO Copyright*

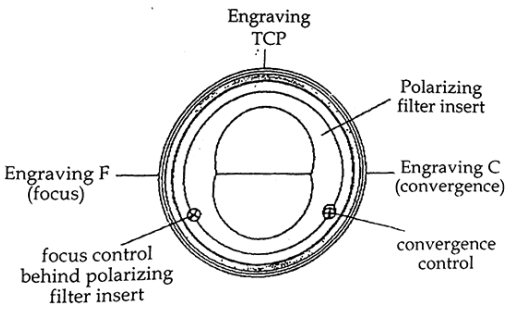


Fig. 1 : CINELUX 3D Front View

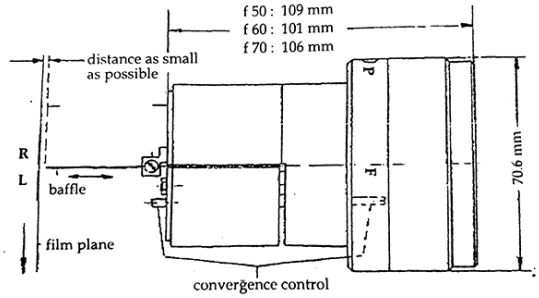


Fig. 2 : CINELUX 3D Right Band Side View

I. Mounting and adjusting of the CINELUX 3-D MC Lens

- Use only the right size aperture plate. Put the aperture plate approved for the 3D film into the film gate. If none is supplied enlarge a spare Cinemascope mask by filing to the full frame height of the right and left partial image (fig. 3). The frame height can vary from film to film.

- In case an alignment film loop has not been sent along with the 3D film and if it does not have an alignment leader strip, make a loop from test film supplied with the lens. Splice on the thin frame lines, and not the thick black separation line between left and right partial image. This is most important if a 3D film has to be spliced. Never splice thin lines to thick ones. This would reverse right and left partial image to the film gate from splice on and thus the 3D effect gets lost.

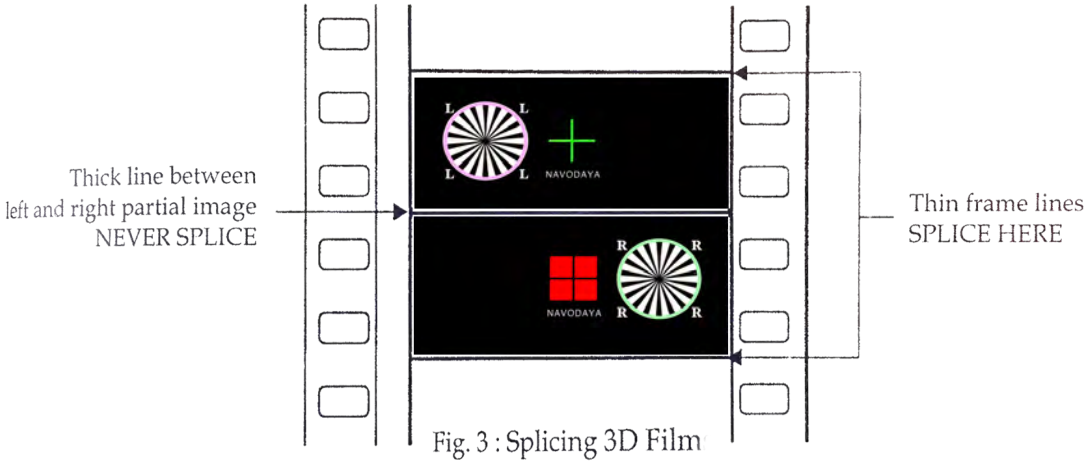


Fig. 3 : Splicing 3D Film

- Thread the alignment film loop into the projector's film guide taking care of the correct position of the sound track. The thicker separation line between the two partial images must be centered in the film gate (the thinner lines are frame lines) (fig. 4)

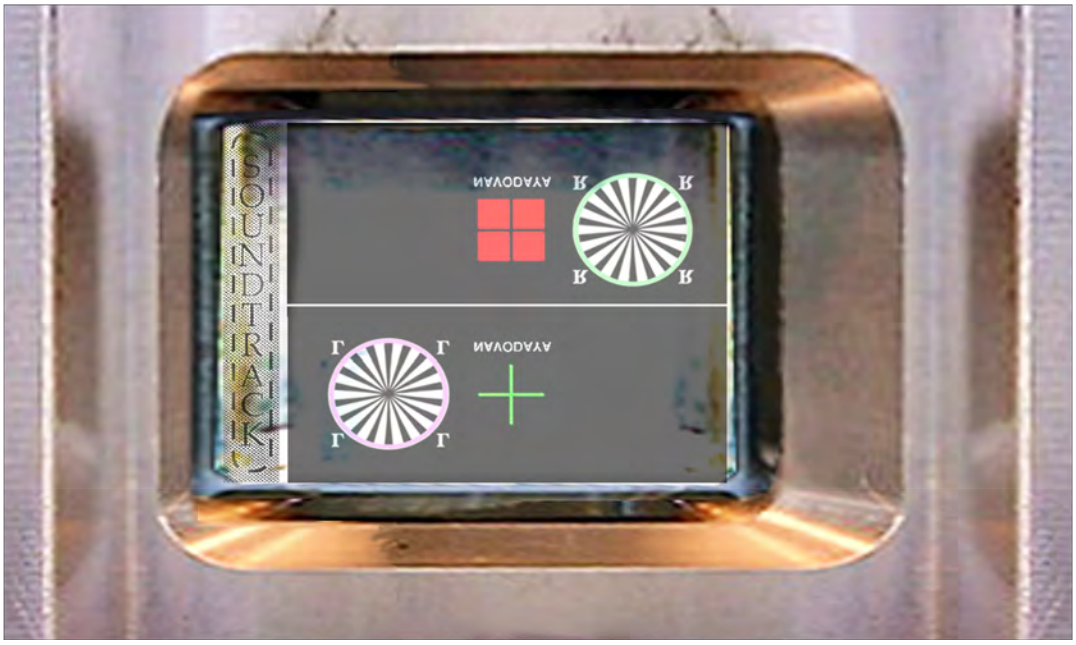


Fig. 4 : 3D Film in the proejctor film gate *seen from the lens side*

- Attention:

If the 3-D film is supplied with an alignment film loop, this should be used, since the distances of the partial images and the width of the separation line between them can vary from film to film which makes necessary a different convergence adjustment (see point 4) for exact superimposition.

- Push the baffle up to its forward stop between two lens halves, insert the lens into the projector mount (70.6mm) with the engraving “TOP” facing upwards and focus onto the screen.

- **Attention:**

NEVER RUN THE PROJECTOR WITHOUT FILM, WHEN YOUR CINELUX 3D LENS IS IN THE HOLDER

Polarizing filters are heat sensitive and may be damaged if running film does not absorb a good part of the heat. Polarizing filters can lose much of their polarizing efficiency without showing visible changes like burns, for example or clouds. Therefore, also use an alignment film loop for light balancing or even better - **remove the polarizing filter insert from the lens.**

- By rotating the lens slightly in the projector mount, superimpose the vertical lines of the adjustment crosses of both partial images on the screen, refocus if necessary, (fig. 5) and clamp the lens in this position in the mount. Now pull the baffle straight out of the lens and push it with its rear edge as close as possible to the film plane. Towards its rear, the baffle can be drawn a maximum of 4.0 cm (1.5”) out of the lens, measured from the rear edge of the lens.

- The horizontal superimposition (fig. 6) is achieved by adjustment of the axial distance (convergence control) of both lens halves. This is done by means of the Phillips screw (fig. 1& 2), which is situated at the left side of the lens - when viewed in the direction of projection, and which can be reached from the front of the lens as well as from the back.

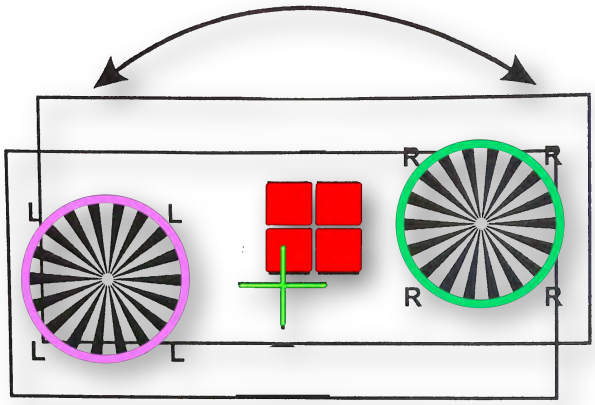


Fig. 5 : Focus the lens. Superimpose vertical lines of centre crosses by rotating lens in holder (See fig. 6)

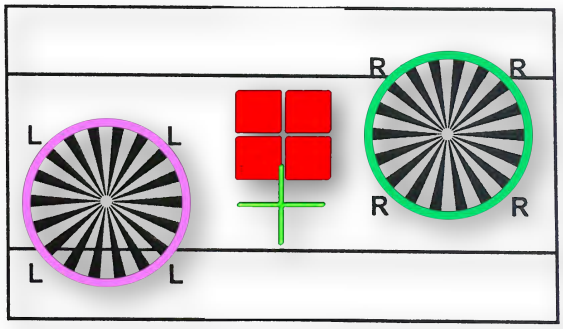


Fig. 6 : Superimpose horizontal lines of centre crosses by adjusting the convergence control. (See fig. 7)

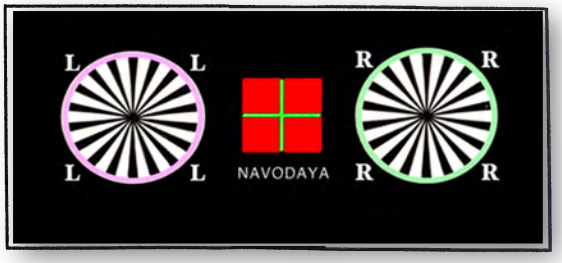


Fig. 7 : Screen image adjustment completed. Refocus if necessary.

- Look through 3D glasses to judge the image on the screen. By now it should be right way round, sharp and superimposed as

shown on fig 7. Should the total image be out of focus, refocusing is necessary.

- Wearing 3D glasses and positioning yourself as close to the lamp house, check for equal light balance of both partial images. By alternately looking onto the screen with your left and right eyes (without leaning your head side wards). If you look through your left eye, the “R” should be completely extinguished by the polarizing filters. And if you look through your right eye, the “L” should be completely extinguished. In case either the R or L - which should be ideally extinguished, appears slightly visible, the two partial images are unevenly illuminated. This leads to double images on any of the eyes when projecting a 3D film. Keeping in mind what has been said under 1 & 4, adjust your lamp house vertically until the upper and the lower partial images are evenly illuminated ... and that the “L” or “R” leak is totally extinguished.

CAUTION - When adjusting the light balance, avoid a shift of the flame focus way further towards the front. This is to protect the polarizing filters from a hotspot. Even an instant of excessive heat would burn a hole in them.

- Now the projector is prepared for 3D projection and the alignment film loop can be replaced by the film.

II. Focusing of lens halves for angle projection:

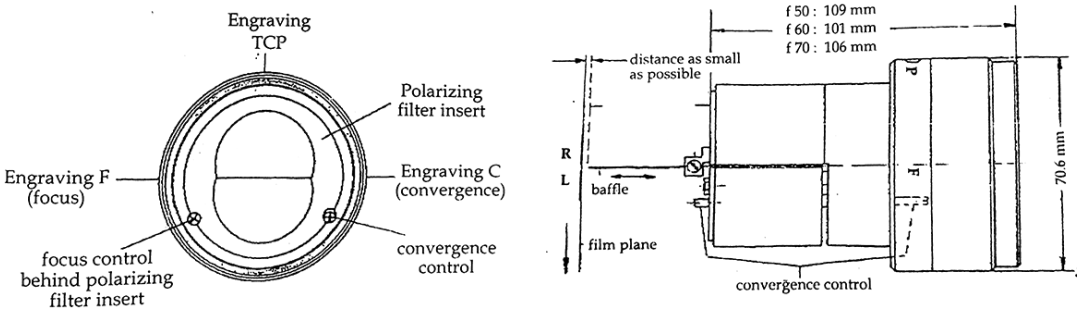
- **Attention:**

Normally this adjustment is not necessary, as both lens halves are pre focused at the factory. It should be done *if and only if* one of the two partial images ought to be focused in a steep-angle projection. The focus control is located behind the polarizing filter insert on the right side of the lens - when viewed in the direction of the projection. The insert has to be taken out of the lens for focus adjustment.

- Focus the right partial image using the projector focus control. ARREST IT.
- Now focus the left partial image using the focus control screw of the lens.

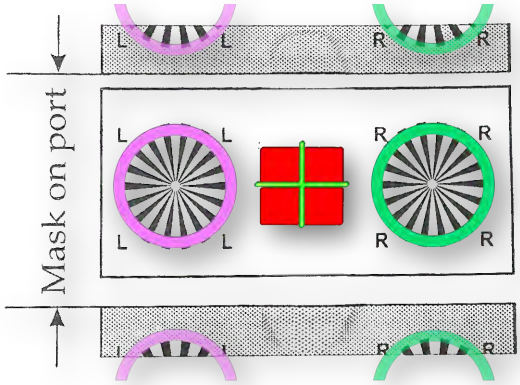
III. Masking

Masking of spill images above and below the screen image should be totally eliminated in the lens itself with CINELUX 3D. Thus an unsharp upper and lower image edges (often caused when attempting projection booth masks) can be avoided.



Yet, some maskings may be necessary due to under mentioned scenarios:

- Due to the construction of the film guide the baffle cannot be placed close enough to the film and thus it cannot secure a sufficient shielding. In this case you have to mask the dark surplus images at the projection window by focusing image onto the pane, in order to determine the exact position of the upper and lower mask (fig. 8).



Fig, 8 : Surplus images if baffle is too far in front of the film plane.

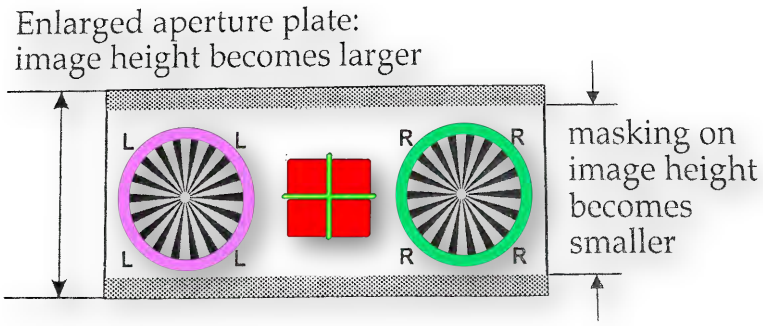


Fig. 9 : Incomplete superimposition of upper and lower image edge if aperture plate is too small.

- Despite exact super imposition of the adjustment process and sufficient shielding by the baffle, the upper and lower edges of the partial images do not superimpose. The height of the aperture plate is not big enough for the film performed. You can either file the aperture plate to the required height or cover the non-covering and somewhat darker stripes on the screen.

G. HOW TO DEAL WITH LIGHT LEAKS

It is assumed that the reader realizes the harmfulness of extraneous light falling on (1) the screen, (2) the auditorium walls and (3) the audience spectacles during a 3D projection. Though this maybe at worse an irritation for 2D films (and hence being the normal) in a theatre, it would affect a 3D screening badly. Hence any light leak is to be prevented.

There are two sources for light leaks

- The Archouse

- Other ambient sources as sunlight leaks, Foyer light, etc.

Archouse

- The Archouse door may not shut properly. It can throw light onto the screen, parallel to the lens rays.

- The Bellows (cone) between the film transport and the Archouse would have come loose while you were adjusting the Archouse or during your Dichroic filter installation. This can throw extraneous light onto screen.

- There could be some leak anywhere from the Archouse which is reflected from some panel onto the screen.

The possibility of light leaking from Cabin room to the screen/ auditorium is greater when the Cabin has large glass window instead of porthole.

If the cabin itself has windows through which sunlight or streetlight comes in, it has to be blocked. Unwanted lights in the cabin are to be switched off during projection. In one case a tiny crack in the cabin wall was noticed to give on screen the images of trees and buildings outside the theatre! The minute slit was acting as a pinhole camera.

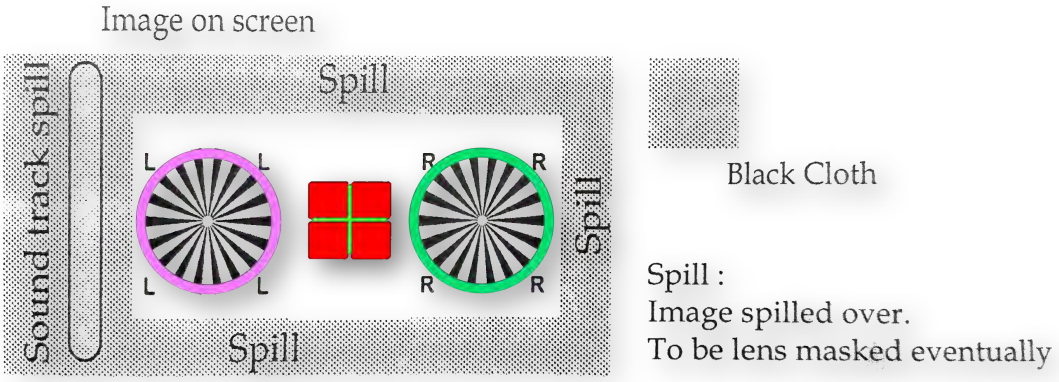
The auditorium would have faulty exit lamp signs which could throw light directly on the screen. If the doors do not have curtains, then light (sunlight during day time, foyer lamps during night time) would fall on the screen whenever the doors are opened during the show. Cracks in the false ceiling, exhaust holes are also potential culprits that can throw light on to the screen.

Auditorium lights are to be dimmed or switched off as soon as the show starts.

H. SCREEN MASKING WITH BLACK CLOTHE

It is assumed that the reader has knowledge on the basic need of black masking a 3D image on the screen plane. This is to make the '3D window' – without which, the effect of stereo image is not complete.

When the 3-D format (chart) is first projected through a prospective 3D lens, then itself the screen crew would have roughly marked-off the image periphery where the black mark would eventually extend up to. While putting up the silver screen, it makes practical sense in fixing the top black cloth mask first. Hence when the lens crew is ready to start aligning lens convergence on the silver screen (stage # 8) they would normally find the silver screen with a top periphery masking already in place (unless of course you need to make some changes yet and had communicated this to the screen crew).



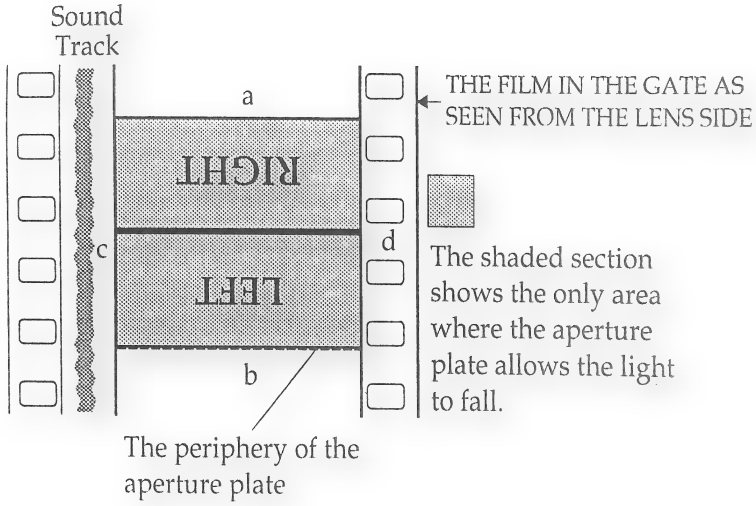
Once you have centered your image on the silver screen (by viz; the projector wheel arrangement, base bolt or packing arrangement, shifting projector left or right, lens turret shifting in some cases, and even framing knob adjustment are the variables which you may bring into play for positioning your final image), and once you have ascertained that absolutely no image shading is occurring to your image and that you are seeing both your left eye image and your right eye image 'en-toto' on the screen, the screen black cloth masking can start. With the guidance of either the print or the 3D alignment chart projected on screen, the screen crew can do the black cloth masking. Refer the diagram below. The

black cloth should bleed or encroach a few inches into the usable image area. Since the black cloth is absolute matte black, this area would act like the 3D window's edge.

Note: Keep in mind that the frame line lowers and rises slightly when shots are intercut. This is a discrepancy between different stereovision shooting lenses. Also the play in the laboratory's contact printer-head causes the frame line variation. THIS HAS BEEN CORRECTED DURING DIGITAL RESTORATION

I. LENS MASKING

In ISCO lens, you can completely mask the lens of all unwanted images spilling over to four sides by putting in a correct aperture plate and pulling the lens baffle close to the gate.



By putting the correct aperture plate you are eliminating –

- The image spill that would have otherwise occurred below the right eye image.

- The image spill that would have otherwise occurred below the left eye image.

- The image spill that would have occurred on screen on the left side of the picture (this would have included the sound track)

- The image spill on the right side of the screen.

Having done this, the only spills now to be taken care of are

- The top spill of the right eye image (which in fact is the bottom of the left eye image taken up by top half of the lens)

- The bottom spill of the left eye image (which in fact is the top of the right eye image taken up by the bottom half of the lens)

To eliminate these two, pull the lens's hind baffle close to the gate. This eliminates the unnecessary image leak onto the alternative halves.

But in the practical world, these a,b,c,d,e,f may not be possible to be eliminated by these steps. The reason being that you may not be able to make a correct aperture plate. And that the baffle would interfere with film threading when gate has to be opened.

In such cases the only way to mask off the extraneous images is to painstakingly mask the porthole area with black- paper. One has to exercise extreme caution to see that the mask do not shade into the screen image in either of the two, stereo images. Also ensure that the black mask is fastened properly and would not shift even accidentally during the period of the 3D screening.